Title
Architecture, a Technique of Environmental Governance

Author
Fox, Gary Riichirō

Publication Date
2023

UNIVERSITY OF CALIFORNIA

Los Angeles

Architecture, a Technique of Environmental Governance

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Architecture

by

Gary Fox

2023

ABSTRACT OF THE DISSERTATION

Architecture, a Technique of Environmental Governance

by

Gary Fox

Doctor of Philosophy in Architecture

University of California, Los Angeles, 2023

Professor Sylvia Lavin, Chair

This dissertation traces the emergence and development of the environmental-managerial project by which federal bureaucracy in the United States sought to administer the visual environment after about 1970. Although this effort relied on interdisciplinary practices and techniques, architects became principal actors in these workings of the administrative state: architects, initially, offered the projective visualization procedures through which state officials sought to account for environmental 'degradation,' but eventually, and perhaps more crucially, these practitioners laid out theoretical frameworks for the concept of the aesthetic which afforded a legally specified lens for assessing the value of particular environments. On one hand, the governmental strategies that transformed nuclear reactors, highways, strip mines, and other forms of environmental disturbance into phenomena that existed primarily on an optical register clearly belonged to a broader governmental strategy of pacification. On the other hand, turning to vocabularies and concepts traditionally rooted in the ineffable, subjective traditions of aesthetics and taste undermined the drive toward data management and quantified systems of accountability that otherwise characterized

the operations of the administrative state. That the effort to reconcile these contradictions required recourse to a distinct array of art-historical, psychological, economic, and statistical procedures, often at odds with one another, reveals conceptual, procedural, and practical conflicts at the base of the managerial approach to the environment in the U.S., as well as the lasting infiltration of these systems into the self-redefinition of architecture as primarily a profession of image managers. Through examination of a wide range of archival sources, this dissertation attends closely to the mechanics of this historical development—the incremental processes of visualizing, psychologizing, quantifying, and projecting that constituted the chain of techniques by which the aesthetic came to be submitted to regimes of governance in the U.S., as well as their effects, intended and otherwise—which together operated to fabricate consensus around the increasingly unmanageable problem of the environment. It is this process of fabrication, the process by which the management of beauty came to constitute a powerful technique useful to "democracy," that this dissertation traces.

The dissertation of Gary Fox is approved.

Maristella Casciato

Dana Cuff

Greg Lynn

Michael Osman

Sylvia Lavin, Committee Chair

University of California, Los Angeles

2023

for my family

who have supported me in ways I can't begin to describe

Contents

Abstract	ii
Dedication	v
Contents	vi
List of Figures	vii
Acknowledgments	xv
Curriculum Vitae	xviii
Introduction	1
Chapter 1 *Cognition and Composite Images*	22
Chapter 2 *Personality, Models, and Moving Images*	91
Chapter 3 *Signal Detection, Behavioral Economics, and Digital Perspective*	195
Conclusion	298
Figures	301
Bibliography	381

List of Figures

Figure 0.1 Schematic Representation of Vision through the Atmosphere. In William C. Malm, Karen K. Leiker, and John V. Molenar, "Human Perception of Visual Air Quality," in *A Specialty Conference on View of Visibility – Regulatory and Scientific (November 26-28, Denver, CO)* (Air Pollution Control Association, 1979): p. 54.

Figures 0.2 and 0.3 Viewer Sensitivity and Visual Quality Evaluation Types. In William G.E. Blair, Peter Harvard, and Jones & Jones, *Esthetics and Visual Resource Management for Highways: Seminar Notes, 1979–1980* (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1979): p. 33, 79.

Figure 0.4 Inputs to the Economic Visibility Benefit Assessment Process. In U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook* (Research Triangle Park, NC: U.S. Environmental Protection Agency, 1981): p. 1-6.

Figure 1.1 As-found and composite views looking northeast toward the Athens site for Greene County Nuclear Power Plant from the Rip Van Winkle Bridge, Oak Ridge National Laboratory, 1978. In U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549* (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979): p. M-41.

Figure 1.2 Photograph of as-found southwesterly view from the east side of the Hudson River north of Germantown toward Greene County Nuclear Power Plant site, Carl Petrich, 1978. In U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549* (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979): p. M-16.

Figure 1.3 As-found and composite panoramic views from Germantown looking west toward Greene County Nuclear Power Plant, Oak Ridge National Laboratory, 1978. In U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549* (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979): p. M-23.

Figure 1.4 Composite views of Greene County Nuclear Power Plant from Germantown looking west across Hudson River, Oak Ridge National Laboratory, 1978 In U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549* (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979): p. M-20.

Figure 1.5 Landscape Analysis Check List. In R. Burton Litton, *Forest Landscape Description and Inventories - A Basis for Land Planning and Design*, Res. Paper PSW-RP-049 (Berkeley, CA: Pacific

Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1968): p. 63.

Figure 1.6 Visual Penetration diagram. In R. Burton Litton, *Forest Landscape Description and Inventories - A Basis for Land Planning and Design*, Res. Paper PSW-RP-049 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1968): p. 38.

Figure 1.7 Frederic Edwin Church, *Winter Scene, Olana*, 1870

Figure 1.8 Vincent Scully, "Palace of the Past," *Progressive Architecture* 46, May 1965: pp. 186–187. Photographs by David Huntington.

Figures 1.9 and 1.10 Landscape Preferences Questionnaire, Oak Ridge National Laboratory, 1978. In U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549* (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979): p. N-4, N-8.

Figure 1.11 Photoquestionnaire for Swift Run Drain study, 1977. In Rachel Kaplan, "A Methodology for Simultaneously Obtaining and Sharing Information," in *Assessing Amenity Resource Values*, USDA Forest Service General Technical Report RM-68, 1979: p. 60.

Figure 1.12 Visual Preferences of Cranberry Glades survey. In William Edgar Hammitt, "Visual and User Preference for a Bog Environment" (Ann Arbor, University of Michigan, 1978): p. 140.

Figure 1.13 Preference Matrix. In Stephen Kaplan, "Perception and Landscape: Conceptions and Misconceptions," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979): p. 245.

Figure 1.14 Composite views of Indian Point Nuclear Generating Plant and visual quality scoring from lagoon viewpoint. In Jones & Jones et al., *Visual Impact Study: Statement of Findings, Alternative Closed Cycle Cooling Systems, Indian Point Nuclear Generating Plant* (Seattle: Jones & Jones, 1975): p. 49.

Figure 1.15 Candidate Areas for a Fossil-Fired Power Plant in Northern Maryland. In Jerome E. Dobson, "A Regional Screening Procedure for Land Use Suitability Analysis," *Geographical Review* 69, no. 2 (1979): p. 227.

Figure 1.16 Landscape Feature Checklist. In Ervin H. Zube, David G. Pitt, and Thomas W. Anderson, "Perception and Measurement of Scenic Resources in the Southern Connecticut River Valley" (Amherst, MA: Institute for Man and His Environment, University of Massachusetts, 1974): pp. 138–139.

Figure 1.17 Map of degrees of scenic quality, Oak Ridge National Laboratory, 1978. In U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*

(Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979): p. M-51.

Figure 1.18 Visual Resource Inventory Class Overlay for Big Flat Squaw Park. In U.S. Bureau of Land Management, *Visual Resource Inventory*, Manual Handbook 8410-1 (Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986): illustration 12.

Figure 1.19 Scenic Quality Field Inventory Form. In U.S. Bureau of Land Management, *Visual Resource Inventory*, Manual Handbook 8410-1 (Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986): illustration 3.

Figure 1.20 Scenic Quality Map. In U.S. Bureau of Land Management, *Visual Resource Management Program* (Washington, D.C.: Department of the Interior, Bureau of Land Management, Division of Recreation and Cultural Resources, 1980): p. 19.

Figure 1.21 Sensitivity Level Rating Sheet. In U.S. Bureau of Land Management, *Visual Resource Inventory*, Manual Handbook 8410-1 (Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986): illustration 8.

Figure 1.22 Sensitivity level maps and matrix. In U.S. Bureau of Land Management, *Visual Resource Management Program* (Washington, D.C.: Department of the Interior, Bureau of Land Management, Division of Recreation and Cultural Resources, 1980):

Figure 1.23 Matrix of analytic factors and overlay maps for management classification. In U.S. Bureau of Land Management, *Visual Resource Management Program* (Washington, D.C.: Department of the Interior, Bureau of Land Management, Division of Recreation and Cultural Resources, 1980): p. 24.

Figure 1.24 Visual Contrast Rating Worksheet. In U.S. Bureau of Land Management, *Visual Resource Contrast Rating*, Manual Handbook 8431-1 (Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986): illustration 2.

Figure 2.1 Environmental Simulation Laboratory, Film strip of simulated boat ride for I-220 highway bypass over Cross Lake, Shreveport, Louisiana. In Jones and Jones, *I-220: Cross Lake Visual Impact Assessment Final Report* (September 1983): cover.

Figure 2.2 Map of proposed I-220 highway bypass with three alternatives for bridge over Cross Lake. In Jones and Jones, *I-220: Cross Lake Visual Impact Assessment Final Report* (September 1983): p. 4.

Figure 2.3 U.S. Department of the Interior, Fred Farr Presenting at the White House Conference on Natural Beauty, May 24, 1965. Archives & Special Collections of California State University, Monterey Bay.

Figure 2.4 Unidentified photographer, Screening of Film Simulation of Proposed Cross Lake bridge in Shreveport, Louisiana, produced by UC Berkeley Environmental Simulation Laboratory, 1983. In William G. E. Blair, "Visual Impact Assessment in Urban Environments," in *Foundations for Visual*

Project Analysis, eds. Richard C. Smardon, James F. Palmer, and John P. Felleman (New York: John Wiley & Sons, 1986): p. 242.

Figures 2.5 and 2.6 Unidentified photographers, Environmental Simulation Laboratory with Donald Appleyard at work (top), ca. 1979. *Environmental Design Archives Exhibitions*, courtesy Peter Bosselmann.

Figure 2.7 Donald Appleyard, Kevin Lynch, and John R. Myer, *The View from the Road* (Cambridge, MA: MIT Press, 1964): pp. 14–15.

Figure 2.8 Max Fourestier, Amédée Joseph Gladu, and Jacques Claude Vulmière, assignors to Centre National de la Recherche Scientifique, Paris, France, *Endoscope*, United States Patent 2,699,770, Application May 9, 1952, Patented Jan. 18, 1955.

Figures 2.9 and 2.10 Robert Auzelle, Maquettoscope and photographic view from within an architectural model. In Robert Auzelle, *323 Citations sur l'Urbanisme* (Paris: Vincent, Freal, 1964): p. 691.

Figures 2.11 and 2.12 "Lilliputian's-Eye Viewer Puts You Inside Tiny Model," *Popular Science* 185, no. 2 (August 1964): p. 85.

Figure 2.13 J.M. Anderson and T.E. Odling, "The Mackintosh Room 'interior' on television," ca. 1970. In J.M. Anderson, "A Television Aid to Design Presentation," *Architectural Research and Training* 1, no. 2 (November 1970): p. 23.

Figures 2.14 and 2.15 Unidentified photographers, Environmental simulator at Lund Institute of Technology, Sweden, ca. 1975. In Jan Janssens and Rikard Küller, "Utilizing an Environmental Simulation Laboratory in Sweden," in *Foundations for Visual Project Analysis*, ed. Richard C. Smardon, James F. Palmer, and John P. Felleman (New York: John Wiley & Sons, 1986): p. 268.

Figure 2.16 Donald Appleyard, Path Sequences in Levittown, New York. In Donald Appleyard, "Toward an Imageable Structure for Residential Areas" (Unpublished Master's Thesis, MIT, 1958), BANC MSS 83/165 c, Carton 11, Folder 11, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

Figure 2.17 Berkeley Environmental Simulation Laboratory, Validation studies comparing an automobile ride (above) to a simulated ride on film (below), ca. 1974. In Stephen Sheppard, *Visual Simulation* (New York: Van Nostrand Reinhold, 1989): n.p.

Figure 2.18 Environmental Simulation Laboratory, Schedule of Procedures for validation studies, 1972. In Nickolaus Reinholt Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements" (Ph.D. Dissertation, University of California, Berkeley, 1979): p. 86.

Figure 2.19 Kenneth Craik, Environmental Adjective Checklist, 1972. In Nickolaus Reinholt Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements" (Ph.D. Dissertation, University of California, Berkeley, 1979): p. 142.

Figures 2.20 and 2.21 Linda Groat, "The Modern Set" and "The Post-Modern Set," ca. 1978. In Linda Groat, "Meaning in Post-Modern Architecture: An Examination Using the Multiple Sorting Task," *Journal of Environmental Psychology* 2 (1982): pp. 3–22.

Figure 2.22 Kenneth Craik, Regional Q-Sort Deck, 1972. In Nickolaus Reinholt Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements" (Ph.D. Dissertation, University of California, Berkeley, 1979): pp. 144–145.

Figures 2.23 and 2.24 Donald Appleyard, Street perception among different subject types, ca. 1970. in "Traveller Response to the Urban Highway Environment," Computed Data from BART Studies, BANC MSS 83/165 c, Carton 8, Folder 26, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

Figure 2.25 William G.E. Blair, Peter Harvard, and Jones & Jones, *Esthetics and Visual Resource Management for Highways: Seminar Notes, 1979–1980* (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1979).

Figure 2.26 The Visual Environment. In Jones & Jones, *Visual Impact Assessment for Highway Projects*, ed. American Society of Landscape Architects and Federal Highway Administration (Washington, D.C.: Federal Highway Administration, 1981): p. 6.

Figure 2.27 Viewer Sensitivity. In William G.E. Blair, Peter Harvard, and Jones & Jones, *Esthetics and Visual Resource Management for Highways: Seminar Notes, 1979–1980* (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1979): p. 33.

Figure 2.28 Visual Quality Evaluation Types. In William G.E. Blair, Peter Harvard, and Jones & Jones, *Esthetics and Visual Resource Management for Highways: Seminar Notes, 1979–1980* (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1979): p. 79.

Figure 2.29 Environmental Simulation Laboratory Photographic Setup for Eyelevel View of Options 2 and 3 from Water Treatment Plant. In Jones and Jones, *I-220: Cross Lake Visual Impact Assessment Final Report* (September 1983): p. 25.

Figures 2.30 and 2.31 Response Survey Instrument distributed to sample viewing film simulations of proposed Cross Lake bridge. In Jones and Jones, *I-220: Cross Lake Visual Impact Assessment Final Report* (September 1983): pp. A2-3, A2-11.

Figures 2.32 and 2.33 Response Survey Instrument distributed to sample viewing film simulations of proposed Cross Lake bridge. In Jones and Jones, *I-220: Cross Lake Visual Impact Assessment Final Report* (September 1983): pp. A2-23, A2-25.

Figure 2.34 Change In Natural Beauty as measured from sample viewing film simulations of proposed Cross Lake bridge. In Jones and Jones, *I-220: Cross Lake Visual Impact Assessment Final Report* (September 1983): p. 52.

Figures 3.1, 3.2, and 3.3 Systems Applications, Inc., Digital Terrain Model for Yovimpa Point in Bryce Canyon National Park and Adjacent Areas; PLUVUE Visualizations for View from Yovimpa Point and for Plume Associated with Surface Mining, to be laid atop one another. In Douglas A.

Latimer, Stanley R. Hayes, and Clark D. Johnson, "Visual Impacts of Particulate Emissions From the Proposed Alton Coal Project," Prepared for U.S. Environmental Protection Agency, Region VIII, Air Programs Branch (San Rafael, CA: Systems Applications, Incorporated, September 23, 1980): p. 20–22.

Figure 3.4 Map of the Southern Utah Petition Area Showing Land Surface Ownership. In U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4* (Washington, D.C.: U.S. Department of the Interior, 1980): p. II-12a.

Figure 3.5 Navajo Mountain from Bryce Canyon, 1978. In U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *Protecting Visibility: An EPA Report to Congress* (Washington, D.C.: U.S. Environmental Protection Agency, 1979): p. 37.

Figure 3.6 Analysis of Valley Character for Hells Canyon, Idaho. In Luna Leopold, "Landscape Esthetics: How to Quantify the Scenics of A River Valley," *Natural History*, October 1969: p. 42.

Figure 3.7 Method Used to Delineate Landscape Zones. In Elwood L. Shafer, John F. Hamilton, and Elizabeth A. Schmidt, "Natural Landscape Preferences: A Predictive Model," *Ekistics* 29, no. 173 (1970): p. 279.

Figure 3.8 Landscape Preference Model. In Elwood L. Shafer and James Mietz, *It Seems Possible to Quantify Scenic Beauty in Photographs*, Forest Service Research Paper, NE-162 (Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, 1970): p. 2.

Figures 3.9 and 3.10 Observer Position Diagrams for Observer Inferior, Observer Normal, and Observer Superior. In R. Burton Litton, *Forest Landscape Description and Inventories - A Basis for Land Planning and Design*, Res. Paper PSW-RP-049 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1968): pp. 7, 9.

Figure 3.11 U.S. Forest Service Visual Quality Objectives Decision Matrix and Map. In U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 1: The Visual Management System*, Agriculture Handbook 462 (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1974): p. 43.

Figure 3.12 U.S. Forest Service Visual Quality Objectives and Visual Absorption Capability Decision Matrix and Map. In U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 7: Ski Areas*, Agriculture Handbook 617 (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1984): p. 18.

Figures 3.13 and 3.14 Visual Absorption as a Function of Transparency and Complexity, and Basic Topographic Types. In Peter Jacobs and Douglas Way, *Visual Analysis of Landscape Development* (Cambridge, MA: Harvard University, Graduate School of Design, Department of Landscape Architecture, 1968): p. 3, A-3.

Figure 3.15 SYMAP Map of Visual Absorption for Boston Region, Southwest Sector. In Peter Jacobs and Douglas Way, *Visual Analysis of Landscape Development* (Cambridge, MA: Harvard University, Graduate School of Design, Department of Landscape Architecture, 1968): p. 37.

Figure 3.16 Visual Absorption Capability as a Function of Visual Magnitude, with Cell C considered to have lower absorption capability than B. In U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 5: Timber*, Agriculture Handbook 559 (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1977): p. 59.

Figure 3.17 VIEWIT Map, ca. 1968. In Elliot L. Amidon and Gary H. Elsner, *Delineating Landscape View Areas… A Computer Approach*, Research Note PSW-RN-180 (Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, 1968): p. 2.

Figure 3.18 VIEWIT Map for Harney Peak, ca. 1971. In Gary H. Elsner, *Computing Visible Areas from Proposed Recreation Developments… A Case Study*, Research Note PSW-RN-246 (Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, 1971): p. 6.

Figure 3.19 VIEWIT Map of Ability to Absorb Visual Modification for Mineral King Ski Resort. In Christine G. Johnson, *Mineral King Visual Analysis* (San Francisco, CA: U.S. Department of Agriculture, Forest Service, 1974): p. 23.

Figure 3.20 Photograph and PREVIEW Visualizations for Gifford Pinchot National Forest. In Erik Myklestad and J. Alan Wagar, *PREVIEW: Computer Assistance for Visual Management of Forested Landscapes*, USDA Forest Service Research Paper NE-555 (Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, 1976): pp. 2–3.

Figures 3.21 and 3.22 Perspective Plot Visualizations for Cascade National Forest. In Devon B. Nickerson, *Perspective Plot: An Interactive Analytical Technique for the Visual Modelling of Land Management Activities* (Portland, OR: U.S. Department of Agriculture, Forest Service, Division of Timber Management, 1980): pp. 94, 97.

Figures 3.23 and 3.24 Perspective Plot Visualizations Applied to Mining and Recreation Development. In Devon B. Nickerson, *Perspective Plot: An Interactive Analytical Technique for the Visual Modelling of Land Management Activities* (Portland, OR: U.S. Department of Agriculture, Forest Service, Division of Timber Management, 1980): pp. 127, 134.

Figure 3.25 SCOPE Visualization of Partially Cut Timber Stand. In Devon B. Nickerson, "SIGHTLINE, PERSPECTIVE PLOT, SCOPE: Three Desktop Computer Programs for Forest Landscape Design," *Journal of Forestry* 77, no. 1 (January 1, 1979): p. 16.

Figure 3.26 Bureau of Land Management, Composite Photograph Simulating Worst-Possible Case of Surface Mining in the Alton hills, Viewed from Yovimpa Point. In U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4* (Washington, D.C.: U.S. Department of the Interior, 1980): n.p.

Figure 3.27 Utah International, Inc., COMARC Map Highlighting Portions of the Petition Area Visible from Yovimpa Point. In U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4* (Washington, D.C.: U.S. Department of the Interior, 1980): p. II-4a.

Figure 3.28 Utah International, Inc., Perspective Depicting View from Yovimpa Point. In Michael Hatfield, A. J. LeRoy Balzer, and Roger E. Nelson, "Computer-Aided Visual Assessment in Mine Planning and Design," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979): p. 326.

Figures 3.29, 3.30, and 3.31 MOSAIC Technique. In *MOSAIC: A System for Displaying a Proposed Modification Before Its Impact on the Environment* (Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, 1977): pp. 7, 8.

Figures 3.32 and 3.33 Existing Landscape Photograph and Hand-Retouched MOSAIC Photomontage Simulating the Presence of a Dam. In *MOSAIC: A System for Displaying a Proposed Modification Before Its Impact on the Environment* (Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, 1977): p. 9.

Figures 3.34 and 3.35 National Park Service, LASL Visibility System Simulations of the Visibility Effects of a Coal-Fired Power Station for Observation and Watchman Points in Zion National Park. In U.S. Bureau of Land Management, ed., *Draft Environmental Impact Statement on the Allen-Warner Valley Energy System* (Cedar City, Utah: U.S. Department of the Interior, 1980): pp. 4-17, 4-19.

Figures 3.36 and 3.37 Systems Applications, Inc., PLUVUE Visualizations of Plume Envelopes Sited in Region West of Page, Arizona. In Douglas A. Latimer et al., "The Development of Mathematical Models for the Prediction of Anthropogenic Visibility Impairment," Prepared for U.S. Environmental Protection Agency (San Rafael, CA: Systems Applications, Incorporated, 1978): pp. 117, 127.

Figure 3.38 Photographs Representing Various Visibility Levels in Grand Canyon National Park Employed in Willingness-to-Pay Studies. In U.S. Environmental Protection Agency, Office of Policy Analysis, *Methods Development for Environmental Control Benefits Assessment*, vol. VIII: The Benefits of Preserving Visibility in the National Parklands of the Southwest (Washington, D.C.: U.S. Environmental Protection Agency, 1985): p. 15.

Figures 3.39 and 3.40 Survey Conducted at Bryce Canyon National Park. In National Park Service, *Results of National Park Service Visitor Survey Conducted At Bryce Canyon National Park Summer 1980* (Washington, D.C.: U.S. Department of the Interior, 1980), Nina Dougherty papers, 1949-2010, Accn 2002, Box 73, Folder 5. Special Collections, J. Willard Marriott Library, The University of Utah: pp. A-3, V-16.

Acknowledgments

This dissertation is no less than the direct result of the tireless mentorship, support, and patience of countless mentors, colleagues, friends, and family. Chiefly, I am indebted to the mentorship of Sylvia Lavin whose guidance has fundamentally shaped both this project and my intellectual and professional formation more broadly, and whose scholarship has laid out a key model for research to which I can only aspire; Michael Osman, who has been a critical guide in my intellectual development at an especially crucial stage; and Maristella Casciato, to whom I owe so much—personally, professionally, and academically. At UCLA, Dana Cuff has been formative in the development of my research interests, and she, along with Greg Lynn, have both offered critical feedback at key stages in this project. I have otherwise benefitted from the rich well of scholarly inquiry which characterizes the UCLA community: Debora Silverman, especially, as well as Margo Handwerker, Cristóbal Amunátegui, Dell Upton, Anthony Cross, and Wonne Ickx have been importantly influential here. Numerous scholars beyond my institutional home have offered key insights in the development of this project, including Zeynep Çelik Alexander, Mark Cousins, Kim Förster, Peter Galison, Lizzie Muller, Amy Murphy, Peg Rawes, Inderbir Singh Riar, and Rafico Ruiz. In many ways, early foundations for my work were formed by Marina Lathouri, Mark Cousins, Tom Weaver, and Douglas Spencer at the Architectural Association.

I've had the distinct benefit of participating in the rich intellectual community of graduate students at UCLA, including Giulia Amoresano, Iman Ansari, Aubrey Bauer, Sebastiano Fabbrini, Christina Gray, Austin Kaa, Esra Kahveci, Marko Icev, Maura Lucking, Megan Meulemans, Jacqueline Meyer, Randy Nakamura, Simon Pennec, Zach Rottman, Mohamed Monkez Shaker, Rebecca Svehla, Shannon Starkey, Shota Vashakmadze, and Henry Yang. In particular, the support, feedback, and close friendship of Jia Yi Gu, Rebecca Choi, William Michael Davis, Alexander Maymind, Brigid Boyle, and Sarah Hearne have been especially crucial throughout this process.

Beyond UCLA, Matthew Allen, Suleman Anaya, Daniel Concha, María Álvarez García, David Johnson, Sandra Meireis, Melany Park, and Veronica Peselmann have offered feedback, support, and care at various stages of my graduate work. Also crucial in this effort was the opportunity to share my work in informal settings with friends and colleagues, including Hannah Rose Feniak, Jia Yi Gu, and Verónica Muñoz-Nájar; Liz Hirsch and Alexander Maymind; and Kate Yeh Chiu, Tim Ivison, Inès Kivimäki, Dan Levenson, Aurora Tang, Julia Tcharfas, and Brendan Threadgill.

I am unspeakably grateful to the countless librarians, archivists, registrars, and conservators whose work has made this research possible. Particular thanks are owed to Aimee Lind, Tina Beyleryan, and Adrian Salas at Getty Research Institute, who in so many ways have been essential to this effort; Henrik Ullstad at Lund University; and Mathieu Pomerleau at Canadian Centre for Architecture. Numerous other archives have been critical to my research, including the Bancroft Library, the Environmental Design Archives, and the Berkeley Art Museum and Pacific Film Archive at University of California, Berkeley; the Irwin S. Chanin School of Architecture Archive at Cooper Union; the McGill University Archives; the Bentley Historical Library at the University of Michigan; the Western Archeological and Conservation Center of the National Park Service; Special Collections and University Archives at Stony Brook University Libraries; Special Collections at Utah State University; the J. Willard Marriott Library at University of Utah; and Special Collections at Weber State University. The financial and intellectual support of the Canadian Centre for Architecture, the Bancroft Library at University of California, Berkeley, and the University of California, Los Angeles have made much of this research possible. Rachel Kaplan, Peter Bosselmann, and Duane Dietz have been generous interlocutors.

Special thanks are owed to Verlena Johnson and Jim Kies at UCLA for their continued guidance, unfailing support, care, and understanding throughout these many years.

I owe a debt of gratitude to a lifetime of educators who have shaped me in ways I can't begin to understand—let alone describe. Perhaps whether they recognized it or not, the educators who left a lasting impact on me prior to my graduate work include Sophia Gruzdys, Sandy Isenstadt, Turner Brooks, Fred Scharmen, and Susie Woo at Yale University; Kushida Kiyomi at the Inter-University Center for Japanese Studies; and Melinda Owen, Mark Johnson, Rebecca Gessert, Scott Holloway, Shukla Sarkar, Ms. Lu, Ms. McLeod, and Ms. Loden in the Los Angeles Unified School District, among countless others whose names have begun to escape me.

And finally, I am grateful to have had the support of a network of close friends—in addition to those listed above!—especially those who offered particular support and generosity throughout this long process: Amanda Chicago Lewis, Beth Fiedorek, Susannah Bragg McCullough, Kyle Cotler, Emmanuelle Massicot, Ric Parada, and Rena. Above all, my family—my mother, Masako Fox, my father, Joel Fox, and my sister, Candice Fox—whom I couldn't have done this without.

GARY RIICHIRŌ FOX Curriculum Vitae

Education

Ph.D., History of Architecture, University of California, Los Angeles, 2023 (expected)

M.A., History of Architecture, Architectural Association School of Architecture, London, United Kingdom, 2012

Certificate in Advanced Japanese, Inter-University Center for Japanese Language Studies, Yokohama, Japan, 2009

B.A., Architecture, Yale University, New Haven, Connecticut, 2008

Professional Appointments

2021– Curatorial Assistant, Getty Research Institute

2019–22 Visiting Faculty, Southern California Institute of Architecture

2017–20 Lecturer, University of Southern California, School of Architecture

2017–18 Teaching Fellow (Lead Instructor), University of California, Los Angeles, Architecture and Urban Design

2016–21 Research Assistant, Getty Research Institute

Selected Publications

2025 Editor, *Ada Louise Huxtable* (Los Angeles: Getty Research Institute Publications, in development)

2021 "The Open Letter and the Spreadsheet: Digital Vigilante Practices in Architecture" (with Jia Yi Gu, Laida Aguirre, and Cyrus Penarroyo), *MAS Context*

2018 "Modeling a Nuclear Aesthetic: Scenic Simulations," in *Climate Changed: After Models?*, eds. Rainar Aasrand, Irina Chernyakova, Irmak Turan, and Jessica Varner (Cambridge, MA: MIT School of Architecture and Planning, 2018)

"Interview with Frank O. Gehry" (with Maristella Casciato), in *Frank Gehry–Hans Scharoun: Strong Resonances / Zusammenklänge*, eds. Barbara Nierhoff-Wielk and Evelyn Wöldicke (Munich: Hirmer Verlag, 2018)

2016 "A Loft, Aloft: John Hejduk at Cooper Union," *The Other Architect* (online), Canadian Centre for Architecture

"Why Write," in *Asymmetric Labors: The Economy of Architecture in Theory and Practice*, eds. Aaron Cayer, Peggy Deamer, Sben Korsh, Eric Peterson, and Manuel Shvartzberg (New York: The Architecture Lobby, 2016)

Presentations

2023 Presenter (with LeRonn Brooks), "The Making of Paul Revere Williams," *Designing While Black*, Society of Architectural Historians Annual International Conference, Montreal, QC, Canada

2022 Invited Lecturer (with Jia Yi Gu and Sarah Hearne), "The Making of 'In the Making,'" University of Colorado Denver, College of Architecture and Planning

Presenter, "Some Architectural Models," Digital Archives Symposium, University of Tokyo

2020 Presenter, "Moving Images... and Other Instruments of Aesthetic Governance," *Pop, Strip, Sprawl: Architecture, the City, and the Streets of Los Angeles*, Research Workshop, Getty Research Institute, Los Angeles, CA

Presenter, "Mock-ups, Model Failure, and Archival Absences," *Understanding the Architectural Model*, Research Workshop, Getty Research Institute, Los Angeles, CA

Panelist, *+History*, Graduate Design Studio, USC School of Architecture, Los Angeles, CA

2019 Presenter, "Simulated Environments," Buell Dissertation Colloquium, Columbia University, New York, NY

Co-Organizer (with Maristella Casciato), *Ada Louise Huxtable and the Formation of the Architecture Critic*, Research Workshop, Getty Research Institute, Los Angeles, CA

Co-Organizer, *Bauhaus Looking Forward: The Legacy of the School in the 21st Century*, Panel Discussion, Getty Research Institute, Goethe-Institut, and A+D Museum, Los Angeles, CA

Panelist, *State of History+Theory Education at Los Angeles Schools of Architecture*, A+D Museum and Archinect, Los Angeles, CA

Panelist, *Formal-isms/Formal-wasms*, with Anna Neimark and David Ruy, SCI-Arc, Los Angeles, CA

Presenter, *The Architecture Play*, Symposium, Kent State College of Architecture, Kent, OH

Podcast, "Teaching and Learning at the Bauhaus," *Art + Ideas* with Jim Cuno, J. Paul Getty Trust

2018	Session Co-Chair (with Maristella Casciato), *Mediating Architecture and its Audiences: the Architectural Critic*, European Architectural History Network Conference, Tallinn, Estonia
	Presenter, "Mechanizing the Organic," *Technohumanities: Exploratory Workshop on Experimentation*, UC Humanities Research Institute, San Francisco, CA
	Co-Organizer (with Maristella Casciato and Katherine Rochester), *Bauhaus Weimar, 1919–1925*, Research Workshop, Getty Research Institute, Los Angeles, CA
2017	Presenter, "Landscapes of Fact," *Technical Landscapes: Aesthetics and the Environment in the History of Science and Art*, Graduate Student Conference, Mahindra Humanities Center at Harvard University and Harvard History of Science Department, Cambridge, MA
	Co-Organizer, *The Body's Politic: Architecture and the Modern Subject*, Graduate Student Symposium, UCLA Architecture and Urban Design, Los Angeles, CA
2016	Presenter, "Scientizing the Senses: The Architecture of Human Subjects Research, 1910–1977," *Toolkit*, Colloquium, Canadian Centre for Architecture, Montreal, QC, Canada
	Panelist, "Curation as Method," with Erin Besler, Sarah Hearne, Andrew Kovacs, and Jimenez Lai, *Supper Studio* 17, UCLA Architecture and Urban Design, Los Angeles, CA
2012	Presenter, "The Bore and the Bored," *Sharp Sparks: History and Theory Told from the Stage*, Architectural Association, London, UK

Exhibitions

2025	*The Making of Paul Revere Williams*, Getty Research Institute [upcoming]
2023	Co-Curator, *Gehry's Variations*, Los Angeles Philharmonic (with Maristella Casciato) [upcoming]
2022	Co-Curator, *Schindler House, 100 Years in the Making*, MAK Center (with Jia Yi Gu and Sarah Hearne)
2019	Co-Curator, *Bauhaus Beginnings*, Getty Research Institute (with Maristella Casciato)
	Co-Curator, *Bauhaus: Building the New Artist*, Getty Research Institute (with M. Casciato and K. Rochester)
2018	Contributing Curator, *Climate Changed: After Models?*, MIT School of Architecture and Planning (Curators Rainar Aasrand, Irina Chernyakova, Irmak Turan, and Jessica Varner)
2015	Curatorial Assistant, *The New Creativity: Man and Machines*, MAK Center (Curator Sylvia Lavin)

Fellowships, Grants, and Awards

2021	Graham Foundation, Organizational Grant, *Schindler House 1922–2022: an anthology of existences*
2020	Graham Foundation, Carter Manny Award Finalist
	American Alliance of Museums, MUSE Award for Online Experience, *Bauhaus: Building the New Artist*
	Goethe-Institut Scholarship
2017	W.M. Keck Foundation Grantee
	UCLA, Collegium of University Teaching Fellows (declined)
2016	UC Berkeley, Bancroft Library Award
	Canadian Centre for Architecture, Doctoral Research Residency
2015–16	UCLA, Graduate Research Mentorship
2015, 14	UCLA, Clifton Webb Fine Arts Scholarship
	UCLA, Graduate Summer Research Mentorship
2008–09	Yale University, Richard U. Light Fellowship
2006	Yale University, Richard U. Light Fellowship

Service and Organizing

2021	Scholar Review Committee, Getty Research Institute
2021–	Diversity, Equity, Accessibility, and Inclusion Taskforce, Getty Research Institute
2020–	Member, Another Possible Imaginary (API)
2020	Reviewer, Artist Relief Fund, United States Artists
2018–	Program Board, Materials & Applications

Introduction

This dissertation examines the manner in which conflicts over the proper management of the environment in the United States were increasingly brought under regulatory control by a distinct array of interconnected technical, psychosocial, legal, and material systems during the 1970s and through the early 1980s. While this broad-based effort relied on a set of interdisciplinary practices and techniques, architects became principal actors in these workings of the administrative state: architects, initially, offered the projective visualization procedures through which state officials sought to account for environmental 'degradation,' but eventually, and perhaps more crucially, these practitioners developed theoretical frameworks for the concept of the aesthetic which afforded a legally specified lens for assessing the value of particular environments. On one hand, the governmental strategies that transformed nuclear reactors, highways, strip mines, and other forms of environmental disturbance into phenomena that existed primarily on an optical register clearly belonged to a broader governmental strategy of pacification—both at home and abroad. On the other hand, turning to vocabularies and concepts traditionally rooted in the ineffable, subjective traditions of aesthetics and taste undermined the drive toward data management and quantified systems of accountability that otherwise characterized the operations of the administrative state. Thus, this dissertation, by examining in close detail the actors, techniques, sites, and conflicts surrounding the development of both new governmental-discursive regimes for shaping the environment as well as new technologies to support those efforts, reveals conceptual, procedural, and practical conflicts at the base of the managerial approach to the environment in the U.S. during the period identified with the emergence of what has been called environmentalism, as well as the lasting infiltration of these systems into the self-redefinition of architecture as primarily a profession of image managers, rather than of designers of conventional buildings, narrowly construed.

Tracking the heterogenous set of activities constituting this project to submit the ineffable to regulation, this dissertation first lays out the historical context in which a substantive legislative charge directed newfound governmental effort toward administering the aesthetic. Each chapter, then, centers the incremental processes by which this substantive charge was worked out through new procedural techniques for regulating the visual, highlighting the development of distinct visualization procedures and the attendant, though variable recourse to psychological, art-historical, and economic techniques, together considered requisite for remediating conflicts around particular infrastructural types. The first chapter examines nuclear power generation in upstate New York, where mixed-media, composite photography conspired with techniques sourced from Gestalt psychology, the then-emergent field of visual studies, cognitive science, and evolutionary psychology to offer novel mediative forms restructuring the U.S. Nuclear Regulatory Commission's practices for managing visual resources. The second chapter considers the expansion of the federal highway program immediately outside Shreveport, Louisiana, where moving image-based model simulation, techniques in personality psychology, and new notions of environmental dispositions contributed to the reconfiguration of the U.S. Department of Transportation Federal Highway Administration's regulatory capacity to handle the visual. The third centers coal strip mining in southern Utah just outside Bryce Canyon National Park, where a turn to increasingly digital forms of perspectival visualization automatically generated from topographic maps and new forms of computational data mapping required recourse to concepts in psychophysics, updated by way of methods developed for the theory of signal detection, and to procedures for contingent market valuation, which were variously interpolated into behavioral-economic and federal bureaucratic, cost-benefit-analytic frameworks and captured in nascent regulatory strategies for the U.S. Bureau of Land Management, the U.S. Forest Service, and the Environmental Protection Agency. Taken together, these shifts in regulatory procedure effected a radical inversion in environmental governance practices in the country: if late nineteenth- and early twentieth-century conservation efforts had largely identified scenic beauty as a particular kind of virtue either to be conserved by delimiting privileged, exceptional landscapes or to be ameliorated in instances of acute concern, by the period in question aesthetic quality had been recast as a generalized condition of visuality subject to the demand for new forms of national accounting, capable of managing local specificities within quantitative frameworks, and thus affording the promise of regulatory oversight.[1]

Organized roughly chronologically, this dissertation traces the contours of this flourishing, yet relatively brief period of cross-disciplinary and cross-media practice, whose legacies were borne out in lasting transformations to regulatory apparatuses germane to the burgeoning administrative state in the U.S. and to professional arrangements in architecture. Despite this chronological organization, the narrative woven through these cases does not intend to imply a teleology—neither with regard to visualization nor psychologization. Rather, informed by strategies in media studies and social constructivist approaches in science and technology studies, it traces the manifold coeval, collateral, imbricated, mutually constitutive, frictive, and otherwise contradictory efforts led variously by a heterogenous assemblage of actors working on, through, and around largely novel technical and

---

[1] Aside from limited legislative provisions for National Parks through the second half of the nineteenth century in advance of the organization of the National Park Service in 1916, aesthetic matters in legal contexts in the United States had largely been relegated to case-by-case judicial determination, where negative aesthetic impacts were handled as nuisance under common law. These cases often required demonstration of personal injury, and courts were demonstrably more willing to act on odors and noise than they were on visual blight, or in instances where intentional malice could be shown. Later judicial decisions supported the application of police power in zoning ordinances to address aesthetic considerations, as well as the use of eminent domain toward similar ends. After about 1960, new statutes rendered aesthetic concerns increasingly a matter of administrative law, which had the subsidiary effect of extending standing in litigation to include the "public interest"—the particular contours of which this dissertation traces. For historical overviews of aesthetics in legal contexts in the United States, see Henry P. Chandler, "The Attitude of the Law Toward Beauty," *American Bar Association Journal* 8, no. 8 (1922): 470–74; Robert Broughton, "Aesthetics and Environmental Law: Decisions and Values," *Land & Water Law Review* 7, no. 2 (January 1, 1972): 451–500; Richard C. Smardon, "Law and Aesthetics, or Where Is the Pig in the Parlor? A Legal/Policy Overview of Legal Factors' Influence on Visual Landscape Policy" (Berkeley: Department of Landscape Architecture, University of California, Berkeley, 1978); Richard C. Smardon, "The Interface of Legal and Esthetic Considerations," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 676–85.

technological forms.[2] It examines the social, cultural, and material processes by which these actors—architects, chiefly, but atmospheric scientists, computer programmers, cognitive psychologists, economists, geographers, perceptual psychologists, planners, and resource managers, among numerous others, too—together labored to embed media forms in a chain of operations constituting the legal techniques by which the successive conversion of the management of the environment into the management of images and, ultimately, the management of information was to be made possible. Necessarily, this study attends closely to the entangled, uneven processes by which these operations both had resulted from and were interpolated back into systems of legality—a mode of address germane to methodological frameworks developed in critical legal studies.[3] If, in architectural historiography, matters of the environment have largely lent themselves to one of just a few forms of methodological treatment—whether materialist analysis, at one extreme, or culturalist study, at the other, with legal analysis often serving as little more than a framing device—here this study rather considers the inexorable, mutual coproduction of governance strategies, architectural skilling, and "the environment" in the period.[4] That is, it argues that a media and critical legal studies

[2] Methods for the study of the social construction of technology were importantly laid out in Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch, eds., *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge, MA: MIT Press, 1987). For the application of these methods to the study of the relationships between technology and state power, see Michael Thad Allen and Gabrielle Hecht, eds., *Technologies of Power: Essays in Honor of Thomas Parke Hughes and Agatha Chipley Hughes* (Cambridge, MA: MIT Press, 2001). An important formulation for the study of visuality as affording "points of intersection where philosophical, scientific, and aesthetic discourses overlap with mechanical techniques, institutional requirements, and socioeconomic forces… embedded in a much larger assemblage of events and powers" is presented in Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge, MA: MIT Press, 1990). Key models for a media studies approach include Lisa Gitelman, *Always Already New: Media, History, and the Data of Culture* (Cambridge, MA: MIT Press, 2006); Bernhard Siegert, "Cultural Techniques: Or the End of the Intellectual Postwar Era in German Media Theory," *Theory, Culture & Society* 30, no. 6 (2013): 48–65.

[3] For a key overview of critical legal histories, see Robert W. Gordon, "Critical Legal Histories," *Stanford Law Review* 36, no. 1/2 (1984): 57–125. For a compendium of studies operating at the interface between critical legal and cultural studies, see Jerry D. Leonard, ed., *Legal Studies as Cultural Studies: A Reader in (Post)Modern Critical Theory* (Albany, NY: State University of New York Press, 1995).

[4] The posture adopted here is perhaps most germane to a particular area of interest developed among some scholars in infrastructure studies, which attends to the mutually constituted relations among technology, nature, systems of culture, and practices of governance. See Thomas Zeller, "Aiming for Control, Haunted by Its Failure: Towards an Envirotechnical Understanding of Infrastructures," *Global Environment* 10, no. 1 (2017): 202–28.

approach to the study of environment becomes requisite in the effort to account for the understudied emergence of the aesthetic as a legally bounded category subject to particular forms of codification and environmental regulation, crucial to a historically specific understanding of the environment as it was constructed in the period.[5]

The introduction to this dissertation attempts, at once, to sketch a historical and historiographic terrain: it first considers the historical convergence of visualization and psychologization and the attendant historiographic stakes in tracking this convergence; it then examines the mechanics by which this convergence laid the foundation for the historically specific problem of the regulation of the visual environment, charged with managing difference at multiple scales—across individuals, across landscapes, and across local, state, and federal power—as it emerged in the period; and finally it considers the manifold effects, intended and otherwise, of these efforts to fabricate consensus around the increasingly unmanageable problem of the environment which together contributed to the significant, though uneven, expansion of the post-1970 administrative state in the U.S. through the period of deregulation that followed. In this way, the dissertation argues that in this very attempt to introduce manageability into an environmental, visual-perceptual problem that had been thought especially resistant to bureaucratic clarity, one finds a particularly revealing object of management that discloses manifold transformations in architecture, psychology, and allied domains of practice, together constituting a broad-based managerial effort functioning at an unprecedented scale of operation.

---

[5] In this way, this dissertation adopts a social constructionist approach to matters of the environment—an approach whose preponderance has garnered some criticism among historians of the environment of late. For the historiography of environmental history, see, variously, Alfred W. Crosby, "The Past and Present of Environmental History," *The American Historical Review* 100, no. 4 (1995): 1177–89; J.R. McNeill, "Observations on the Nature and Culture of Environmental History," *History and Theory* 42, no. 4 (2003): 5–43; Paul S. Sutter, "The World with Us: The State of American Environmental History," *Journal of American History* 100, no. 1 (June 1, 2013): 94–119.

Psychovisualization

At the center of the chain of techniques that had made possible the management of the visual were novel architectural visualization procedures, coupled with strategies of psychologization, which together facilitated the deputization of images as surrogates for environments. A disparate set of designers brought architectural skillsets to bear in this development of what had been referred to, variously, as representation, rendering, or visual simulation in the period—and what I refer to, collectively, as *visualization*, highlighting the material-cultural practices constituting this broad-based effort. Seeking the means to systematically test perceptual responses to environmental variables, these architects charged the development of new forms of imaging with the promise of an improved base of knowledge of environmental perception. The development of this new class of images was thought necessary to satisfy multiple criteria: visualizations required a demonstrable fidelity to the real, replicating the optical and sensorial processes of vision often by way of recourse to strategies of visual immersion, and the ready ability for controlled manipulation in order to test alternatives and variables. These dictates directed the production of unprecedented, hybrid media types, including manually and digitally generated mixed-media composite photography; stereography; immersive, photographic slide environments; film-, television-, and video-based immersive model simulation; holography; digitally generated perspectives and other forms of computer-drawn graphic simulation; and full-scale mock-ups.[6] These architectural efforts, to be sure, drew on longer histories of the discipline's commitment to the development of representational practices, inflected by this period by

[6] For overviews of longer-extant and novel visualization strategies developed in the period, see George McKechnie, "Simulation Techniques in Environmental Psychology," in *Perspectives on Environment and Behavior: Theory, Research, and Applications*, ed. Daniel Stokols (New York: Plenum Press, 1976); Donald Appleyard, "Understanding Professional Media," in *Human Behavior and Environment*, ed. Irwin Altman and Joachim F. Wohlwill (New York: Plenum Press, 1977), 43–88; Stephen R. J. Sheppard, "Landscape Portrayals: Their Use, Accuracy, and Validity in Simulating Proposed Landscape Changes" (Ph.D., Berkeley, CA, University of California, Berkeley, 1982); Ervin H. Zube, David E. Simcox, and Charles S. Law, "Perceptual Landscape Simulations: History and Prospect," *Landscape Journal* 6, no. 1 (1987): 62–80; Henry Sanoff, *Visual Research Methods in Design* (Van Nostrand Reinhold, 1991).

a more recent, pointed ethical charge to position visualization as a medium for supporting participatory design methods.[7] This architectural activity drew in equal measure on a historical convergence of disparate charges afforded to visual images more broadly in the period: it encountered a growing understanding of the rhetorical capacity of images to muster and effect political change around matters of the environment; the burgeoning notion of visual culture which was subject to early theoretical formulation in these years; and image-making regimes in the social sciences charged with objective testing and demonstration.[8]

If historiography in architecture has long attended to the production of certain types of images as a privileged area of activity among architects, historiographic attention of a more recent vintage has tended to locate interest in the instrumentation that has structured these image-making practices—whether accounting for the deferral, the bounding, or the expansion of architectural agency, the dialectical reconfiguration of hand and instrument through an attention to techniques, or, significantly, other regimes of operation, including the market, the academy, and government, whose interface with architecture becomes revealed through an examination of tools, implements, and supplies.[9] Broadly construed, this historiographic turn has tended to rely on methods generated

---

[7] For an overview of this latter history, see Peter Blundell-Jones, Doina Petrescu, and Jeremy Till, eds., *Architecture and Participation* (New York: Routledge, 2005).

[8] The rhetorical capacity of images has often been made central to longer histories of the production of the environment. Histories of conservation—and official histories especially—have, for example, foregrounded the instrumentality of artist representations of landscapes as having offered cause for the founding of various National Parks. In an analogous mode of operation, with, to be sure, a fundamentally distinct mode of address, environmental historians have suggested that later incidents, such as the fires on the Cuyahoga River, the Santa Barbara oil spill, or the discovery of the pervasive effects of toxic waste disposal in Love Canal, New York, were rendered subject to unprecedented mass-media attention, whereby the rhetorical capacity of both images of crisis and the visual-cultural response to crisis together annealed public cause for reform. For examinations of the role of visual culture in longer histories of environmental movements in the United States, see Finis Dunaway, *Natural Visions: The Power of Images in American Environmental Reform* (Chicago, IL: University of Chicago Press, 2008); Finis Dunaway, "Gas Masks, Pogo, and the Ecological Indian: Earth Day and the Visual Politics of American Environmentalism," *American Quarterly* 60, no. 1 (2008): 67–99; Kathryn Morse, "There Will Be Birds: Images of Oil Disasters in the Nineteenth and Twentieth Centuries," *Journal of American History* 99, no. 1 (June 1, 2012): 124–34. See also Spencer R. Weart, *Nuclear Fear: A History of Images* (Cambridge, MA: Harvard University Press, 1988).

[9] See, variously, Sylvia Lavin and UCLA Curatorial Project, *The New Creativity: Man and Machines*, Exhibition at MAK Center for Art and Architecture, Los Angeles, CA, June 11–August 16, 2015; Zeynep Çelik Alexander and John May, eds., *Design Technics: Archaeologies of Architectural Practice* (Minneapolis, MN: University of Minnesota Press, 2020); Sarah

by historians of science, and to a lesser extent by scholars of scientific visual culture, which have identified frameworks for foregrounding the role of images, models, and demonstrations in experimentation as forms of material-cultural practice. However rightly, many of these histories of science have tended to maintain structuring oppositions between mimesis and analysis, with corollary implications for epistemic dichotomies between the instance and the rule.[10] Indebted to these methods, this study, by comparison, elects to take up another class of image—the visual image explicitly charged, recursively, as a vehicle for studying the visual—whose instrumentation reveals the processes of instrumentalization by which subjective particularities, it was hoped, could be aggregated to constitute new generalities, in direct service of diverse strategies of aesthetic governance.[11]

The application of these visualizations in matters of governance was sustained by an increasingly robust array of instrumentation enabling new kinds of subjective observation, perceptual measurement, and statistical analysis in order to construct a robust social-scientific, experimental apparatus around these images. Equipment including eye-tracking devices, tachistoscopes, olfactometers, hodometers, and electrocardiographic and electroencephalographic tests were deployed to variously measure physiological, optical, psychophysical, and preferential

---

Hearne, "Other Things Visible on Paper: Architectural Writing and Imaging Craftsmanship 1960-87" (Ph.D. Dissertation, Los Angeles, CA, University of California, Los Angeles, 2020).

[10] For a historiographic reflection on the attention to images in histories of science, see M. Norton Wise, "Making Visible," *Isis* 97, no. 1 (2006): 75–82. For crucial examples of the handling of images in histories of science and in science studies, see Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, NJ: Princeton University Press, 1985); Lorraine Daston and Peter Galison, "The Image of Objectivity," *Representations*, no. 40 (1992): 81–128; Lisa Cartwright, *Screening the Body: Tracing Medicine's Visual Culture* (Minneapolis, MN: University of Minnesota Press, 1995); Peter Galison, *Image and Logic: A Material Culture of Microphysics* (Chicago: University of Chicago Press, 1997).

[11] Key historiographic models for addressing the interface between novel architectural visualization procedures and governance practices include Felicity D. Scott, *Outlaw Territories: Environments of Insecurity/Architecture of Counterinsurgency* (Princeton, NJ: Princeton University Press, 2016); Catherine F. McMahon, "Predictive Machines: Data, Computer Maps, and Simulation," in *A Second Modernism: MIT, Architecture, and the "Techno-Social" Moment*, ed. Arindam Dutta (Cambridge, MA: MIT Press, 2013). This historiographic interest raises difficult questions regarding the "politics" of technological artifacts; for a key handling of this issue, see Langdon Winner, "Do Artifacts Have Politics?," *Daedalus* 109, no. 1 (1980): 121–36.

responses to simulations and visualizations. Key psychometric instruments, in turn, furnished the capacity to render subjective responses to these media forms in structured and quantified terms, variously measuring meaning, attitudes, and perceptual preferences by way of recourse to instruments including structured questionnaires, response inventories, adjective checklists, rating scales, semantic differentials, q-sort exercises, electronic voting devices, and gaming exercises.[12] Multivariate statistical procedures, including factor analysis and multiple regression analysis, finally, promised to identify strong relationships among the resulting, multidimensional datasets, variously affording what was considered the possibility of powerful extrapolation, predictivity, and generalizability of experimental findings.[13]

These instruments, procedures, and techniques provided experimental formats and frameworks charged with resolving significant, long-intractable debates across discourses germane to multiple domains of investigation: to be reconciled in this effort were the degree to which visual perception was directed by objective, physical determinants of the environment; the role of sensation versus cognition in processes of perception; the degree to which judgments were individually determined, whether by background, experience, attitude, or personality, or collectively shared; and the corollary matters of how to measure, quantify, and aggregate individual judgments to yield generalizable—and therefore legally actionable—aesthetic certainties.[14] These matters bore

---

[12] The growing significance of these psychometric instruments across multiple domains of practice corresponded with the significant expansion of public opinion research and polling in the period. On the early use of structured tests in personality research, see Paul E. Meehl, "The Dynamics of 'Structured' Personality Tests," *Journal of Clinical Psychology* 1, no. 4 (1945): 296–303. On the expansion of public opinion research in the period, see Sarah E. Igo, *The Averaged American: Surveys, Citizens, and the Making of a Mass Public* (Cambridge, MA: Harvard University Press, 2007). On the specific turn in architectural practice to the use of questionnaires, interviews, and surveys, see Sylvia Lavin, "A Cloudburst of Happiness, or Modernism by Other Means," in *Architecture Itself and Other Postmodernization Effects* (Montreal: Canadian Centre for Architecture, 2020).

[13] On the application and limits of these statistical techniques in matters of landscape appraisal in the period, see Neil David Weinstein, "The Statistical Prediction of Environmental Preferences: Problems of Validity and Application," *Environment and Behavior* 8, no. 4 (December 1, 1976): 611–26.

[14] For one, characteristic excursus suggesting the contours of this debate in the period, see Joachim F. Wohlwill, "The Environment Is Not in the Head!," in *Environmental Design Research*, vol. 2 (Stroudsburg, PA: Dowden, Hutchinson, & Ross, Inc., 1973), 166–81. For overviews of these debates in psychological discourse, see Edwin G. Boring, *Sensation and*

variously on disparate lines of psychological inquiry: mobilized across this particular effort were techniques sourced from Gestalt psychology, personality psychology, information-processing models of perception, cognitive science, psychophysics updated by way of recourse to the theories of signal detection, behavioral economics, evolutionary psychology, and what some in the period termed empirical aesthetics.[15] On the whole, these disparate, and often opposing, schools of psychological thought and psychologically inflected inquiry have been little attended to in architectural historiography.[16]

The commitment to the empirical in the study of perception and aesthetics in psychology converged with multiple strains of psychological discourse of a slightly more recent vintage, which, by the period in question, had become increasingly concerned with matters of the environment—whether as an object of analysis, in se, or as a methodological approach to understanding behavior, perception, or cognition more broadly. In historiographic retrospect, this burgeoning psychological interest in the environment has tended to be treated wholesale as "environmental psychology," a

---

Perception in the History of Experimental Psychology (New York: Appleton-Century-Crofts, Inc., 1942); Richard J. Herrnstein and Edwin G. Boring, eds., *A Source Book in the History of Psychology* (Cambridge, MA: Harvard University Press, 1965).

[15] Psychology was largely considered better equipped to handle perceptual and aesthetic matters of natural environments than was, say, philosophy, in this historical context. Analytic philosophers in the middle of the twentieth century lamented what they identified as the half-century-long project which had effectively restricted aesthetic discourse to the study of art, rather than the study of things like natural landscapes, and psychology had offered procedures for the production of purportedly objective, quantified aesthetic data necessary for the regulatory project in question here. For a characteristic diagnosis of the turn away from the study of nature in aesthetic discourse in philosophy, see Ronald Hepburn, "Contemporary Aesthetics and the Neglect of Natural Beauty," in *British Analytical Philosophy*, ed. Bernard Williams and Alan Montefiore (London: Routledge & Kegan Paul, 1966), 285–310. For overviews of empirical aesthetics as an area of psychological inquiry, see Charles W. Valentine, *The Experimental Psychology of Beauty* (London: Methuen & Co., Ltd., 1962); Daniel E. Berlyne, ed., *Studies in the New Experimental Aesthetics: Steps toward an Objective Psychology of Aesthetic Appreciation* (Oxford, UK: Hemisphere, 1974).

[16] A recent line of historiographic inquiry in architecture has attended to longer histories of psychological investigation into matters of sensation, perception, and cognition developed in the late nineteenth and very first decades of the twentieth centuries, particularly in Germanic contexts; these histories have variously considered the impact of these psychological-discursive practices in the formation of art psychology, pedagogical theory, and twentieth-century architectural and artistic output. This dissertation, by comparison, picks up on these areas of psychological inquiry to address their extension into matters of governance by the second half of the twentieth century in the United States. See Mark Jarzombek, *The Psychologizing of Modernity: Art, Architecture and History* (Cambridge, UK: Cambridge University Press, 1999); Zeynep Çelik Alexander, *Kinaesthetic Knowing: Aesthetics, Epistemology, Modern Design* (Chicago: University of Chicago Press, 2017); James Graham, "The Psychotechnical Architect: Perception, Vocation, and the Laboratory Cultures of Modernism, 1914-1945" (Ph.D., New York, Columbia University, 2019).

denomination whose seemingly self-evident explanatory power continues to cover over the disparate, often conflicting lines of investigation and schools of psychological thought constituent to this broad-based project.[17] A bias perhaps encouraged by the seeming formalization of a distinct discipline by the late 1960s, this understanding in part rests on the numerous degree programs, journals, professional organizations, symposia, and conferences which proliferated in just a few-year span.[18] In fact pointing to a diffuse body of research, this disciplinarization belies the significant conflicts and fundamental divergences characterizing the heterogenous assemblage of experimentalists and introspectionists; elementarists, atomists, and holists; associationists and nativists; structuralists and functionalists; and behaviorists and cognitivists, each representing schools of psychological thought largely considered irreconcilable, who comprised this commitment to the psychological study of the environment. This is to say: "environmental psychology" never identified a stable activity—much less a singular line of inquiry. [19] The environmental-managerial

[17] The diverse, and often conflicting, accounts of the origins and development of "environmental psychology" generated by key protagonists in this area of research attest to, and often directly acknowledge, this very problematic. See Kenneth Craik, "Environmental Psychology," in *New Directions in Psychology 4* (New York: Holt, Rinehart and Winston, Inc., 1970); Joachim F. Wohlwill, "The Emerging Discipline of Environmental Psychology," *American Psychologist* 25 (1970): 303–12; Harold M. Proshansky, William H. Ittelson, and Leanne G. Rivlin, *Environmental Psychology: Man and His Physical Setting* (New York: Holt, Rinehart and Winston, Inc., 1970); Yi-Fu Tuan, "Environmental Psychology: A Review," *Geographical Review* 62, no. 2 (1972): 245–56; William H. Ittelson et al., eds., *An Introduction to Environmental Psychology* (New York: Holt, Rinehart and Winston, Inc., 1974); Kenneth H. Craik, "Multiple Scientific Paradigms in Environmental Psychology," *International Journal of Psychology* 12, no. 2 (January 1, 1977): 147–57; Harold M. Proshansky and Timothy O'Hanlon, "Environmental Psychology: Origins and Development," in *Perspectives on Environment and Behavior: Theory, Research, and Applications*, ed. Daniel Stokols (Boston, MA: Springer US, 1977), 101–29; David V. Canter and Kenneth H. Craik, "Environmental Psychology," *Journal of Environmental Psychology* 1 (1981): 1–11; Ervin H. Zube, James L. Sell, and Jonathan G. Taylor, "Landscape Perception: Research, Application and Theory," *Landscape Planning* 9 (1982): 1–33. See also J. Douglas Porteous, *Environmental Aesthetics: Ideas, Politics and Planning* (London: Routledge, 1996).

[18] Among the earliest of these were the graduate program in Environmental Psychology at City University of New York established in 1968; the program in Man-Environment Relations at Penn State founded in the same year; the organization, by about 1969, of the Association for the Study of Man-Environment Relations; the publication of the journal *Environment and Behavior* beginning in 1969; the founding of the Institute for Man and his Environment at the University of Massachusetts, Amherst, in 1971; and the organization of a Task Force on Environment and Behavior within the American Psychological Association in 1974. It was in these same years that the Environmental Design Research Association had its start: organized by 1968, the Association held its first annual conference in 1969. See Robert B. Bechtel, "The History and Promise of Environment and Behavior Research," in *Environment & Behavior: An Introduction* (Thousand Oaks, CA: Sage Publications, 1997), 75–104.

[19] A recent strain of historiography in architecture has tended to treat environmental psychology as largely reducible to behaviorism—at the conspicuous expense of numerous other schools of psychological thought. However central in the historical interface between the disciplines of psychology and architecture, behaviorism's historiographic emphasis

project outlined in this dissertation, rather, required specific recourse to particular lines of psychological inquiry into perceptual and environmental concerns as they were explicitly brought to bear in matters of architectural skilling, aesthetic testing, and the development of regulatory regimes in the period—at the expense, to be sure, of other modes central to the development of "environmental psychology," as it has been historically and historiographically construed.[20]

In attending to this convergence of architectural visualization and psychologization practices, this history necessarily sketches analogous, if not parallel, reorientations in the professional structuring of both the disciplines of architecture and of psychology. Most expressly, architects and psychologists directly paired with one another in significant numbers, teaming to form sustained research collaborations which this dissertation traces. This phenomenon has often been cited as a characteristic mark of the turn toward interdisciplinarity—which pervaded not only architecture, but the university more broadly in the period—captured especially in the emergence of

---

perhaps mirrors its purported success as the dominant mode of psychological inquiry in the academy in the United States especially before the 1960s. This tendency to conceive of environmental psychology in architecture as indexical with behaviorism, too, is perhaps an artefact of the ready translation between behaviorism's commitment to the study of outward actions and architectural form's perceived (functionalist) capacity to condition such behavior. If behaviorism had, on the whole, taken the inner workings of the mind to be unavailable, secondary, or irrelevant, even, to scientific analysis, this dissertation takes up the understudied turn in architectural practice toward cognitivist theories of mind whose development had proceeded contemporaneously and, especially, subsequently to behaviorism's prime in the U.S. American academy. For histories importantly accounting for the interface between behaviorism and architecture, see Avigail Sachs, "Architects, Users, and the Social Sciences in Postwar America," in *Use Matters: An Alternative History of Architecture*, ed. Kenny Cupers (London: Routledge, 2014), 70–84; Joy Knoblauch, *The Architecture of Good Behavior: Psychology and Modern Institutional Design in Postwar America* (University of Pittsburgh Press, 2020).

[20] Although crucial in histories of environmental psychology broadly construed, notably marginalized in the specific discussions here are important contributions including Kurt Lewin's field theory and Roger Barker's ecological psychology, both of which applied Gestalt psychological frameworks to the study of behavior in order to identify the structuring influence of environments, as well as James Gibson's ecological theory of perception, which maintained that perception was largely the result of direct, unmediated response to environmental stimuli, among others. For reasons addressed in the chapters, these theories did not particularly lend themselves to this domain of historical production whose commitment to the study of perceptual judgment had relatively little use for the study of behavior and required particular recourse to notions of cognition and mental mediation. See Kurt Lewin, *A Dynamic Theory Of Personality* (New York: McGraw-Hill Book Company, Inc., 1935); Kurt Lewin, *Field Theory in Social Science: Selected Theoretical Papers*, ed. Dorwin Cartwright (New York: Harper and Row, 1951); Roger G. Barker and Herbert F. Wright, *One Boy's Day: A Specimen Record of Behavior* (New York: Harper & Brothers, 1951); Roger G. Barker and Herbert F. Wright, *Midwest and Its Children: The Psychological Ecology of an American Town* (Evanston, IL: Row, Peterson and Company, 1955); James J. Gibson, *The Ecological Approach to Visual Perception* (Boston, MA: Houghton, Mifflin and Company, 1979).

"environmental design."[21] Psychology, in this context, was among the key areas of extra-disciplinary research positioned to inform a new type of architectural practice, the perceived importance of which was perhaps most clearly suggested in the growing number of psychologists on faculties of schools of architecture in the period. In fact, however, both professions were subject to more fundamental reorganization in many ways irreducible to interdisciplinarity. Rather, new forms of skilling and reskilling allowed both architectural and psychological expertise to be distributed across new economic arrangements outside the strictures of normative disciplinary practice, narrowly construed: architects and psychologists were employed, increasingly, as external contractors, technical consultants, federal agents, and managers—representing, perhaps, a broad-based loosening of disciplinarity as such, which has been subject to relatively little historiographic attention.[22] To wit, by the period in question, the U.S. Forest Service had become the largest single employer of landscape architects, who were no longer employed primarily as designers but increasingly as researchers and land managers, charged with developing visualization practices, analytic frameworks, and other forms of managerial oversight. Elsewhere, architects played central roles in the significant growth of planning consultancies whose primary outputs included environmental impact reports produced under contract to governmental agencies. The psychological profession was subject to strikingly similar transformations in the period. Following the Second World War, the profession had witnessed a rapid expansion in which psychologists were engaged, increasingly, as consultants and contractors, offering counsel in matters of policy, testifying before Congress, serving as expert

---

[21] For a historical account of this cross-disciplinary traffic, see Avigail Sachs, *Environmental Design: Architecture, Politics, and Science in Postwar America* (Charlottesville, VA: University of Virginia Press, 2018).

[22] An important exception, to which my argument is indebted, is laid out in Sylvia Lavin, *Architecture Itself and Other Postmodernization Effects* (Montreal: Canadian Centre for Architecture, 2020).

witnesses in courtrooms, and employed as advisors across diverse institutions.[23] These developments in the architectural and psychological professions corresponded with a roughly contemporaneous history of the growth of management consulting as an industry, which saw, among other things, the federal government hiring management consulting firms in significant numbers to restructure administrative practices and an increased governmental reliance on external contractors and technical consultants for core functions. By about the 1970s, then, relations among architecture, psychology, and federal government had been fundamentally reshaped, suffused through by a new corporate logic.[24]

Regulation

It was as a result of these various conditions—legislative, discursive, practical, and professional—that the visual was able to be rendered available to the workings of law. The multidisciplinary turn to practices of visualization, coupled with strategies of psychologization, constituted what historians Peter Becker and William Clark have called little tools of knowledge—the pervasive, yet little-seen documentation practices whose interpolation into governance comprise claims to authority.[25] Inserted into laboratory reports and government-sponsored studies, and presented at planning meetings, hearings, and in official surveys and tests, these visualization-

---

[23] Ellen Herman, *The Romance of American Psychology: Political Culture in the Age of Experts* (Berkeley: University of California Press, 1995); Morton M. Hunt, "Users and Misusers of Psychology," in *The Story of Psychology* (New York: Anchor Books, 1993), 599–633.

[24] This specific turn in the professional activity of architects and psychologists corresponds with what business historian Christopher McKenna had identified as the emergence of "the contractor state." Christopher D. McKenna, "The Origins of Modern Management Consulting," *Business and Economic History* 24, no. 1 (1995): 57; Christopher D. McKenna, "Creating the Contractor State: Consultants in the American Federal Government," in *The World's Newest Profession: Management Consulting in the Twentieth Century* (New York: Cambridge University Press, 2006), 80–110.

[25] Peter Becker and William Clark, *Little Tools of Knowledge: Historical Essays on Academic and Bureaucratic Practices* (Ann Arbor: University of Michigan Press, 2001). For an account of the turn across architectural practice to these little tools of knowledge in the period, see Sylvia Lavin, "A Report on Little Tools of Knowledge," in *Architecture Itself and Other Postmodernization Effects* (Montreal: Canadian Centre for Architecture, 2020).

psychologization techniques mediated perceptual feedback in order to form the basis for an increasingly extensive array of regulatory instruments and agency procedures: federal visual planning frameworks, visual impact assessment and reporting protocols, new forms of data mapping, and perceptual quality indices each required the structured, subjective data made possible by these representational techniques.[26] Together, these regulatory instruments constituted the general system for accounting for what had come to be termed, as a result of these historical transformations, "visual quality" in the period: broadly conceived at once as a novel resource type and as a suprageographic evaluative metric, visual quality was thought able to be measured, monitored, predicted, and thus managed across locales in a manner analogous to air or water quality, both of which had been subject to new forms of accounting in the years immediately previous.[27] In this way, visual quality promised the possibility of an actuarial approach to accounting for individual difference—whether across individuals' perceptual judgments or the specificity of particular landscapes—within comprehensive frameworks for purportedly objective assessment. With the promise of this newfound systematicity, federal agencies developed extensive processes for inventorying, classifying, and mapping visual quality across lands under agency jurisdiction, putting to use novel administrative instruments including inventory forms, checklists, distance analysis procedures, and decision matrices to yield area-specific standards specifying allowable degrees of

[26] For a broad overview of the treatment of aesthetic matters in governmental and private planning practices following the National Environmental Policy Act, see Marilyn D. Bagley et al., *Aesthetics in Environmental Planning*, EPA-600/5-73-009 (Washington, D.C.: U.S. Environmental Protection Agency, Office of Research and Development, 1973). For overviews of federal agency visual management systems in the United States, see Edward H. Stone, *Visual Resource Management*, Landscape Architecture Technical Information Series (Washington, D.C.: American Society of Landscape Architects, 1978); Richard C. Smardon, "An Organizational Analysis of Federal Agency Visual Resource Management Systems" (Ph.D. Dissertation, University of California, Berkeley, 1982).

[27] In the United States, the Water Quality Index and Air Quality Index had both made their debuts just a few years earlier, in 1965 and 1968 respectively. Gary C. Thom and Wayne R. Ott, *Air Pollution Indices: A Compendium and Assessment of Indices Used in the United States and Canada* (Washington, D.C.: The Council on Environmental Quality and the U.S. Environmental Protection Agency, 1975); Wayne R. Ott, *Water Quality Indices: A Survey of Indices Used in the United States* (U.S. Environmental Protection Agency, Office of Research and Development, Office of Monitoring and Technical Support, 1978).

development. Measured against these standards, project-specific impacts could be quantified, projected, and captured in environmental impact statements and administrative determinations. En masse, these regulatory instruments facilitated the visual management of the territory not only as strategies by which the overall quality of the country's landscapes could be improved but, perhaps more crucially, as procedural mechanisms for accommodating infrastructure development increasingly capable of staving off litigation and other forms of legal challenge. In this way, the drive to manage the environment which had come to take the particular form of the management of images had, by this series of subsequent operations, been recast as the management of information.

A striking consequence of this effort was made plainly visible in the proliferation of diagrams of human perception proffered by various federal agencies and appearing in countless governmental reports, training programs, and visual impact guidelines in the period (figs. 0.1–0.4). Against narratives that have suggested that this period witnessed the production of a new "mass public" founded upon the notion of the "average man," largely made possible through new opinion polling instruments and marketing techniques, here, rather, a bureaucratic redefinition of human subjectivity recast individuals as irretrievably heterogenous, to be aggregated, rather than averaged, through new visual, psychometric, and statistical techniques of reconciliation.[28] Both a product of and a site for the working out of these relations, the human figure was here recast in manifold ways: often reduced primarily to a seeing eye, these diagrams strongly underscored the primacy afforded to vision which was characteristic of this broader-based project; structured into a detailed, linear, and predictable set of operations often beginning with an environmental stimulus, filtered successively

[28] In recent decades, historians have sought to disentangle abstractions such as quantification, standardization, and normalization, which have often served as structuring forces in historical narratives, instead arguing that these particular projects cannot be understood to be coterminous. See, for example, Theodore M. Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton, NJ: Princeton University Press, 1995); Sarah E. Igo, *The Averaged American: Surveys, Citizens, and the Making of a Mass Public*; Martha Lampland and Susan Leigh Star, eds., *Standards and Their Stories: How Quantifying, Classifying, and Formalizing Practices Shape Everyday Life* (Ithaca, NY: Cornell University Press, 2009); Emanuele Lugli, *The Making of Measure and the Promise of Sameness* (University of Chicago Press, 2019).

through optical, perceptual, and cognitive frameworks, including, in at least one instance, economic needs, the human visual and aesthetic process could be organized and mapped, with each step available to new forms of study and datafication. This production of a visual bias required, to be sure, the insistent elimination of other forms of sensory input—not to mention other environmental concerns whose effects, often, were decidedly invisible—an incremental process that this dissertation traces, countering narratives that have sought to naturalize the reduction of various realities to the status of image. Through this set of operations structuring human vision in predictable ways, individual subjectivity could be systematically represented and accounted for—thus forming the basis for the reinterpolation of diverse individuals into new, heterogenous aggregates, which were considered necessary for the workings of administration.[29]

This history contributes in this way to a topic of recent interest in architectural historiography, which has attended increasingly to relationships between architecture and the law.[30] Looking beyond architecture's capacity to serve as a vehicle for the representation of power or its resistance, these histories have instead elected to take up instances in which architects, in their capacity as designers, have worked with, as, or against political actors, narrowly defined, as well as

---

[29] In many ways, this project is indebted to Michel Foucault's notion of governmentality, which foregrounds, among other things, the techniques of power that operate to construct subjects. In recent decades, scholars have extended the notion of governmentality to matters of the environment, alternately coining concepts including environmentality and ecogovernmentality. See Michel Foucault, *Security, Territory, Population: Lectures at the Collège de France, 1977-1978*, ed. Michel Senellart (New York: Picador Palgrave Macmillan, 2009). For an application of this framework to the study of the National Environmental Policy Act and "the potential of law to shape identities," examined through a case concerning the Yavapai Nation, see Wendy Espeland, "Legally Mediated Identity: The National Environmental Policy Act and the Bureaucratic Construction of Interests," *Law & Society Review* 28, no. 5 (1994): 1149–79. For conceptualizations of ecogovernmentality and environmentality, respectively, see Paul Rutherford, "'The Entry of Life into History,'" in *Discourses of the Environment*, ed. Éric Darier (Oxford: Blackwell Publishers, 1999); Arun Agrawal, *Environmentality: Technologies of Government and the Making of Subjects* (Durham, NC: Duke University Press, 2005).

[30] Broadly speaking, this architectural-historiographic interest in matters of governance seems to have emerged from immediately earlier commitments in architectural history to looking to histories of science as an external, animating source. Key examples of this recent interest include Aggregate Architectural History Collaborative, *Governing by Design: Architecture, Economy, and Politics in the Twentieth Century* (Pittsburgh, PA: University of Pittsburgh Press, 2012); Timothy Hyde, "Striking and Imposing Beauty": On the Evidence of Aesthetic Valuation," in *Writing Architectural History: Evidence and Narrative in the Twenty-First Century*, ed. Aggregate Architectural History Collective (Pittsburgh: University of Pittsburgh Press, 2021).

architecture's capacity to indirectly condition individual behavior and thought, through the lens of governmentality. Under-accounted for in this area of historiographic interest is, however, this matter of regulation—narrowly defined, in its legal specificity—and its effects on administrative practice.[31] This dissertation attends closely to these procedural transformations for managing the aesthetic, operating in concert with, but also often against, outward policy orientations and values, to sketch one constituent aspect of the significant growth of the administrative state in the U.S. in the period.[32]

A Promise of Reconciliation

The effort to administer the visual through techniques of visualization, psychologization, and regulation effected the incremental conversion of landscapes into images and, ultimately, into the newly pressing category of information—a process of translation whose effects remain pervasive, yet have been little addressed in architectural historiography. Novel informatic techniques characterized numerous operations throughout this history: a broad-based effort among architects to develop serial visualizations, automatically generated digital perspectives, and proto-geographic information system softwares facilitated the production of images as informative surrogates for environments.

---

[31] A notable exception, which forms a key influence in the development this dissertation, attends to the role of architecture discourse around aesthetic matters in the formulation of regulation and policy in a markedly distinct political context. By comparison, the focus of the study here is necessarily less discursive in orientation, and rather centered on the development of regulatory instrumentation. See Timothy Hyde, *Ugliness and Judgment: On Architecture in the Public Eye* (Princeton, NJ: Princeton University Press, 2019).

[32] For a "classic" handling of the emergence of the administrative state as a characteristic feature of U.S. American governance, see Dwight Waldo, *The Administrative State: A Study of the Political Theory of American Public Administration* (New York: The Ronald Press Company, 1948). For recent, historical and contemporary examinations of the administrative state in the U.S., see the special issue Mark Tushnet, ed., "The Administrative State in the Twenty-First Century: Deconstruction and/or Reconstruction," *Daedalus* 150, no. 3 (Summer 2021), and in particular Susan E. Dudley, "Milestones in the Evolution of the Administrative State," *Daedalus* 150, no. 3 (July 1, 2021): 33–48. For an overview of the National Environmental Policy Act's role in these regulatory transformations, see Lynton K. Caldwell, *Science and the National Environmental Policy Act: Redirecting Policy through Procedural Reform* (Tuscaloosa, AL: University of Alabama Press, 1982). Environmental historians have increasingly taken up these matters in order to sketch the emergence of the "environmental-management state"; see Adam Rome, "What Really Matters in History: Environmental Perspectives in Modern America," *Environmental History* 7, no. 2 (2002): 303–18.

These images were sustained, in turn, by a burgeoning array of surveys and psychometric techniques, generating copious statistical data, structured inventories, and formulae, corresponding with a wholesale turn in psychological discourses from matters of behavior to cognition and information-processing, along with practices in economics in the period which turned increasingly to problems of information asymmetries and notions of bounded rationality. Mobilized in the context of public hearings and demographic studies, these visualization and psychologization techniques together afforded novel strategies for public participation explicitly charged not only with soliciting increasingly copious feedback from the general public in order to inform governmental decision-making but, so too, with better "informing" the public, in equal measure.[33] This effort was supported by a growing class of consultants, contractors, and in-house specialists charged with informing federal agency practices and was bolstered by a proliferation of workshops, training programs, conferences and symposia responsible for training, in turn, new classes of agents and managers. In total, these activities furnished the basis for the development of an array of new regulatory instruments, including extensive visual management frameworks and environmental quality indices, and new forms of disclosure, captured in regularized forms of agency reporting and the tens of thousands of environmental impact statements that had been issued in less than a decade following the passing of the National Environmental Policy Act, many of which were in excess of a thousand pages.[34] These various informatic practices sought to address what legal scholars have identified elsewhere as "the knowledge problem" characterizing administrative governance in this country: as information was thought to be decentralized and unevenly distributed across society,

[33] For a characteristic reflection on the conflicting dictates of the federal agency charge to "inform and involve" the public in the period, see Sally K. Fairfax, "Public Involvement and the Forest Service," *Journal of Forestry* 73, no. 10 (October 1, 1975): 657–59.

[34] Elizabeth Peelle, "Socioeconomic Impact Assessment and Nuclear Power Plant Licensing, Greene County, New York" (Conference on Improving the Scientific and Technical Information Utilized in Environmental Impact Statements, The Institute on Man and Science, Rensselaerville, New York, 1980), 1.

federal agencies were increasingly understood as primarily responsible for managing this asymmetrical distribution of information through new forms of compilation, aggregation, and dissemination, whether in an effort to improve decision-making or, often, to demonstrate due diligence, to accommodate development, and, in many cases, to stave off litigation.[35] This effort seems, largely, to have been successful: already by 1979, litigation around aesthetic matters in the U.S. had significantly subsided, with the visual increasingly rendered a matter of regulatory discretion.[36]

It was by this set of procedures, this dissertation argues, that novel informatic techniques facilitated the conflation of the management of images and of the environment, interpolated into an information economy increasingly native to the burgeoning bureaucratic administrative state. If, as historians Samuel and Barbara Hays have suggested, a correspondence, if not a determinism, might be drawn between attitudes toward the environment and prevailing economic arrangements in this country—the Hays suggest that the shift from a conservation ethos to concerns over the environment following the Second World War mirrored a shift in an economic history of production to a history of consumption, with natural beauty increasingly understood, at least in part, as a consumptive object—here, then, we might proffer a corollary: that the subsequent turn to the management of information suggests the outlines of the contemporaneous emergence of what would come to be called, increasingly, post-industrial society or information society, by this period.[37]

---

[35] This identification of the 'knowledge problem' has been credited to Friedrich A. Hayek, "The Use of Knowledge in Society," *The American Economic Review* 35, no. 4 (1945): 519–30. For recent handlings of the 'knowledge problem' in legal scholarship, see Adrian Vermeule, "Local and Global Knowledge in the Administrative State," in *Law, Liberty and State: Oakeshott, Hayek and Schmitt on the Rule of Law*, ed. David Dyzenhaus and Thomas Poole (Cambridge: Cambridge University Press, 2015), 295–327; Kenta Tsuda, "Making Bureaucracies Think Distributively: Reforming the Administrative State with Action-Forcing Distributional Review," *Michigan Journal of Environmental & Administrative Law* 7, no. 1 (November 1, 2017): 131–78; François Facchini and Mickael Melki, "The Democratic Crisis and the Knowledge Problem," *Politics & Policy* 47, no. 6 (2019): 1022–38.

[36] Smardon, "Law and Aesthetics, or Where Is the Pig in the Parlor? A Legal/Policy Overview of Legal Factors' Influence on Visual Landscape Policy," iv.

[37] Samuel P. Hays and Barbara D. Hays, *Beauty, Health, and Permanence: Environmental Politics in the United States, 1955-1985* (Cambridge: Cambridge University Press, 1987); Daniel Bell, *The Coming of Post-Industrial Society: A Venture in Social*

Deputized as a surrogate for the management of the environment, the management of information was, in this way, germane to the development of a computational model of governance considered necessary to manage unprecedented historical conditions concerning visual landscapes, which had seen a fundamental opposition emerge between aesthetic quality and purportedly democratic values. If, at the opening of the 1965 White House Conference on Natural Beauty, First Lady Lady Bird Johnson had averred:

> Our immediate problem is: How can one best fight ugliness in a nation such as ours—where there is great freedom of action or inaction for every individual and every interest—where there is virtually no artistic control—and where all action must originate with the single citizen or group of citizens?
>
> That is the immediate problem and challenge. Most of the great cities and great works of beauty of the past were built by autocratic societies. The Caesars built Rome. Paris represents the will of the Kings of France and the Empire. Vienna is the handiwork of the Hapsburgs, and Florence of the Medici.
>
> Can a great democratic society generate the concerted drive to plan, and having planned, to execute great projects of beauty? I not only hope so—I am certain that it can.[38]

This dissertation plumbs the consequences, intended and otherwise, of this multidecade project by which "great projects of beauty" were to be reconciled with what was purported to be "a great democratic society."

Forecasting (New York: Basic Books, 1973); Yoneji Masuda, *The Information Society as Post-Industrial Society* (Tokyo: Institute for the Information Society, 1980).

[38] *Beauty for America: Proceedings of the White House Conference on Natural Beauty, May 24-25, 1965* (Washington, D.C.: U.S. Government Printing Office, 1965), 17.

Chapter 1 *Cognition and Composite Images*

In the interface between the aesthetic and the legal in the United States, two dates bracket a period of pivotal transformation. In 1965, the United States Federal Court of Appeals for the Second Circuit granted legal standing to a citizen group opposed to the projected scenic impacts of a hydroelectric storage plant proposed for Storm King Mountain on the Hudson River in Orange County, New York—a procedural action then unprecedented in the history of environmental litigation in the United States.[1] Fourteen years later, in 1979, the U.S. Nuclear Regulatory Commission denied license to a proposal for a nuclear power plant to be sited along the banks of the Hudson River in Greene County, New York, on aesthetic grounds—a regulatory action similarly unprecedented in the history of nuclear power generation in this country.[2] These two events, not fifty-five miles apart and separated by less than a decade and a half, begin to suggest the contours of a fundamental inversion in the aesthetic management of landscapes that had taken hold by the early-to-mid-1970s: expert testimony in court proceedings or in public hearings attesting to landscapes of exceptional "natural beauty" had given way, incrementally, to consensus-driven testing, mapping, and statistical practices which labored to convert the aesthetic into a suprageographic quality that could be indexed, measured, and managed across locales. In this broad-based reorientation, aesthetics in legal contexts transformed from a matter largely treated—however uncertainly—as nuisance under common law and instead increasingly subject to new forms of regulatory and

---

[1] David Sive, "Securing, Examining, and Cross-Examining Expert Witnesses in Environmental Cases," *Michigan Law Review* 68, no. 6 (May 1, 1970): 1187.

[2] Elizabeth Peelle, "Socioeconomic Impact Assessment and Nuclear Power Plant Licensing, Greene County, New York" (Conference on Improving the Scientific and Technical Information Utilized in Environmental Impact Statements, The Institute on Man and Science, Rensselaerville, New York, 1980), i; Carl H. Petrich, "Aesthetic Impact of a Proposed Power Plant on an Historic Wilderness Landscape," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 477.

bureaucratic codification.[3] This process of transformation required the deliberate chaining together of techniques which themselves tracked longer histories of disciplinary realignments: variously marshalled in this effort were traditions of art history informed by Gestalt psychology; humanistic discourses of *Kunstwollen* and zeitgeist in landscape architecture; the then-emergent field of visual studies and expanding notions of visual culture; contemporary theories and techniques germane to the relatively new, interdisciplinary field of cognitive science; controversial functionalist frameworks sourced from evolutionary psychology; and statistical techniques developed in personality psychology. These techniques together labored to interpolate the aesthetic into rationalized systems of economic accounting—understood as requisite for devising any regulatory apparatus around the aesthetic matter at hand. At the center of this transformation were simulative testing strategies which employed mixed-media, composite photographs coupled with psychometric techniques to facilitate the conversion of the qualitative into the quantitative (fig. 1.1). Together, these cross-disciplinary theories, techniques, and media conspired to construct new regulatory mechanisms for accommodating and managing the aesthetic, constituting a key, yet understudied aspect of the broad transformation in strategies for environmental governance that emerged and took hold in the United States after about 1970 and that were subsequently subverted, redirected, but nevertheless perpetuated through the period of deregulation that followed into the 1980s.

3 For in-depth overviews of histories of aesthetics and the law in the U.S., see "Aesthetic Nuisance: An Emerging Cause Of Action," *New York University Law Review* 45, no. 5 (November 1970); Leighton L. Leighty, "Aesthetics as a Legal Basis for Environmental Control," *Wayne Law Review* 17, no. 5 (1971): 1347–96; Robert Broughton, "Aesthetics and Environmental Law: Decisions and Values," *Land & Water Law Review* 7, no. 2 (January 1, 1972): 451–500; "Beyond the Eye of the Beholder: Aesthetics and Objectivity," *Michigan Law Review* 71, no. 7 (June 1, 1973): 1438–62; Richard C. Smardon, "Law and Aesthetics, or Where Is the Pig in the Parlor? A Legal/Policy Overview of Legal Factors' Influence on Visual Landscape Policy" (Berkeley: Department of Landscape Architecture, University of California, Berkeley, 1978); Richard C. Smardon, "The Interface of Legal and Esthetic Considerations," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 676–85.

The precedent-setting 1965 decision in *Scenic Hudson Preservation Conference v. Federal Power Commission* affirmed legal standing on aesthetic grounds for the first time in U.S. Federal Court. In the landmark decision, the United States Federal Court of Appeals for the Second Circuit ruled that a resident group, the Scenic Hudson Preservation Conference, had legal standing to bring action against the U.S. Federal Power Commission and Consolidated Edison on grounds of projected aesthetic impacts. Early that year, the Federal Power Commission had granted Consolidated Edison a license to construct what purportedly was to have been the world's largest pumped-storage hydroelectric plant at Storm King Mountain on the Hudson River, about 65 miles south of Greene County.[4] Scenic Hudson, a well-heeled, well-funded group of local residents and recreationists who had organized soon after plans for the Storm King facility were first made public, objected to the granting of the license and deployed a multifaceted strategy in opposition. Mustering significant financial resources and professional expertise, with eminent lawyers, businesspeople, historians, and public relations professionals counting among their ranks, the group aggressively and adroitly generated negative publicity against ConEd's project.[5] Among other concerns, Scenic Hudson highlighted the project's potentially destructive effects on the river's population of striped bass, whose spawning grounds were in its immediate proximity; the visual impact of new transmission lines required to transmit energy south to New York City; and the resulting displacement of residents in the region.[6]

[4] As historian David Schuyler points out with regard to this case, "then as now, there was a revolving door between industry and regulatory agencies." See David Schuyler, *Embattled River: The Hudson and Modern American Environmentalism* (Ithaca: Cornell University Press, 2018), 13; Scenic Hudson Preservation Conference v. Federal Power Commission, 354 F.2d 608 (2d Cir. 1965).

[5] According to historian Alex Patrick Gobright, two of the group's financiers later went on to found the Natural Resources Defense Council. See Alex Patrick Gobright, "'Care Enough to Take Some Action': Storm King, Scenic Hudson, and the Local Citizens Who Saved a Mountain and Started a Movement, 1963-2013," *The Hudson River Valley Review* 30, no. 1 (Autumn 2013).

[6] Ibid.; Schuyler, *Embattled River: The Hudson and Modern American Environmentalism*.

Scenic Hudson took the Federal Power Commission to court in July 1965 in an effort to overturn the license granted to Consolidated Edison. Counsel for Scenic Hudson argued that the Federal Power Commission had failed to fulfill its public responsibility to fully account for these various impacts, the aesthetic chief among them. If, as historian David Schuyler has detailed in his *Embattled River: The Hudson and Modern American Environmentalism*, a hearing officer for the Federal Power Commission could aver in 1963 that the facility "would have relatively little adverse effect on the natural beauty of the area," for Scenic Hudson such direct claims were unsubstantiated and therefore legally insufficient.[7] The respondent, in turn, countered that the group had no legal standing as its members had not demonstrated "personal economic injury" suffered as a result of the proposed project, and thus they did not qualify as an "aggrieved party."[8] By the end of the year, Circuit Judge Paul R. Hays ruled against the Federal Power Commission and Consolidated Edison and in favor of Scenic Hudson. In his opinion, Hays affirmed Scenic Hudson's standing, suggesting that the Commission's argument limiting standing to economic injury was an overly "narrow view."[9] The Federal Power Commission, he maintained, had the responsibility to "protect the public interest in the aesthetic, conservational, and recreational aspects of power development," as outlined by the Federal Power Act, and in failing to do so the plaintiffs could justly claim to be aggrieved.[10] Hays's interpretation of the Federal Power Act, first enacted in 1920, hinged on a key phrase that had been added in 1935 which mandated energy projects conform with development guidelines accounting "for other beneficial public uses, including recreational purposes."[11] Hays's interpretation of *recreation*

---

[7] Schuyler, *Embattled River: The Hudson and Modern American Environmentalism*, 14.

[8] Scenic Hudson Preservation Conference v. Federal Power Commission, 354 F.2d at 615.

[9] Ibid.

[10] Ibid., 616.

[11] Federal Power Act, 16 U.S.C. § 803(a) (1964); cited in Scenic Hudson Preservation Conference v. Federal Power Commission, 354 F.2d at 614.

was expansive, writing, "The phrase undoubtedly encompasses the conservation of natural resources, the maintenance of natural beauty, and the preservation of historic sites."[12] Eliding the aesthetic concern into recreation had been a key strategy by which early legal efforts could interpolate visual matters into regimes of legality; in this longer history of traffic, aesthetics would incrementally move from a matter identified with "recreation" to "natural beauty" and finally to environmental quality.[13] (At the risk of overdetermination, this turn from conceiving the aesthetic as conferring a specific type of activity, namely recreation, to a category of visual experience, and finally to something to be assessed for its quality was largely coincident with and in fact coproduced by a shift in the discipline of psychology's emphasis from behaviorism to cognitive science which had largely taken hold by the 1960s, as will be detailed in a moment and elsewhere throughout this dissertation.)

Amid his legal arguments, Judge Hays affirmed Scenic Hudson's claims to the region's exceptionalism—an exceptionalism, for him, that was at once historic and aesthetic:

> The Storm King project is to be located in an area of unique beauty and major historical significance. The highlands and gorge of the Hudson offer one of the finest pieces of river scenery in the world. The great German traveler Baedeker called it "finer than the Rhine." Petitioners' contention that the Commission must take these factors into consideration in evaluating the Storm King project is justified by the history of the Federal Power Act.[14]

Hays's argument suggested there was an affirmative public interest in the aesthetic impacts of this project specifically and precisely because of the region's exceptionalism. Such a claim would stand in stark contrast to the generalized system of accounting that emerged as a result of this very historical process less than two decades later.

---

[12] Scenic Hudson Preservation Conference v. Federal Power Commission, 354 F.2d at 614.

[13] Michael McCloskey, "Litigation and Landscape Esthetics," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 674–75.

[14] Scenic Hudson Preservation Conference v. Federal Power Commission, 354 F.2d at 613.

Justified in this way, Judge Hays's ruling reversed the granting of the license for Storm King and remanded the case back to the Federal Power Commission to conduct further reviews to address the inadequacies of the first round of studies. In what prominent environmental lawyer David Sive, who later represented the Sierra Club in the following round of *Scenic Hudson Preservation Conference v. Federal Power Commission* proceedings in 1971, described in a legal review as Judge Paul R. Hays's "now classic language," the court concluded that "The Commission's renewed proceedings must include as a basic concern the preservation of natural beauty and of national historic shrines, keeping in mind that, in our affluent society, the cost of a project is only one of several factors to be considered."[15] According to Sive, this ruling established the weighing of the aesthetic against the economic as a fundamental "test" for other environmental disputes.[16] The question then that emerged was one of valuation: how could one begin to ascertain the "value" of a landscape beyond modes of economic analysis, with its disciplinary biases toward notions of scarcity? That is, how could the aesthetic be interpolated into a new system of accounting?

Although the ruling did not put an end to Consolidated Edison's efforts to develop the facility at Storm King—further hearings and rounds of litigation followed the 1965 trial, and ConEd didn't agree to finally drop the project until 1980—*Scenic Hudson Preservation Conference v. Federal Power Commission* importantly affirmed for the first time that action could be brought on aesthetic grounds. This ruling represented a major legal precedent, often cited in efforts by other litigants to bring aesthetics-focused litigation against infrastructural projects. To count, the ruling has been cited in some 200 cases in state and federal court, with the most recent in 2021. Some historians have,

[15] Sive, "Securing, Examining, and Cross-Examining Expert Witnesses in Environmental Cases," 1186; Scenic Hudson Preservation Conference v. Federal Power Commission, 354 F.2d at 624.

[16] Ibid., 1198.

somewhat narrowly, pointed to this instance as the foundation of "modern" environmental law, or, even, one of the beginnings of the "modern" environmental movement itself.[17]

The implications of Hays's ruling were largely procedural rather than substantive. If in his opinion Hays suggested that the federal agency was required to take into account the aesthetic, the question of how exactly to argue a legal case around projected aesthetic impacts remained unsettled. The subsequent hearings for the Storm King facility marshalled numerous expert witnesses who, like Hays himself had, could offer testimony to the exceptional natural beauty of the Hudson River Valley. Among the environmentalists, planners, landscape architects, and art historians who were called on offer such expert judgment was the architectural historian Vincent Scully who, at a 1967 hearing before the Federal Power Commission, testified in his characteristic tone:

> [Storm King Mountain] rises like a brown bear out of the river, a dome of living granite, swelling with animal power. It is not picturesque in the softer sense of the word but awesome, a primitive bodiment of the energies of the earth. It makes the character of wild nature physically visible in monumental form. As such it strongly reminds me of some of the natural formations which mark sacred sites in Greece and signal the presence of the Gods; it recalls Lerna in Argolis, for example, where Herakles fought the Hydra, and various sites of Artemis and Aphrodite where the mother of the beasts rises savagely out of the water. While Breakneck Ridge across the river resembles the winged hill of tilted strata that looms into the gulf of Corinth near Calydon. …
>
> Hence, Storm King and Breakneck Ridge form an ideal portal for the grand stretch of the Hudson below them. The dome of one is balanced by the horns of the other; but they are both crude shapes, and appropriately so, since the urbanistic point of the Hudson in that area lies in the fact that it preserves and embodies the most savage and untrammeled characteristics of the wild at the very threshold of New York. It can still make the city dweller emotionally aware of what he most needs to know: that nature still exists, with its own laws, rhythms, and powers, separate from human desires.[18]

---

[17] viz. Gobright, "'Care Enough to Take Some Action': Storm King, Scenic Hudson, and the Local Citizens Who Saved a Mountain and Started a Movement, 1963-2013"; Schuyler, *Embattled River: The Hudson and Modern American Environmentalism.*

[18] Record at 4888-89, In re Consolidated Edison Co. of New York, Inc. Project No. 2338 (F.P.C. 1967). Quoted in Sive, "Securing, Examining, and Cross-Examining Expert Witnesses in Environmental Cases," 1188.

Scully's description of landscape, dizzyingly Gestaltic, phenomenological, transcendentalist, mythological, and classicizing, in turns, testified to the unique exceptionalism of the particular landscape in question. Such an approach contributed to what Sive identifies as a "theory of proof" that, despite the fact that the area is not contained within a national park or monument, its "beauty is as unique as that of areas such as Yosemite, the Olympic Mountains, and the Great Smokies" and thus worthy of conservation.[19]

Such expert testimony concerning the judgment of beauty placed newfound pressure on notions of evidence production in legal contexts. Scully's testimony, along with that of other experts, was received over objections by the respondents. Traditional rules around expert testimony, Sive points out, dictate that such testimony becomes inadmissible if it comments directly on the matter in issue; if it concerns "matters of common knowledge"; or if it is not based on facts in evidence.[20] These rules produce competing aims for aesthetic testimony: experts testifying to aesthetic impacts on the general public had at once to demonstrate their highly trained expertise; at least some degree of objective basis for judgment; and an ability to speak to subjective concerns on behalf of the general public better than they themselves might. This is to say, expert judgment around the subjective concern required claims to universality while also reserving its status as a privileged domain of expert knowledge. Further problems could emerge on cross-examination, as cross-examiners then had "far greater latitude" when dealing with such subjective concerns and competing aims.[21] As Sive details,

> One of the most significant of those problems involves the degree to which opposing counsel will attempt to portray the witness as a composite of several objects of derision, among which are the feminized male, the unworldly sentimentalist, the professor who has

[19] Sive, 1187.

[20] Ibid., 1190.

[21] Ibid., 1195.

> never met a payroll, the enemy of the poor who need more kilowatts and hard goods, and the intellectual snob.[22]

In this way, the aesthetic question posed key challenges to the nature of legal expertise and evidence production in adversarial contexts.

If the aesthetic question posed fundamental challenges to the nature of expert testimony and the question of legal standing on non-economic grounds by the mid-1960s, and if Scully's embodied description of landscape sufficed, at least in part, as testimony in ultimately preventing the plant at Storm King from being built, the dictates of evidence production around the aesthetic would radically transform by just the following decade. By the mid-1970s, as made most clear in the context of the proposed nuclear power plant in Greene County, the terms had changed.

The $1.8-billion Greene County Nuclear Power Plant had promised to furnish New York City—and its subway system, in particular—with 1,200 megawatts of power.[23] After initially identifying 32 potential sites along or near the Hudson River in upstate New York, the Power Authority narrowed the possible sites down to two: their preferred location sat in the hamlet of Cementon on the west bank of the river near Catskill, New York, while a second site, in the town of Athens about 10 miles to the north, served as the legally required alternative for comparative analysis.[24] Both sites were deemed suitable by virtue, among other criteria, of their relatively sparse population densities and the supply of river water available to feed the reactor's cooling towers. Of the two, the site in Cementon was considered ideal for the fact that already on or near the site were three cement manufacturing plants, suggesting that the proposed land use would be compatible with existing heavy industry and thus would generate little controversy.[25]

---

[22] Ibid., 1194.

[23] Petrich, "Aesthetic Impact of a Proposed Power Plant on an Historic Wilderness Landscape," 478.

[24] "Upstate Area Divided by Atomic Project," *The New York Times*, April 14, 1974, 38.

[25] U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549* (Washington, D.C.;

The proposal, however, was nothing if not controversial. The pressurized water reactor was to have been supplied by Babcock & Wilcox—the energy firm that had built the reactor at Three Mile Island whose partial meltdown on March 28, 1979 would coincide with, if not directly lead to, the official cancellation of the project in Greene County just eight days later.[26] Among various concerns, local stakeholders had objected to the proposal's projected impacts on human health, fish populations, land values, and tourism in the region. But the fiercest debates centered on the proposal's visual effects, with its 450-foot-tall cooling tower, 205-foot-tall domed containment structure, and the plume of vapor that would invariably result from its operation subject to particular scrutiny. These various controversies took literal form in the tens of thousands of pages of written testimony, along with thousands of pages of supporting exhibits, documentation, and studies produced for the project—much of which was dedicated solely to the aesthetic question.[27] If the Storm King proceedings had affirmed, procedurally, that legal action could be brought on aesthetic grounds, the question remained: how could aesthetics be dealt with substantively?

In the intervening years between the first Storm King proceedings in 1965 and the controversy around the Greene County Nuclear Power Plant emerging by 1974, United States Congress passed its first comprehensive federal policy on the environment, the National Environmental Policy Act. Enacted in 1969, the Act laid out substantive, federal-governmental commitments providing for the protection of air and water quality, public health, and, crucially here, aesthetic values, newly understood to be fundamentally interrelated: an oft-cited provision in the Act affirmed the federal responsibility to "assure for all Americans safe, healthful, productive, and

---

Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979), 9-40.

[26] Peter Kihss, "New York Power Agency Drops Nuclear-Energy Project Upstate," *The New York Times*, April 6, 1979, 17.

[27] Peelle, "Socioeconomic Impact Assessment and Nuclear Power Plant Licensing, Greene County, New York," 5.

esthetically and culturally pleasing surroundings." That the Act had been passed unanimously in the U.S. Senate and along a 372–15 vote in the House suggests a broad (unrecognizable) political consensus around the matter, though the mechanisms by which these aims could be realized remained admittedly unclear. Acknowledging the dearth of objective, managerial techniques immediately available in this effort to administer the visual, the Act stipulated the development of a "systematic, interdisciplinary approach" bridging "the natural and social sciences" and "environmental design arts" to facilitate the development of comprehensive, analytic frameworks guiding federal agency practices—which, the Act further specified, necessitated new procedures capable of accounting not only for "economic and technical considerations," but also, importantly, for "presently unquantified environmental amenities and values."[28] Although substantive in aim, the effects of the National Environmental Policy Act were, in this way, largely procedural, directing the development of novel planning techniques for the aesthetic management of landscapes across federal bureaucratic practice.[29] Over the next decade and a half, then, architects, planners, psychologists, activists, and other state actors attempted to further resolve the question laid out some years earlier: how could the aesthetic be rendered available to governance? Which is to ask—how to quantify the unquantified?

This chapter accounts for the strategies by which landscape architecture, art history, and the social sciences conspired to develop new techniques and instruments for quantifying the unquantified. The chapter argues a historical arc directing this long process of transformation: embodied description, whether through expert testimony in legal settings or in articles, books,

---

[28] National Environmental Policy Act, 42 U.S.C. § 4331 (1969).

[29] A bevy of other environmental statutes in period, addressed elsewhere in this dissertation, bolstered this procedural effort by aiming to reform agency-specific techniques for administering the scenic, including, among others, the Department of Transportation Act of 1966, the Federal Land Policy and Management Act of 1976, the National Forest Management Act of 1976, the Surface Mining Control and Reclamation Act of 1977, and the Clean Air Act Amendments of 1977.

lectures, and exhibitions, served as a key form of evidence production in early aesthetic disputes; this gave way, incrementally, to predictive techniques, psychometrically projecting impacts of proposed projects on local populations; and finally, prescriptive systems, including the development of federal visual management guidelines and new indices like the Perceived Environmental Quality Index, came to replace both. In this chain of techniques—description, prediction, prescription—visual propriety was converted incrementally from a privileged domain of expertise, to a structured language available to algorithmic and statistical analysis, and finally to a suprageographic quality to be managed across locales in a manner analogous to air or water quality. (The Water Quality Index and Air Quality Index had both made their debuts in the U.S. just a few years earlier, in 1965 and 1968 respectively.) It is by this process, I argue, that visual propriety came to be rendered amenable to increasing juridical, legislative, and bureaucratic clarity in order to constitute new strategies for environmental governance in the United States.

By no means, however, do I intend to suggest here that this was a smooth, collective project with a singular, shared aim: environmental activists brought to the effort the demand for participatory, values-based decision-making; infrastructure engineers sought to predict, accommodate, and ultimately invisiblize the scenic impacts of infrastructure projects; politicians explicitly linked these efforts to a perceived need to demonstrate cultural power on a world stage while contending with various energy crises in light of geopolitical concerns; and state and federal bureaucrats sought to manage these competing aims in large part to avoid drawn-out legal battles and to ensure the smooth progress of infrastructure development vis-à-vis the dictates of territorial management. The incongruencies among these parties' various interests would quickly become untenable.

If the Storm King proceedings had relied on countless experts to make the case for aesthetic impacts, by the following decade, a novel documentary type came to constitute a radically new medium for discourse around the environment and infrastructure development. Section 102 (2)(C) of the National Environmental Policy Act mandated reporting of projected impacts for all proposed federal projects in the form of a "detailed statement"—what came to be called the environmental impact statement.[30] This mandate, it should be pointed out, had only been added late in the legislation's development, as it had become clear that the Act needed at least one "action-forcing" mechanism that went beyond ethical appeal.[31] The advent of the environmental impact statement was, arguably, the most visible and perhaps significant result of the National Environmental Policy Act in the United States. Immediately following the Act's passing, environmental impact statements proliferated quickly and emerged en masse as a site for and an object of debate. The Council on Environmental Quality reported that already by 1978, some 10,000 environmental impact statements had been issued, which in turn triggered nearly 1,000 lawsuits.[32]

By March 1976, the federal agency tasked with regulating nuclear power generation in the United States, the Nuclear Regulatory Commission, issued a draft environmental statement which supported the licensing of the nuclear power plant in Greene County. In keeping with National Environmental Policy Act mandates, the Commission maintains responsibility to produce independent environmental assessments of each application to construct or operate a nuclear power plant in the U.S. The Nuclear Regulatory Commission typically subcontracts this work to one of the

---

[30] National Environmental Policy Act, 42 U.S.C. § 4331 (2)(C).

[31] Indiana University School of Public and Environmental Affairs and National Science Foundation, *A Study of Ways to Improve the Scientific Content and Methodology of Environmental Impact Analysis: Final Report to the National Science Foundation*, Advanced Studies in Science, Technology and Public Policy (Bloomington, IN: School of Public and Environmental Affairs, Indiana University, 1982), 5; Lynton K. Caldwell, "Environmental Impact Analysis (EIA): Origins, Evolution, and Future Directions," *Impact Assessment* 6, no. 3–4 (December 1, 1988): 75.

[32] Peelle, "Socioeconomic Impact Assessment and Nuclear Power Plant Licensing, Greene County, New York," 1.

country's national laboratories, often Argonne National Laboratory or Oak Ridge National Laboratory, to produce technical analyses and writing for significant portions of the statements.[33] In the case of the nuclear power plant at Greene County, the Commission subcontracted with Oak Ridge National Laboratory to produce the draft assessment. But this draft statement was heavily criticized, among other things, for its lack of analysis of the plant's potential visual impacts, and the regulatory commission was directly challenged to address these criticisms.[34]

As an emergent documentary genre, the impact statement, at this point just over five years old, in many ways continued to exhibit adolescent growing pains. Early impact statements had been unrecognizably short in length and focused primarily on material concerns such as water or air quality. In the case of an early 1970 Bureau of Land Management impact statement written for the then-proposed Trans-Alaska pipeline, to offer one example, the draft statement was no more than eight pages in length, which a member of the Indigenous Inuit community pointed out conspicuously excluded any discussion of social impacts on both Indigenous and white settler populations.[35] Only incrementally, and often by dint of force, did federal agencies broaden the scope of these statements to address "softer" concerns including socioeconomic or aesthetic impacts.[36] This broadening was in large part due to public pressure, specifically: as the issue of aesthetic impacts had been raised repeatedly in public hearings, statements were compelled to contend with the matter despite its initial marginalization, if not erasure.[37] Nearing the end of the decade, impact

---

[33] Ibid., 3.

[34] Carl H. Petrich, "Assessing Aesthetic Impacts in Siting a Nuclear Power Plant: The Case of Greene County, New York," *Environmental Impact Assessment Review* 3, no. 4 (1982): 313.

[35] Rabel J. Burdge, "A Brief History and Major Trends in the Field of Impact Assessment," *Impact Assessment* 9, no. 4 (December 1, 1991): 93–94.

[36] Stuart L. Hart, Gordon A. Enk, and William F. Hornick, eds., *Improving Impact Assessment: Increasing the Relevance and Utilization of Scientific and Technical Information* (Boulder, CO: Westview Press, 1984), 2.

[37] Carl H. Petrich, "EIA Scoping for Aesthetics: Hindsight from the Greene County Nuclear Power Plant EIS," in *Improving Impact Assessment: Increasing the Relevance and Utilization of Scientific and Technical Information*, ed. Stuart L. Hart, Gordon A. Enk, and William F. Hornick (Boulder, CO: Westview Press, 1984), 86.

statements had ballooned in length, regularly exceeding thousands of pages, compelled at least in part by a defensive compulsion to avoid litigation: if matters could be shown to have been addressed in a statement, agencies could disprove allegations that the concerns hadn't been taken into account, even if they were ultimately ignored.[38] To address the bureaucratic morass, in mid-1977 President Jimmy Carter issued Executive Order 11991 which directed the Council on Environmental Quality to develop new regulations for impact statements

> … designed to make the environmental impact statement process more useful to decisionmakers and the public; and to reduce paperwork and the accumulation of extraneous background data, in order to emphasize the need to focus on real environmental issues and alternatives. They will require impact statements to be concise, clear, and to the point, and supported by evidence that agencies have made the necessary environmental analyses.[39]

The Council issued its streamlined regulations very late in 1978—too late to change the course of the impact assessment process for Greene County, which would have been largely completed by then.[40] Still, the findings of the final impact statement for Greene County ran in many ways diametrically counter to its draft predecessor.

To address the criticisms levied against the Draft Environmental Statement for the Greene County Nuclear Power Plant, in April 1977 Oak Ridge National Laboratory hired Carl Petrich, a recent graduate of the landscape architecture program at the University of Michigan, as a Research Associate in the Resource Analysis Group of the Energy Division at the Laboratory.[41] For a time,

---

[38] Indiana University School of Public and Environmental Affairs and National Science Foundation, *A Study of Ways to Improve the Scientific Content and Methodology of Environmental Impact Analysis: Final Report to the National Science Foundation*, x.

[39] "Executive Order 11991, "Relating to Protection and Enhancement of Environmental Quality," May 24, 1977, 42 FR 26967, 3 CFR, 1977.

[40] For more on the history of impact statements, see Daniel A. Dreyfus and Helen M. Ingram, "The National Environmental Policy Act: A View of Intent and Practice," *Natural Resources Journal* 16, no. 2 (1976): 243–62; Caldwell, "Environmental Impact Analysis (EIA): Origins, Evolution, and Future Directions"; Burdge, "A Brief History and Major Trends in the Field of Impact Assessment."

[41] Petrich, "Assessing Aesthetic Impacts in Siting a Nuclear Power Plant," 311, 313.

Petrich was the sole landscape architect in the group; the interdisciplinary team otherwise comprised cultural and physical geographers, a lawyer, a systems analyst, and support staff.[42]

Petrich's background in landscape architecture at the University of Michigan seems to have primed him for robust interdisciplinary collaboration. Some years earlier, in 1965, the program in landscape architecture at the University of Michigan had been transferred from the College of Architecture and Design to what was then called the School of Natural Resources (today the School for Environment and Sustainability) at the request of faculty in landscape architecture. This disciplinary realignment, bridging the longer traditions of studio-based design pedagogy in landscape architecture with the increasingly technical and social-scientific dictates of laboratory-based programs in environmental science, afforded purchase on the burgeoning turn of landscape practice away from its disciplinary traditions in architecture and instead toward the technocratic, political, and interdisciplinary alignments of the discipline of planning.[43] To wit, a 1976 accreditation report for the program conducted by the American Society of Landscape Architects underscored the continued student demand for coursework and case studies taking up "the design implications of political and legislative processes."[44] Further, it is perhaps worth noting that by the early 1990s, if not earlier, the U.S. Forest Service had become the largest employer of landscape architects in the country, suggesting the very clear demand for a reformulated notion of landscape architectural practice that had emerged in this period.[45]

---

[42] Peelle, "Socioeconomic Impact Assessment and Nuclear Power Plant Licensing, Greene County, New York," 4.

[43] Jonathan W. Bulkley, William J. Johnson, and Charles E. Olson, "Report of the Task Group on Further Integration of Landscape Architecture in the School of Natural Resources" (Ann Arbor: University of Michigan, August 1972), Box 63, School for Environment and Sustainability (University of Michigan) records 1903–2012, Bentley Historical Library, University of Michigan.

[44] "Landscape Architecture Program ASLA Evaluation Report" (Ann Arbor: University of Michigan, September 1976), 23, Box 11, School for Environment and Sustainability (University of Michigan) records 1903–2012, Bentley Historical Library, University of Michigan.

[45] Carl H. Petrich, "Science and the Inherently Subjective: The Evolution of Aesthetic Assessment Since NEPA," in *Environmental Analysis: The NEPA Experience*, ed. Stephen G. Hildebrand and J. B. Cannon (Boca Raton, FL: Lewis Publishers, 1993), 268.

In the School of Natural Resources, Petrich's studies put him in close proximity with researchers like prominent environmental psychologist Rachel Kaplan, whose cognitive-scientific work on perception was crucial in his later work at Oak Ridge National Laboratory; with contemporary ideas in ecological thinking, botanical sciences, and plant genetics; with applied programs such as Resource Policy and Management; and with elective courses oscillating between the art-historical and the environmental-psychological.[46] Elective courses offered at the school in 1974 ranged—to offer just a few examples—from "Environmental Aesthetics," which promised "a synoptic consideration, pre-Greek to 20th century," to "Methods of Predictive Modeling" and "Advanced Statistical Techniques."[47] Notably, the program's required course in the history of landscape architecture taught by landscape architect and then-chair of the landscape program Charles W. Cares promised "a critical and historical analysis of man's progress in designing land and outdoor space to meet varying needs in different times and places," suggesting a teleological narrative of "development" leading to a contemporary situation in which landscape architecture had become "an instrument of service in the public welfare."[48] If on first glance some of these commitments seem at odds with one another—the humanistic and the positivistic, schematically—it is perhaps worth recalling the robust mutual traffic between the two in the immediately preceding decades, especially in the context of landscape architecture and planning.[49] This traffic was not only put on full display after about 1970 in instances including the case of Greene County; it was reaffirmed and re-entrenched in a fundamentally new manner.

---

[46] University of Michigan, "Bulletin: School of Natural Resources, 1974–1976" (Ann Arbor: University of Michigan, February 13, 1974), Box 2, School for Environment and Sustainability (University of Michigan) publications 1903–2015, Bentley Historical Library, University of Michigan.

[47] Ibid., C-21, C-11, C-12.

[48] Ibid., 22, C-5.

[49] Avigail Sachs, *Environmental Design: Architecture, Politics, and Science in Postwar America* (Charlottesville, VA: University of Virginia Press, 2018).

Petrich brought his multidisciplinary training to bear in order to conduct the aesthetic analyses that found their way into the final environmental impact statement for the Greene County Nuclear Power Plant. The landscape architect argued that the "highly subjective nature" of the enterprise compelled a combination of complementary research methods.[50] For his contribution to the impact statement, Petrich alternatingly yet concurrently recruits an art historical descriptive method steeped in longer traditions of Gestalt psychology and notions of *Kunstwollen* and zeitgeist; a predictive psychological method informed by cognitive theories of mind—specifically, the information-processing model of perception; and a physicalist and atomistic prescriptive method endemic to discourses in landscape architecture and strains of behaviorist thinking. None alone sufficing, together these various methods, he argued, could identify areas of "congruent interpretations" and thus mutually validate one another.[51]

Petrich schematized perception as a tripartite process, with each component selectively recruiting aspects of these various methodologies. His analysis begins by taking up "what is there to be seen"—the objective facts on the ground, as it were; he then considers the "historical and cultural context" in which that seeing takes place; and finally, he examines "who does the seeing."[52] In other words, landscape is taken as a series of objective facts, filtered through a shared historical and cultural context, that then produces subjective response. In many ways this scheme is in keeping with a classic Gestalt construction—object, context, subject—however updated with contemporary thinking from both cognitive psychology and landscape theory. The traffic across methodologies afforded the landscape architect justification for interpolating the aesthetic into the regulatory mechanism afforded by the impact statement.

---

[50] U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-55.

[51] Ibid.

[52] Ibid., 5-56; 5-68; 5-72.

I. Description

Petrich marshalled multiple forms of imaging in order to conduct visual analyses of "what is there to be seen," the first pole in his tripartite scheme. In early spring in two successive years, 1977 and 1978, the landscape architect travelled to Greene County to take photographs in black-and-white which captured views of the potential nuclear power plant sites from "visually sensitive and intensive-land-use locations," including population centers, historic sites, and recreational facilities (fig. 1.2).[53] Meanwhile, engineers at Oak Ridge National Laboratory developed computer models accounting for meteorological data in order to project the plant's atmospheric effects, namely the frequency and extent of its vapor plume.[54] In-house artists at Oak Ridge then airbrushed atop Petrich's photographs to-scale cooling towers and vapor plumes representing a "typical meteorological condition" to produce mixed-media, composite images suggesting future views (fig. 1.3).[55] The composite views played key roles in multiple stages of the impact analysis.

Loosely drawing upon principles derived from Gestalt psychology, the landscape architect performed visual analyses on a select number of these images. Certain concepts sourced from Gestalt thinking recurred in these analyses—integrity, uniformity, coherence, uniqueness, balance, and unity, to name a few. In the case of a composite view from Germantown toward the site in Cementon (fig. 1.4), for example, Petrich describes a "situation of codominance," where the mocked-up cooling towers compete with the existing cement plants for the viewer's attention, resulting in a negative state of "imbalance" and "tension."[56] The analysis immediately recalls any

---

53 Ibid., 5-58.

54 This method was adapted from the Argonne National Laboratory Hybrid Model for plume modeling. Ibid., O-3.

55 Ibid., 5-58.

56 Ibid., M-19.

number of Gestalt theories but seems likely to have been sourced from second-generation Gestalt psychologist Rudolf Arnheim's 1954 *Art and Visual Perception*, where the art psychologist outlines his first principle of balance and illustrates this principle with a visual demonstration composed of two disks in a square.[57] Though Petrich does not cite Arnheim, to be sure, it's worth noting that a reading list for a landscape design studio at the University of Michigan dating to Fall 1977, just after Petrich's graduation, led by landscape architect Kenneth J. Polakowski, included Arnheim's 1954 text, as well as Gyorgy Kepes's 1951 *Language of Vision* and László Moholy-Nagy's 1947 *Vision in Motion*, both of which were, in different ways, explicitly indebted to Gestalt thinking.[58] (It is perhaps also worth pointing out here that Arnheim, specifically, was heavily cited throughout the legal and bureaucratic literature around this broad-based managerial effort, and in at least one instance he directly advised for the development of an Environmental Protection Agency report.[59])

Addressing the issue of *codominance* further, Petrich quotes a visual resource management principle from a U.S. Forest Service publication which suggests "Codominant… features often produce a symmetrical composition that does not blend with the characteristic landscape. Visual competition between like features distracts the viewer and provides a landscape inferior to one of single dominance."[60] Of this same composite image, Petrich quotes R. Burton Litton, a professor of landscape architecture at UC Berkeley whose early work played a prominent role in this history and

---

[57] Rudolf Arnheim, *Art and Visual Perception: A Psychology of the Creative Eye* (London: Faber & Faber, 1954), 7.

[58] Kenneth J. Polakowski, "Natural Resources 788, Landscape Architectural Design Problems," Syllabus (University of Michigan, Fall 1977), Box 57, School for Environment and Sustainability (University of Michigan) records 1903–2012, Bentley Historical Library, University of Michigan.

[59] Marilyn D. Bagley et al., *Aesthetics in Environmental Planning*, EPA-600/5-73-009 (Washington, D.C.: U.S. Environmental Protection Agency, Office of Research and Development, 1973), ix.

[60] U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management: Volume 1*, Agriculture Handbook 434 (Washington, DC: U.S. Department of Agriculture, 1973), 44; Quoted in U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, M-19.

who was largely responsible for developing the visual resource management guidelines for the U.S. Forest Service:

> Lines of visual tension or attraction should converge upon the single element or upon the grouped elements. Equally important, surroundings should be definitely subordinate. The size of a landmark in relation to its surroundings (its scale), the distinction of its configuration, and its juxtaposition with adjacent forms or planes establish the area of subordinance. We see, therefore, that a feature has a sphere of influence that needs to remain intact or that can tolerate only certain changes without deterioration of the composition.[61]

In this way, Petrich's visual analysis, borrowing directly from strategies developed for the U.S. Forest Service, adopts a normative posture: failing to account for the visual might threaten, as Litton puts it, a deterioration of composition.

In his research sponsored by the Forest Service and published beginning in the mid-1960s, the landscape architect R. Burton Litton put forth what he identified as a "descriptive approach" for the development of landscape inventories and checklists. A landscape inventory, Litton maintained, could offer a "rational," valueless accounting of the visual in a controlled fashion that could, in turn, serve as the foundation for the assessment of any landscape.[62] Control in his inventories came by way of a strategically "limited number of terms" that facilitated the development of narrow description. Litton's scheme centered six key factors which he argued constituted the landscape as a "visual, physical entity"—and, decidedly, "not as a state of mind or abstract emotional quality." The first three attended to the landscape per se—form, spatial definition, and light—while the latter three considered the relationship between the observer and the landscape—distance, observer

---

[61] R. Burton Litton, *Forest Landscape Description and Inventories - A Basis for Landplanning and Design*, Res. Paper PSW-RP-049 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1968), 26; Quoted in U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, M-19.

[62] R. Burton Litton, "Descriptive Approaches to Landscape Analysis," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 80.

position, and sequence (fig. 1.5).[63] Based on these elements, Litton maintained, a landscape could be classified into one of seven compositional types: panoramic landscape, feature landscape, enclosed landscape, focal landscape, undergrowth landscape, detail landscape, or ephemeral landscape. Litton is sure to clarify here that he does not mean to imply that the landscape is a work of art; rather, landscapes only "can be seen to have certain characteristics of a work of art."[64] Although Litton repeatedly cites the work of Gestalt psychologists Kurt Koffka and Rudolf Arnheim, as well as Gestalt-inclined designer and thinker Gyorgy Kepes—alongside the likes of Monroe Beardsley, Stephen Pepper, James Gibson, and Kevin Lynch, slightly strange bedfellows whose works were in important ways at odds with one another—in many ways his scheme was in fact decidedly anti-Gestaltic in both method and ambition. The method he proposes begins by dividing the landscape into its physical components and into geographic subunits, and, as he suggests, demonstrates how these elements have direct, relatively unmediated implications for visual quality, which in turn establish direct implications for management strategies. He offers an example which suggests a direct relationship between the tree species found in a forest—lodgepole pine, mixed conifer, red fir, or oak-pine mix—and the degree of "visual penetration" that those species would each afford (fig 1.6). The degree of visual penetration, in turn, "can be manipulated, as by judicious thinning, to enhance contrasts—or even to create them."[65] Litton's method, with its atomistic and physicalist emphasis on discrete elements described in a structured linguistic format, served importantly as the basis for both the U.S. Forest Service's and later the Bureau of Land Management's strategies for visual resource management, which will be described later in this chapter and in this dissertation.[66]

---

[63] Litton, *Forest Landscape Description and Inventories - A Basis for Land Planning and Design*, 2.

[64] Ibid., 23.

[65] Ibid., 38–39.

[66] Ervin H. Zube, "Themes in Landscape Assessment Theory," *Landscape Journal* 3, no. 2 (1984): 106.

Whether made explicit or not, and with varying degrees of orthodoxy, landscape theory and environmental psychological thinking in the period were suffused with Gestalt thinking. Of central concern was the relationship of parts to wholes, or rather, how the mind might be able to organize parts into good wholes. Petrich, for one, in describing his method of visual analysis in the Greene County Impact Statement, employs what is popularly understood to be a classic Gestalt claim, in fact misquoting Kurt Koffka's 1935 dictum: "a landscape composition is more than the aggregation of its component parts."[67] Elsewhere in theories of landscape in the period, oft-repeated dualisms—including order versus complexity, harmony versus variety, monotony versus chaos, and familiarity versus novelty—were sourced directly from earlier discourse in Gestalt psychology and addressed for landscape architects what had become a key disciplinary problem.[68] Namely, landscape architects en masse had become concerned with the question of how to sustain viewer interest while simultaneously maintaining harmony of the visual scene, which is to say, how monotony at one extreme and chaos at the other could be avoided. So too, the question of familiarity contra uniqueness had important implications for bureaucratically minded visual analysts, who were compelled to contend with the economic bias and disciplinary predications on notions of scarcity which characterized resource management practices in this period.

Though the notion of a Gestalt had first emerged as a concept in psychological discourse in Austria by the mid-1880s, as a distinct field of inquiry Gestalt psychology's disciplinary origins are typically located a few decades later in the early 1910s. In the United States, however, Gestalt psychology never quite came to be a dominant force; instead, the roughly contemporaneous

---

[67] U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-72.

[68] Rudolf Arnheim, "Order and Complexity in Landscape Design" (1960), in *Toward a Psychology of Art: Collected Essays* (Berkeley: University of California Press, 1966), 123–35; Amos Rapoport and Robert E. Kantor, "Complexity and Ambiguity in Environmental Design," *Journal of the American Institute of Planners* 33, no. 4 (July 1, 1967): 210–21.

emergence of behaviorism, which took the workings of the mind to be either unavailable or irrelevant to scientific analysis, largely became the dominant modality for experimental psychology in the country. (Historiography in architecture concerning the emergence of environmental design has in large part seemingly mirrored this inclination, focusing on the influence of behaviorism in architectural practice in the period at the expense of numerous other schools of psychological thought, the later cognitive psychology perhaps chief among them.[69]) To be sure, psychologists and historians of psychology have variously argued Gestalt psychology's continued foundational influence which suffused mid-to-late twentieth-century psychological thought. In particular, Gestalt psychology has long been identified as one of the key sources for the later emergence of environmental psychology as a field of inquiry, however heterogeneously composed, as detailed in the introduction to this dissertation, as well as personality psychology. By the time Carl Petrich was writing in the mid-to-late 1970s, Gestalt theory had in large part already fallen out of favor among psychologists, both in the United States and abroad, some decades earlier. Among the schools of psychological thought that emerged, in some sense, in its stead, cognitive psychology sat at the fore and would play an essential role in this history. Cognitive psychology was similarly indebted to a longer inheritance of Gestalt thinking—though to what extent remains a matter of debate.[70] If Gestalt psychology maintained a pervasive, latent influence across disparate schools of psychological thought, its role remained somewhat invisible; as psychologist and historian of psychology Edwin G. Boring suggested, it had perhaps "died of its own success."[71]

---

[69] cf. Joy Knoblauch, *The Architecture of Good Behavior: Psychology and Modern Institutional Design in Postwar America* (University of Pittsburgh Press, 2020).

[70] See Mary Henle, "Some New Gestalt Psychologies," *Psychological Research* 51 (1989): 81–85; Lynn C. Robertson, "From Gestalt to Neo-Gestalt," in *Approaches to Cognition: Contrasts and Controversies*, ed. Terry J. Knapp and Lynn C. Robertson (New York: Routledge, 1986); William Epstein, "Has the Time Come to Rehabilitate Gestalt Theory?," *Psychological Research* 50, no. 1 (June 1, 1988): 2–6; Irvin Rock and Stephen Palmer, "The Legacy of Gestalt Psychology," *Scientific American* 263, no. 6 (December 1990): 84–90.

[71] Edwin G. Boring, *A History of Experimental Psychology* (Englewood Cliffs, NJ: Prentice-Hall, 1950).

The historical, and at times fraught, traffic between Gestalt psychology and the discipline of art history is well documented.[72] In many ways, art history had long been suffused with many distinct forms of psychological thinking as modes of critical address.[73] But these various practices came together in a new, robustly cross-disciplinary way in this period. Gestalt psychology served as something of a common denominator across these disparate practices of landscape theory, environmental psychology, cognitive psychology, art history, and museology. The impact statement for Greene County, then, symptomatically brought these various modes together.

Recourse to Gestalt principles was not only useful to analysts at Oak Ridge National Laboratory. Proponents of the project, too, found use for a similar language of Gestaltic description. The Power Authority of the State of New York, arguing in favor of their proposal, maintained that the plant would afford its immediate vicinity with a then-lacking focal point and would, as Petrich summarizes their language, "become a dominant structure among simple, contrasting geometric forms assembled into a coherent, uniform whole." Petrich disagrees with their assertion, countering that the form and scale of the power plant would be so alien to its immediate context so as to "negate any unifying effect."[74] The landscape architect concludes his analysis of the individual photographs with the assertion that they unequivocally demonstrate that the Greene County Nuclear

---

[72] For sources and reflections on the somewhat fraught relationship between Gestalt psychology and art history, see Arnheim, *Art and Visual Perception: A Psychology of the Creative Eye*, vii; David Carrier, "Rudolf Arnheim as Art Historian," in *Rudolf Arnheim: Revealing Vision*, ed. Kent Kleinman and Leslie Van Duzer (Ann Arbor: University of Michigan Press, 1997); Ladislav Kesner, "Warburg/Arnheim Effect: Linking the Cultural/Social and Perceptual Psychology of Art," *Journal of Art Historiography* 11, no. 2 (2014); Arturo Carlo Quintavalle and Robert Julian, "Arnheim and the History of Art," *Salmagundi*, no. 78/79 (1988): 62–69.

[73] For analyses of the historical relationship between psychology and art history, see Daniel Adler, "The Formalist's Compromise: Wölfflin and Psychology," in *German Art History and Scientific Thought: Beyond Formalism*, ed. Mitchell B Frank and Daniel Adler (Farnham, Surrey: Ashgate, 2012); Kerr Houston, *The Place of the Viewer: The Embodied Beholder in the History of Art, 1764-1968* (Leiden: Brill, 2019); Mark Jarzombek, *The Psychologizing of Modernity: Art, Architecture and History* (Cambridge, UK: Cambridge University Press, 1999).

[74] U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-60.

Power Plant would be "quite disruptive" to the existing landscape scenes: "The real impact," he writes, "is the total aesthetic one."[75]

Following his Gestalt reading of the mixed-media, composite images, Petrich acknowledges that these purportedly objective aspects of the landscape would necessarily be filtered through their unique historical and cultural context. Petrich mustered multiple forms of narrativity to address this contextual concern. In the environmental impact statement, he develops a historical argument for this region which begins no earlier than the second quarter of the nineteenth century, a moment he identifies as having been marked by optimism, national pride, and technological progress. Yet, in this moment, he contends the nation still "had no art that it could call its own." He points out that as figures like William Cullen Bryant, Thomas Cole, James Fenimore Cooper, and Washington Irving gathered in the mid-Hudson area of New York by mid-century, they began to "catalyze a Romantic movement." The Hudson River School in particular, for Petrich, constituted what he not unproblematically calls "America's first indigenous fine-art form."[76]

Explicitly drawing on notions of manifest destiny, and borrowing at least loosely from theories of *Kunstwollen* or zeitgeist, Petrich suggests that the landscape scenes put forth by the Hudson River School brought into sharp relief "the Divinity's plans for America."[77] In roughly the same period, he argues, "the country's first great literary works" by the likes of Edgar Allan Poe, Herman Melville, Nathaniel Hawthorne, Henry David Thoreau, Walt Whitman, and others engaged themes of dualism between the city and the country, contending directly with nature and its transformation by way of technological and industrial progress.[78] His characterization of course

---

[75] Ibid., 5-68, 5-64.

[76] Ibid., 5-68.

[77] Ibid.

[78] Ibid., 5-70.

recalls that of Leo Marx in his 1964 *The Machine in the Garden: Technology and the Pastoral Ideal in America*, which Petrich cites in a separate essay describing his work on the impact statement.[79] For Petrich, it was the landscape painters who offered the clearest answers to the tensions, dualisms, and problems of their day: "…everything … was beginning to flower into a New Eden and they [the artists] were the New Adams. The American nation, as they popularized it, was on the threshold of a new Genesis."[80] Petrich's argument here closely follows those laid out by art historian David Huntington, then at the University of Michigan, with whom the landscape architect was in close contact and who was heavily involved in other preservation efforts in the region, in his dissertation "Frederic Edwin Church, 1826–1900: Painter of the Adamic New World Myth," completed at Yale in 1960. The dissertation, produced in part with guidance from the likes of Vincent Scully, George Kubler, and Henry-Russell Hitchcock, was published in 1966 as *Landscapes of Frederic Edwin Church: Vision of an American Era*.[81] Just as Petrich does later, Huntington argues in his dissertation a generational will-to-form, claiming that Church's imagery "corresponded with the deepest psychic needs of his generation."[82] At least loosely mobilizing notions of *Kunstwollen* and zeitgeist, such arguments were perhaps not uncommon among a set of cultural historians by this point.

Frederic Edwin Church, whose estate at Olana sat about six miles from the site of the proposed generator, was usefully identified as key protagonist in this generational effort. The environmental impact statement is filled with claims to his exceptionalism. Petrich calls Church "the most popular and best known painter in the country in the 1850s and 1860s"; he quotes John Wilmerding, then Curator of American Painting at the National Gallery of Art, who wrote in a letter

[79] Petrich, "Aesthetic Impact of a Proposed Power Plant on an Historic Wilderness Landscape."

[80] U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-70.

[81] David C. Huntington, "Frederic Edwin Church, 1826-1900: Painter of the Adamic New World Myth" (Ph.D., New Haven, CT, Yale University, 1960), vi–vii.

[82] Huntington, iii.

to Petrich that Church "distilled the national vision and gave it visibility"; Petrich cites Huntington's suggestion that "Church's hand held the pulse of a generation, not just any generation"; and he offers commendations by other prominent art historians, including Barbara Novak, then Chair of the Department of Art History at Barnard College and Professor of Art History at Columbia University, John Howat, Curator of American Painting at the Metropolitan Museum of Art, and Theodore Stebbins, Curator of American Painting at the Boston Museum of Fine Arts, who, in letters and phone calls to Petrich, likewise attest to Church's exceptionalism.[83] Elsewhere Petrich suggests that Church was the "best able" of the Hudson River School painters "to give graphic image to the public's longings and feelings about nature and America's role in Western civilization."[84]

The southwesterly view from Church's home at Olana, which the artist painted at least 35 times during his career and which in one instance Howat claims "comes as close to perfection as anything done by American artists painting in the field," was to have been conspicuously transformed by the proposed nuclear power plant, planned to sit precisely at the spot Church called the "bend in the river" (fig. 1.7).[85] Church had begun developing his estate at Olana around 1860, and he commenced on the design of his house beginning around 1870. Alternatingly described as "Persian," "Italian-Moorish," "Persian-Moorish-Eclectic," "Victorian," and, for Scully at least, reminiscent of the "Shingle Style of the 80's," the design of the house has been variously attributed to Calvert Vaux, Frederick Law Olmsted, and Church himself.[86] Amid various claims to the house's

---

[83] Ibid.

[84] Petrich, "Aesthetic Impact of a Proposed Power Plant on an Historic Wilderness Landscape," 481.

[85] U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-71.

[86] David Schuyler, "Saving Olana," *The Hudson River Valley Review* 32, no. 2 (Spring 2016): 4; Vincent Scully, "Palace of the Past," *Progressive Architecture* 46, no. 5 (May 1965): 185; 189; Petrich, "Aesthetic Impact of a Proposed Power Plant on an Historic Wilderness Landscape," 482.

historical authenticity in the impact statement, claims to Church's exceptionalism in painting are matched by claims to the site's exceptionalism in landscape. Petrich calls the view from Olana "nationally important"; a view of "historical importance"; "a classical view"; and "one of classical composition."[87] He offers a litany of others' attestations to the view, as well:

> 'The whole point of Olana is the view' (Scully); 'It [the view] is what makes Olana. It is why Church located the house where he did' (Slavin); 'It was sited because of the view' (Wilmerding); or, 'This [the view] is why Church chose the site, this is why it is so important' (Howat).[88]

Church is in fact credited with having designed the view as such, in a productive elision of landscape and landscape painting. Petrich describes Church's involvement in the "picturesque romantic tradition" of master planning, having designed a lake and organized plantings to frame particular scenes, with some degree of collaboration from Frederick Law Olmsted.[89] (Petrich points out that Church and Olmsted were "close" cousins, though it seems their relations were in fact distant.[90]) But Petrich's rhetoric goes further: Church is repeatedly credited with refiguring the landscape as itself a form of art practice and in fact constituting the landscape as an artwork as such, amounting to what Petrich calls "a three-dimensional painting."[91] The rhetorical posture perhaps loosely recalls, if not intentionally associates Church with, contemporaneous discussions around land art—some of which were importantly centered in the immediate vicinity in the context of Storm King Art Center which had turned from its initial focus on the paintings of the Hudson River School around its founding in

---

87 Ibid., 5-62.

88 Ibid., 5-71.

89 Ibid., 5-62.

90 Petrich, "Aesthetic Impact of a Proposed Power Plant on an Historic Wilderness Landscape," 481, 482.

91 Ibid., 482.

1960 to contemporary environmental sculpture, increasingly activated by a public education mission with pedagogical principles informed by Gestalt techniques by the late 1960s.[92]

In this way, the site's contemporary importance is justified in the impact statement by way of its indexical relationship with Church's artwork and Church's authorship: landscape is productively elided into the work and the artist himself. Already plainly on evidence here is a conflation of the management of images and of the physical world. For Petrich, the exceptionalism of the view from Olana is confirmed by the fact that photographs of that view have appeared in journals including *Progressive Architecture*, *Life*, *Antiques*, and *American Heritage*, and that footage of the view has appeared on NBC; Petrich then suggests "A 10-mile radius around the proposed power plant would take in literally dozens of the scenic views and picturesque areas that were eventually transferred to canvases now hanging in the country's major museums and art galleries."[93] The conflation is made possible, at least in part, by certain linguistic slippages. Offering an explicit definition of aesthetics, Petrich equates aesthetic inquiry to "analysis of the quality of the visual resource."[94] Such an assertion figures into a longer history of unhinging the aesthetic from the specificity of art and generalizing it to encompass all that is visible, perhaps most notably landscapes and nature. Here, the term *visual* productively holds together both images and landscape. *Resource*, by comparison, perhaps re-interpolates the visual back into an economic logic; elsewhere Petrich refers to the visual as a "nonrenewable resource."[95]

---

92 John Beardsley, *A Landscape for Modern Sculpture: Storm King Art Center* (New York: Abbeville Press, 1985); Storm King Art Center, "Mark di Suvero: 25 Years of Sculpture and Drawings," 1985, Storm King Art Center Archives.

93 U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-62; 5-68.

94 Petrich, "Assessing Aesthetic Impacts in Siting a Nuclear Power Plant," 320.

95 The phrase "visual resource," to be sure, is not unique to Petrich. It was in fact, perhaps symptomatically, widely used among many actors involved in this history, as is described elsewhere in the dissertation. Petrich, 328.

These productive elisions correspond roughly with a historical moment in which disciplinary categories were beginning to loosen in specific ways. In roughly this same period, the term *visual* had begun to take on a new cross-disciplinary power, with the notion of "visual culture" emerging as a new, generalized way of seeing the world, unhinged from—although by no means discarding—the specificity of art and art history. Visual studies, to be sure, would not be fully codified into a formal discipline replete with standalone academic departments until the mid-to-late 1990s, a codification usually attributed to an exhaustion with critical theory's longstanding textual bias.[96] But already at this relatively early moment in the 1970s, as historians and theorists of visual culture have suggested, some of the key origins for visual studies as a field of inquiry might be located. Art historian Thomas DaCosta Kaufmann, for one, has pointed to the work of Svetlana Alpers and Michael Baxandall in the early 1970s as among the foundational works in this broader turn; Kaufmann points out that in her 1983 *Art of Describing* Alpers specifically cites Baxandall for the concept and phrase "visual culture." Kaufmann also draws direct links from Alpers and Baxandall back to the likes of Alois Riegl, Aby Warburg, and Ernst Gombrich, suggesting a longer tradition that was newly catalyzed and repurposed in this originary moment.[97] Analogously, W.J.T. Mitchell locates the origins of what he calls the "indiscipline" of visual culture in the mid-1970s; in a hypothetical syllabus accounting for the field of inquiry described in his remarks delivered to the festschrift dedicated to Erwin Panofsky in 1993, Mitchell includes the disparate work of Rudolf Arnheim, James Gibson, Gombrich, Panofsky, and others.[98] Perhaps worth noting here too is that Rudolf Arnheim's

---

[96] Norman Bryson, Michael Ann Holly, and Keith Moxey, eds., *Visual Culture: Images and Interpretations* (Hanover, N.H.: University Press of New England, 1994); Barbara Maria Stafford, *Good Looking: Essays on the Virtue of Images* (Cambridge, MA: MIT Press, 1996); Marsha Meskimmon, "Visuality: The New, New Art History?," *Art History* 20 (June 1997); William Innes Homer, "Visual Culture: A New Paradigm," *American Art* 12, no. 1 (1998): 6–9; W. J. T. Mitchell, "Showing Seeing: A Critique of Visual Culture," *Journal of Visual Culture* 1, no. 2 (2002).

[97] Svetlana Alpers et al., "Visual Culture Questionnaire," *October* 77 (1996): 45–46.

[98] W.J.T. Mitchell, "What Is Visual Culture?," in *Meaning in the Visual Arts: Views from the Outside; A Centennial Commemoration of Erwin Panofsky (1892-1968)*, ed. Irving Lavin (Princeton, NJ: Princeton University Press, 1995), 212.

appointment to Harvard as Professor of Psychology of Art in 1967 was specifically to what was then called the Visual Studies program.[99] Certain forms of psychological thinking, however divergent, can in this way be located in immediate pre-histories to the field of visual studies, which was beginning to take form by the mid-1970s.

Vincent Scully, who had made impactful contributions to the Storm King case years earlier, yet again served as a key protagonist in the debate around the Greene County Nuclear Power Plant. Carl Petrich had at least one "personal conversation" with the historian on January 10, 1978, and he quotes heavily from Vincent Scully's earlier essay "Palace of the Past," published in *Progressive Architecture* in May 1965, in the aesthetic analysis in the final impact statement.[100] Scully's article had been the direct result of another conservation effort: in an episode which historian David Schuyler closely details in his essay "Saving Olana," around 1964 heirs to Frederic Edwin Church's estate had planned to sell the Olana property and auction its contents. David Huntington organized a campaign to purchase the site, marshalling a robust team of art historians, academics, and curators, as well as donors, journalists, and local and state officials, to construct a public relations apparatus around the cause. Huntington orchestrated a series of public tours, talks, and receptions; among those invited to tour the site were Scully, Henry-Russell Hitchcock, and other architecture historians. Scully later delivered a talk at one of these events in January 1965. Philip Johnson and Edgar Kaufmann Jr. were among the early financial supporters to the campaign.[101]

As a result of Huntington's lobbying efforts, historians and journalists published articles about the estate and about Church's legacy in general-audience publications including *Harper's*, *Saturday Review*, *Antiques*, and *Life*. For his contribution to the cause, Scully published his essay for an

---

[99] "Arnheim Will Teach 'Psychology of Art,'" *The Harvard Crimson*, September 29, 1967.

[100] U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-78.

[101] Schuyler, "Saving Olana."

audience of architecture professionals. Smithsonian Museum curator Richard Wunder organized a major retrospective of the artist's work in 1966; the exhibition traveled from the National Collection of Fine Arts to the Albany Institute of History and Art and then to the M. Knoedler & Company gallery in New York City. The intention of the exhibitionary strategy was made no secret: the preface to Wunder's exhibition catalog detailed the imminent threat to the Olana estate and explicitly linked the show to the preservation cause. At the Knoedler gallery, revenue generated from a $1-admission fee was funneled directly to the fundraising campaign. The effort was ultimately successful by the middle of 1966, having secured enough private and state funding to acquire and maintain the site in perpetuity.[102]

Perhaps plainly on evidence here was art history's already well-established history of entanglement with lobbying efforts, preservation causes, and political organizing at various scales.[103] In the case of Storm King, to offer just one other example, John Howat, curator at the Metropolitan Museum of Art, published his volume *The Hudson River and Its Painters* on the specific encouragement of the chair of Scenic Hudson who argued that the text could help the cause; as David Schuyler points out, all royalties from the sale of the book were donated to Scenic Hudson.[104] But following the passing of the National Environmental Policy Act, for a short time at least, such entanglements took place at an increasingly robust scale, with art historians recruited to engage and develop new mechanisms of aesthetic governance.

Although the Impact Statement draws from Scully's text to suggest that he agrees with the other art historians' claims that the site itself constitutes a type of artwork in which Church's authorship becomes visible, the architecture historian in fact takes a different tack. Casting Church

---

[102] Ibid.

[103] To offer just one of the most well-known examples, see Lynn H. Nicholas, *The Rape of Europa: The Fate of Europe's Treasures in the Third Reich and the Second World War* (New York: Alfred A. Knopf, 1994).

[104] Schuyler, *Embattled River: The Hudson and Modern American Environmentalism*, 21.

as one of his ancient Greeks or Taos Pueblo dwellers, Scully positions Church as a mediator of the divine on the landscape. In series of extended embodied descriptions, again alternatingly Gestaltic and phenomenological in turns, Scully writes:

> The curvature of the earth is perceived from it, and the continental air masses can be seen from far off as they move ponderously across it, mounting up in squadrons of cloud while rain and sunshine drench the earth in their passage. It is a panorama, like one of Church's paintings themselves, where only the vastest scene, most complete in "eternal genesis," could satisfy the painter's passion to grasp and depict nature as a whole.[105]

Scully's extended visual analysis in writing is paralleled by a two-page spread of some fifty photographs, courtesy of David Huntington, which telescope from the widest views to the narrowest details of the house (fig. 1.8). Together these forms of linguistic and photographic description make the case, seemingly irrefutably, that the estate must be preserved.[106]

Drawing upon a wide array of methodologies and direct references sourced from cultural and art history, Petrich's historical description fulfills a demand for narrative closure: if the landscape architect had credited the mid-nineteenth-century generation of artists and architects in the United States with capturing a unique moment of optimism in the nation's history in which there was yet a fragile coexistence of technological progress and an embrace of nature, he suggests that this soon would all be lost. The rapid acceleration of technological progress around the telegraph and the railroad, the expansion of finance capitalism, and the Civil War eroded, for him, the earlier sense of generational promise. Above all, for Petrich, however, were the theories of Charles Darwin which he argues fully evacuated the romantic worldview: suddenly, it seemed, "no deity had a plan for

[105] Scully, "Palace of the Past," 185.

[106] For more on the art historical implications of Scully's embodied description, see Rudolf Arnheim, "Vincent Scully and Rudolf Arnheim: Dialogue," in *Rudolf Arnheim: Revealing Vision*, ed. Kent Kleinman and Leslie Van Duzer (Ann Arbor: University of Michigan Press, 1997); Jonathan Massey, "Review of Vincent Scully, *Modern Architecture and Other Essays*, ed. Neil Levine," *caa.Reviews*, July 8, 2004, http://www.caareviews.org/reviews/660.

America."[107] If evolutionary thinking had spelled the end of the nation's sense of divine right and of manifest destiny, in the architect's take, it's important to point out that theories of evolutionary psychology would come to play an important role in thinking the function of aesthetics in the environment in Petrich's own, and other environmental psychologists', later theories.

It is precisely because of this loss of divine right that Petrich locates a contemporary importance for the historic context in question: "at Olana, however, the romantic world still lives." It is there that "one can see and try to understand the vast panorama of the American nation looking confidently westward across the continent with great expectations." Petrich repeatedly returns here to the metaphor of landscape as window: Olana offers, quoting David Huntington, a "window to the 'minds of our ancestors.'"[108] Elsewhere the landscape architect identifies Olana as a "window" onto "America in one of its most critical decades."[109]

Perhaps made abundantly clear here are the stakes laid out by the controversy around the Greene County Nuclear Power Plant, seemingly imbricated in notions of nationalist identity and legacies of settler colonialism, and perhaps especially so in a moment of renewed crisis in U.S. American identity. This is to say—without going too far—that national identity was to some extent inextricably wrapped up in thinking the nuclear in this period. Images, in turn, played key roles in alternately expressing, accommodating, managing, and negating these tensions and anxieties.[110] If Petrich had argued in 1980 that the Hudson River School laid bare the promise that the country

---

[107] U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-71.

[108] Ibid.

[109] Petrich, "Assessing Aesthetic Impacts in Siting a Nuclear Power Plant," 319.

[110] For an in-depth discussion of the role of images in thinking the nuclear, see Spencer R. Weart, *Nuclear Fear: A History of Images* (Cambridge, MA: Harvard University Press, 1988).

could "coalesce into a unique civilization—the climax of Western civilization," it was clear that, for him at least, the stakes were existential.[111]

The stakes, it seems, were exceedingly clear to the art historians engaged in the effort alongside Petrich, as well. The composite images produced under Petrich's direction were shown to at least some of the art historians with whom the architect corresponded. Their feedback could be summarized pithily in the impact statement: "A clear 'devastating' was recorded."[112]

II. Prediction

The particularity of this historical context, for Petrich, suggests a validation of his psychological method: the romantic movement, he argues, not only engendered "this country's still-growing love affair with nature," but it importantly "asserted the validity of the subjective" as such.[113]

If Petrich's Gestalt analyses of his mixed-media composite images were positioned as an objective accounting of what there was to be seen in the landscape, and if his *Kunstwollen*-inflected cultural-historical narrativity contextualized the landscape in a shared nationalist past, the landscape architect concludes his three-part visual analysis with an "analysis of who does the seeing." It is only with this last step that Petrich can achieve his Gestaltic goal:

> Because a landscape composition is more than the aggregation of its component parts… research must turn to the people who see the landscape as a whole. Even an exhaustive set of relevant landscape elements can never totally explain the variation in scenic preference. Modeling and measurement techniques must be combined with a preference approach to assess the whole.[114]

---

111 Petrich, "Assessing Aesthetic Impacts in Siting a Nuclear Power Plant," 316.

112 U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-71.

113 Petrich, "EIA Scoping for Aesthetics," 59.

114 U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-72.

Over the course of three days in May 1978, Carl Petrich and an unnamed colleague approached local residents and recreationists, unprompted, on the streets and in restaurants, stores, and parks in the immediate vicinity of the proposed project, as well as at the Olana Historic Site, at a meeting of a women's group, the Fortnightly Club, and at a nearby cement factory. The colleagues asked willing participants to respond to a visual preference survey: a questionnaire employing black-and-white reproductions of forty images—including Petrich's initial, unretouched reconnaissance photographs, the composite images he and the art historians had analyzed, and the same scenes with a cement plant superimposed in place of the nuclear power generator—were each to be rated. (The inclusion of the latter images depicting cement plants was intended to isolate the aesthetic variable and thus control for a general antinuclear attitude.) Asked to quantify how much they liked each image, 154 respondents in total marked their preferences for each of the forty views on five-point Likert rating scales, with one representing "not at all" and five representing "very much" (figs. 1.9 and 1.10).[115]

The technique to predict how residents might respond to the novel presence of the proposed power plant made use of what appears by now, perhaps, to be a quite commonplace method for data gathering. The five-point rating scale measuring degrees of intensity of feeling was in fact one of a number of key data-collecting techniques borrowed from personality psychology into environmental psychology by midcentury. In 1932, the social psychologist Rensis Likert, who would later become a key protagonist in developing surveying strategies for the U.S. Department of Agriculture, the Treasury, the Federal Reserve Board, the Office of War Information, and the U.S. Strategic Bombing Survey, championed the development of a scale to allow qualitative assessments of personality to be rendered available to quantification and statistical analysis. His, however, wasn't

[115] Ibid., N-12.

the first; a few years earlier, quantitative psychologist Louis Leon Thurstone had developed a strategy for what he called the measurement of attitudes. Building upon methods developed in psychophysics, Thurstone proposed a technique employing a series of statements around topics such as militarism, internationalism, or religiosity, to which respondents were asked, simply, if they agreed or disagreed.[116] In one study, for example, Thurstone asked subjects to respond to statements including "I believe the church is the greatest institution in America today," and "I believe the church represents outgrown primitive beliefs that are based largely on fears."[117] These statements had been pre-sorted, unbeknownst to respondents, by a panel of expert judges along an 11-step continuum ranging from "very much in favor of the church" to "extremely against the church."[118] The two-part strategy allowed the subjects' binary responses to be converted into a linear spectrum accounting for intensity of attitude. The scaling method represented an early step in the psychometric effort to submit personality to quantification.

Likert's scaling method attempted to correct for a number of deficiencies the social psychologist had identified in Thurstone's technique. Chief among these was the issue of expert judgment. Likert, along with other psychologists in the period, argued that though Thurstone's technique might be shown to work in select contexts such as the classroom where participants were already familiar with experimentation practices, it had less purchase on real-world settings. Additionally, the assumption that one statement could be definitively scaled in relation to the next overdetermined the outcome of these studies.[119] Instead, Likert proposed to short-circuit the

---

116 Louis Leon Thurstone, "Attitudes Can Be Measured," *American Journal of Sociology* 33, no. 4 (January 1928): 529–54.

117 Louis Leon Thurstone and Ernest J. Chave, *The Measurement of Attitude* (Chicago: Univ. of Chicago Press, 1929), 28, 25.

118 Ibid., 30.

119 Rensis Likert, "A Technique for the Measurement of Attitudes," *Archives of Psychology* 22, no. 140 (1932): 6; 24–25.

judgment process, rendering it available to direct reporting: respondents were to self-report on their intensity of feeling for each item independently on a scale of either three or five points.

Likert demonstrated his strategy in a study which initially addressed five major areas of attitudinal disposition, namely "international relations," "race relations," "economic conflict," "political conflict," and "religion."[120] His survey of opinions, for example, posed normative value statements such as: "The United States should have the largest military and naval air fleets in the world"[121]; "We should use military force in South America whenever needed to protect American investments"[122]; and "Where there is segregation, the negro section should have the same equipment in paving, water, and electric light facilities as are found in the white districts."[123] Some statements solicited respondents' opinions on events in the news: "A group of Japanese truck-farmers in Southern California, through their industry and lower standards of living, are able to undersell their American competitors. The American farmers insist that IT IS THE DUTY OF ALL WHITE PEOPLE TO PURCHASE ONLY FROM WHITE FARMERS."[124] Respondents were asked to rate these each for degrees of agreement ranging from "strongly approve" to "strongly disapprove"; where responses began to correlate, they might reveal a general "pro-Negro" or "anti-Japanese" attitude in a subject.[125]

For Likert, the method constituted a contribution to a major disciplinary debate of his day regarding the "generality" versus the "specificity" of character traits.[126] The problem was one of prediction: how might agreement or disagreement with a single, specific statement indicate general

---

[120] Ibid., 11.

[121] Ibid., 17.

[122] Ibid., 20.

[123] Ibid., 19.

[124] Capitalization in the original. Likert, "A Technique for the Measurement of Attitudes," 15.

[125] Ibid., 13.

[126] Ibid., 7.

attitudes? Could response to one statement predict response to another? By extension, could behavior in one setting indicate behavior in any other? Likert argued that such generalities could not be presumed but instead could be identified only through quantification and statistical analysis, which identified clusters of personality traits that hung together to produce general attitudes. Further, the strategy allowed large groups to be compared: Likert showed in his study, for example, that white male college students in northern states in the U.S. showed a marginally more pro-Black attitude when compared against that of white male college students in the South. Likert's argument went even further, suggesting some degree of predictive power in identifying how one attitude might relate to the next—asking how an individual's attitude toward, say internationalism, might predispose them to other attitudes, like belligerence.[127] This promised to offer a degree of predictive power for behavior in at least one example:

> It is perhaps striking that the individual who (in 1929) was the only person to make the highest possible score on the Internationalism scale, who was one of two that made the highest possible score on the Negro scale and who made the highest (anti-)Imperialism score yet recorded, is a student who has recently taken a very prominent part in radical activities on the Columbia Campus.[128]

Likert's scaling method was one of a number of psychometric tools developed for the study of personality that was brought to bear on questions of environmental perception by the 1970s. In Likert's time, the effort to convert the qualitative into the quantitative represented an incremental step away from the then-prevailing behaviorist approach in experimental psychology which, generally, understood things like meaning, attitude, and opinion to be unavailable to experimental analysis. In many ways this was a problem of language; Likert argues that verbal responses could be understood as "valid indices" for "overt behavior."[129] If left at the level of language alone, however,

---

[127] Ibid., 36–41.

[128] Ibid., 32.

[129] Ibid., 32, 37.

Likert asserted, "the number of possible verbal combinations is, of course, infinite and the number of attitudes must on this basis likewise be so."[130] The question for Likert, like the environmental psychologists who later adopted his technique, was how to structure language to render it available to statistical analysis, thought to be key to both the study of personality and the study of environmental perception later. Other such psychometric techniques—most notably the q-sort and the semantic differential, both developed a few decades after Likert's scaling method by the early-to-mid-1950s—would come to play important roles in later cases in this longer history of cross-disciplinary exchange, as detailed in following chapters.

Petrich justified the use of photographs and composite images in his predictive studies "as valid representations of the real landscapes" by way of recourse to a number of popular theories of media as well as psychological theories then at the vanguard of the discipline.[131] This was not, however, an uncontroversial position among landscape architects, environmental psychologists, and geographers in the period, as Petrich himself admits; some had argued that pictures could only be engaged as such, and that their mediated nature was in fact insurmountable.[132] But Petrich maintained that the image-based strategy was not only the lone practicable method to address the projective issue at hand, but so too that since the general public was well accustomed to television

---

130 Ibid., 7.

131 U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, N-3.

132 Petrich cites David Lowenthal, *Finding Valued Landscapes*, Environmental Perception Research, Working Paper No. 4 (Toronto: University of Toronto, 1978); Other instances include Robert O. Brush, "Perceived Quality of Scenic and Recreational Environments; Some Methodological Issues," in *Perceiving Environmental Quality: Research and Applications*, ed. Kenneth H. Craik and Ervin H. Zube, Environmental Science Research (Boston: Springer, 1976), 47–58; Robert E. Coughlin and Karen A. Goldstein, *The Extent of Agreement among Observers on Environmental Attractiveness*, Discussion Paper No. 37 (Philadelphia: Regional Science Research Institute, 1970); Carla B. Rabinowitz and Robert E. Coughlin, *Analysis of Landscape Characteristics Relevant to Preference*, Discussion Paper No. 38 (Philadelphia: Regional Science Research Institute, 1970); Neil David Weinstein, "The Statistical Prediction of Environmental Preferences: Problems of Validity and Application," *Environment and Behavior* 8, no. 4 (December 1, 1976): 611–26.

and photojournalism, they already understood two-dimensional pictures as surrogates for a three-dimensional world.[133]

Nevertheless, the exchange of images for reality required further justification in the environmental impact statement by way of recourse to the latest thinking emerging from the then relatively young subdiscipline of cognitive psychology. Petrich cites the work of prominent environmental psychologists Rachel and Stephen Kaplan at the University of Michigan, whose work he would have likely encountered in his time at the University—Rachel Kaplan's course in "Research Methods" and Stephen Kaplan's course in "Environmental Psychology" are listed among the top extradepartmental elective courses consistently chosen by students in landscape architecture in the program's 1976 accreditation report.[134] There is also evidence of direct engagement between Petrich and the Kaplans in the context of at least one symposium, later in 1980. At the time, Rachel Kaplan held multiple appointments at the University: she was an associate professor in the School of Natural Resources and in the doctoral program in Urban and Regional Planning, as well as a lecturer in the Department of Psychology; Stephen Kaplan was then a professor of Psychology and of Computer and Communication Sciences. Much of the work Rachel and Stephen Kaplan developed was sponsored by the U.S. Forest Service, and they worked especially closely with the Urban Forestry Project for the Forest Service's North Central Experimentation Station.[135]

The information-processing model of perception that the Kaplans championed constituted one form of cognitive psychological thinking coming to the fore in the period. Largely rejecting the previously dominant behaviorist paradigm that characterized much of experimental psychology until

---

133 U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, N-3.

134 "Landscape Architecture Program ASLA Evaluation Report," 24.

135 Rachel Kaplan and Stephen Kaplan, *The Experience of Nature: A Psychological Perspective* (Cambridge; New York: Cambridge University Press, 1989), xii.

at least the mid-to-late 1950s in the United States, cognitive science emerged as an interdisciplinary force to address the workings of the brain—long thought by behaviorists and others to be largely unavailable to scientific analysis. Bringing cognitive psychological perspectives to bear on the specific question of perception, the Kaplans argued that perception was not merely a sense-based process comprising a stimulus and a direct, unmediated response. Instead, they contended, perception had an important, yet understudied, cognitive component: "visual information," as they termed it, was received, processed, compared, and stored in the mind, and constituted but one type of information upon which basic human functioning depended.[136] For them, the environment was a key source of such visual information.[137]

Countering contemporaneous emergent theories of the day, most notably James Gibson's ecological theory of perception and his notion of affordances, which argued a direct, unmediated, non-representational relationship between stimulus and perception, their work also sat in direct opposition to the physicalist and atomistic accounts proffered in much of the roughly contemporaneous discourse in landscape architecture, such as that of Litton and others, a longer history of which will be considered in the third chapter of this dissertation. Although the notion of information-processing ran directly counter to Gibson's theories, Rachel and Stephen Kaplan suggested their thinking was at least "several steps in direction of Gibson" insofar as it offered a functionalist accounting of what possibilities the perception of an object afforded the subject.[138]

---

136 Rachel Kaplan, "Visual Resources and the Public: An Empirical Approach," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 213; Kaplan and Kaplan, *The Experience of Nature: A Psychological Perspective*, 3.

137 Kaplan and Kaplan, *The Experience of Nature: A Psychological Perspective*, 3.

138 Kaplan and Kaplan, 7; Stephen Kaplan, "Perception and Landscape: Conceptions and Misconceptions," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 241;

Petrich effectively recapitulates many of the Kaplans' arguments around cognition in summarizing his analytical approach in the impact statement, where he suggests that a cognitive psychological approach could begin to account for individual difference across continuous forms of visual stimulation:

> People perceive in as many different ways as they have sense organs, and these sensory perceptions are acted upon in as many different ways as there are different people. Cognition is concerned with the working of the mind on that information which is perceived so that it is registered and stored in the mind in some fashion reflective of individual values, experiences, culture, etc. It focuses on issues of symbolic knowledge, thinking, remembering, learning, mental development, simplification, selection, abstraction, analysis and synthesis, competition, correction, and comparison.[139]

Maintaining that perception was mentally mediated, Rachel and Stephen Kaplan argued that sensory stimuli trigger the production of mental pictures which are necessarily compared against other, already extant mental pictures in order to facilitate judgments of preference.[140] The grand total of these mental representations constituted what they, and countless other likeminded thinkers across disparate disciplines in the period, alternately described as "mental models" or "cognitive maps."[141]

Since perception was already mediated by images in the mind, for the Kaplans this justified, at least in part, the use of photographs as a research tool for the study of perception. Calling the

---

For further discussion of the relationship between the work of the Kaplans and the work of Gibson, see Stephen Kaplan and Rachel Kaplan, *Cognition and Environment: Functioning in an Uncertain World* (New York: Praeger, 1983), 36–39.

139 U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-56.

140 See Stephen Kaplan, "Adaptation, Structure and Knowledge," in *Environmental Knowing: Theories, Perspectives and Methods*, ed. Gary T. Moore and Reginald G. Golledge (Stroudsburg, PA: Dowden, Hutchinson and Ross, 1976), 32–45; Rachel Kaplan, "Physical Models in Decision Making for Design: Theoretical and Methodological Issues," ed. Robert W. Marans and Daniel Stokols (New York: Plenum Press, 1993).

141 See Edward C. Tolman, "Cognitive Maps in Rats and Men," *Psychological Review* 55, no. 4 (1948): 189–208; Kevin Lynch, *The Image of the City* (Cambridge, MA: The MIT Press, 1960); John L. Fischer, "Art Styles as Cultural Cognitive Maps," *American Anthropologist* 63, no. 1 (1961): 79–93; Gerald D. Suttles, *The Social Construction of Communities* (University of Chicago Press, 1972); Roger M. Downs and David Stea, *Image and Environment: Cognitive Mapping and Spatial Behavior* (Chicago: Aldine Publishing Company, 1973); Stephen Kaplan, "Cognitive Maps, Human Needs and the Designed Environment," in *Environmental Design Research*, ed. Wolfgang F.E. Preiser (Stroudsburg, PA: Dowden, Hutchinson and Ross, 1973); Frederick Reif, "Educational Challenges for the University," *Science* 184, no. 4136 (May 3, 1974): 537–42; Gary T. Moore and Reginald G. Golledge, eds., *Environmental Knowing: Theories, Research and Methods* (Stroudsburg, PA: Dowden, Hutchinson and Ross, 1976); Petrich, "Science and the Inherently Subjective: The Evolution of Aesthetic Assessment Since NEPA," 261.

experience of familiar environments "inevitably mediated," they argue in a 1976 essay co-authored with psychologist Thomas R. Herzog that mental representations produced "by a word, a picture, or, presumably, by the place itself" were "essentially the same."[142] The impact statement for the Greene County project quotes from this same essay in justifying a similar use of images: "When one does present photographs of familiar places, the effect is to trigger the individual's concept or internal representation of that place. Thus, the reaction is not to the presented stimulus per se but to a distillation of experience and knowledge about the place depicted."[143]

Two key precedents developed under Rachel Kaplan's direction are taken as representative of Petrich's methodology as laid out in the impact statement, both addressing judgments of preference in familiar settings through the experimental use of photographs rated on five-point Likert scales. A 1977 study of the perception of drains, prompted after a county drain commissioner in Michigan retained Kaplan to address complaints regarding open storm drains in residential areas, identified "strong regional differences" in the judgment of waterways, knowledge of which led to direct application in the differential refashioning of these systems, but also, according to Kaplan, revealed generalizable insights into patterns of preference (fig. 1.11).[144] Kaplan's student William Hammitt conducted work for his doctoral dissertation, completed in 1978, on the visual preferences of recreationists in bog environments in the context of the Cranberry Glades Botanical Area in Monongahela National Forest, West Virginia. Like Kaplan, Hammitt was interested in studying the

[142] Thomas R. Herzog, Stephen Kaplan, and Rachel Kaplan, "The Prediction of Preference for Familiar Urban Places," *Environment and Behavior* 8, no. 4 (1976): 643.

[143] Herzog, Kaplan, and Kaplan, 640–41; Quoted in U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, N-3.

[144] Stephen Kaplan and Rachel Kaplan, "The Visual Environment: Public Participation in Design and Planning," *Journal of Social Issues* 45, no. 1 (1989): 75.

role of familiarity in judgments of preference (fig. 1.12).[145] Both studies offered precedent for the use of images alongside the Likert scaling technique: in both, photographs of existing scenes were subjected to evaluation along a five-point rating scale, the results of which were importantly submitted to statistical analysis to reveal patterns of preference.

Because they understood perception to be at least in part a problem of cognition, Rachel and Stephen Kaplan's techniques could account for subjects' already established value systems and cognitive categories, which a straightforward behaviorist stimulus-response model could not. This ability to contend with cognitive categories served Petrich's needs particularly well. Early on, the Kaplans had considered things like the role of complexity and the effects of familiarity on aesthetic preference for urban and natural scenes.[146] Quickly, however, their studies moved away from single variable analysis and attempted to bring such factors together in order to identify the fundamental "categories of visual experience" that might underlie any immediate rating of preference.[147] The categorical approach was thought to better afford a predictive capacity: while it might be anecdotally interesting to know which specific image, say, received the highest preference rating, the psychologists maintained that only by locating statistical correlations among these individual preference ratings could groupings emerge that revealed the underlying "informational properties" of the scenes that amounted to "powerful predictors of landscape preference."[148] This effort was made possible by statistical methods in dimensional analysis employing algorithmic processing by

---

145 William Edgar Hammitt, "Visual and User Preference for a Bog Environment" (Ann Arbor, University of Michigan, 1978).

146 Stephen Kaplan, Rachel Kaplan, and John S. Wendt, "Rated Preference and Complexity for Natural and Urban Visual Material," *Perception & Psychophysics* 12, no. 4 (1972): 354–56.

147 Herzog, Kaplan, and Kaplan, "The Prediction of Preference for Familiar Urban Places," 641; Stephen Kaplan and John S. Wendt, "Preference and the Visual Environment: Complexity and Some Alternatives," in *Environmental Design: Research and Practice*, ed. William J. Mitchell (Stroudsburg, PA: Dowden, Hutchinson and Ross, 1972).

148 Rachel Kaplan, "A Methodology for Simultaneously Obtaining and Sharing Information," in *Assessing Amenity Resource Values*, USDA Forest Service General Technical Report RM-68, 1979, 59; Rachel Kaplan, "Some Methods and Strategies in the Prediction of Preference" (Stroudsburg, PA: Dowden, Hutchinson and Ross, 1975), 122.

computer to identify correlated factors; the experimenter then manually examined the resulting groupings, named them, and thus established categories of experience.[149]

By the mid-to-late 1970s, this methodology had led the Kaplans to schematize four key "informational elements" which they argued guided the aesthetic judgment of any landscape—namely, coherence, legibility, complexity, and mystery (fig. 1.13).[150] A landscape's sense of coherence and legibility, they contended, correlated with the fundamental human need for understanding or making sense, whereas a landscape's complexity or mystery related to the human drive for exploration and involvement. Each of these needs had a two-dimensional and a three-dimensional component: coherence and complexity were perceived in what Stephen Kaplan called the "two-dimensional space of the 'picture plane,'" while legibility and mystery were perceived in three-dimensional space.[151] In this way, the Kaplans staked out an explicitly functionalist position for aesthetics: judgments of preference, they argued, emerged directly from fundamental human needs and purposes, and highly rated environments were likely those which could be shown to "support"—or "afford," citing Gibson—the successful execution of these basic purposes.[152]

This functionalist theory of aesthetic perception centered controversial frameworks sourced from the then-nascent field of evolutionary psychology. Aesthetic judgment, the Kaplans

---

149 Rachel Kaplan, "The Dimensions of the Visual Environment: Methodological Considerations," in *Environmental Design: Research and Practice*, ed. William J. Mitchell (Washington, D.C.: Environmental Design Research Association, 1972); Rachel Kaplan, "A Strategy for Dimensional Analyses," in *Man-Environment Interactions: Evaluation and Applications. Proceedings of the Environmental Design Research Association Conference No.5*, ed. Daniel H. Carson (Stroudsburg, PA: Dowden, Hutchinson and Ross, 1975), 66–68; Kaplan and Kaplan, *The Experience of Nature: A Psychological Perspective*, 211–13.

150 Rachel Kaplan, "Down by the Riverside: Informational Factors in Waterscape Preference," in *Proceedings: River Recreation Management and Research Symposium (January 24-27, 1977, Minneapolis, Minnesota)*, USDA Forest Service General Technical Report NC-28 (St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station, 1977), 285–89; Kaplan, "Perception and Landscape: Conceptions and Misconceptions"; Kaplan and Kaplan, *The Experience of Nature: A Psychological Perspective*, 49–71.

151 Kaplan, "Perception and Landscape: Conceptions and Misconceptions," 241.

152 Ibid., 243.

maintained, constituted a distinct evolutionary "adaptation."[153] A terrain, for example, might afford or constrain the possibility of locomotion, of refuge, of prospect, and so on; the ability of humans to perceive these affordances and to process this information accordingly functioned as a marked advantage against selection pressures.[154] Landscape preference, then, they understood as "an expression of bias towards adaptively suitable environments," which, again, they took to mean environments that were coherent, legible, complex, and mysterious.[155] Thus, they argued, aesthetics performed a key function in the long-term development of the human species.[156] They made their position clear:

> Aesthetic reactions thus reflect neither a casual nor a trivial aspect of the human makeup. Rather, they appear to constitute a guide to human behavior that is both ancient and far-reaching. Underlying such reactions is an assessment of the environment in terms of its compatibility with human needs and purposes. Thus aesthetic reaction is an indication of an environment where effective human functioning is more likely to occur.[157]

This line of argumentation figures into a longer history of psychology's justification by way of evolutionary thinking; some years earlier, personality psychology, too, had looked to evolutionary pressures as a means for explaining the development of personality types. Rachel Kaplan's later work increasingly turned to questions of racial, cultural, and ethnic difference, attempting to study differential patterns of environmental perception across groups.[158]

---

153 Stephen Kaplan, "Adaptation, Structure, and Knowledge: A Biological Perspective," in *Environmental Design: Research and Practice*, ed. William J. Mitchell (Washington, D.C.: Environmental Design Research Association, 1972); Kaplan, "Adaptation, Structure and Knowledge."

154 Kaplan, "Cognitive Maps, Human Needs and the Designed Environment."

155 Kaplan, "Perception and Landscape: Conceptions and Misconceptions," 242.

156 Stephen Kaplan and Rachel Kaplan, *Humanscape: Environments for People* (North Scituate, MA: Duxbury Press, 1978).

157 Kaplan and Kaplan, *The Experience of Nature: A Psychological Perspective*, 10; Quoted in Petrich, "Science and the Inherently Subjective: The Evolution of Aesthetic Assessment Since NEPA," 259.

158 See Rachel Kaplan, "Dominant and Variant Values in Environmental Preference," in *Environmental Preference and Landscape*, ed. Ann S. Devlin and Sally L. Taylor (New London, CT: Connecticut College, 1984); Janet Frey Talbot and Rachel Kaplan, "Needs and Fears: The Response to Trees and Nature in the Inner City," *Journal of Arboriculture* 10, no. 8 (1984): 222–28; Rachel Kaplan and Eugene J. Herbert, "Cultural and Sub-Cultural Comparisons in Preferences for Natural Settings," *Landscape and Urban Planning* 14 (January 1, 1987): 281–93; Rachel Kaplan and Janet Frey Talbot, "Ethnicity and Preference for Natural Settings: A Review and Recent Findings," *Landscape and Urban Planning* 15, no. 1

Carl Petrich echoed the Kaplans' evolutionary thinking in later discussions of his work for Greene County. Citing their research alongside biologist and environmentalist René Dubos's 1968 *So Human an Animal* and biologist E.O. Wilson's 1984 *Biophilia*, the landscape architect argued that the "information processing approach" was in fact "based on the belief that evolving humans found the processing of spatial information to be crucial to survival."[159] In staking a claim for the evolutionary basis of aesthetic preference, Petrich cited Wilson's notion of a "savanna gestalt" in which the biologist argued that humans maintain deeply rooted preferences for environments which recall the highlands of east Africa where the species evolved millennia ago.[160] That the savanna landscape has served as a "model" for suburban development, for the design of parks, and for cemeteries only provides evidence, quoting Wilson, for a "deep genetic memory of mankind's optimal environment."[161] Petrich argued that the work of Olmstead and other picturesque landscape designers and of the romantic-era poets and painters expressed a foundational connection to this very notion of a savanna Gestalt.

The suggestion that an originary psychological predilection might be located in an ancient, prehistoric, yet unspecified location in east Africa and was somehow best exemplified by a largely British and U.S. American cohort of artists and landscape architects clearly indicates the persistence of a specific colonialist worldview. (To be sure, Wilson also offers two other citations as exemplifying this drive, namely, the gardens of ancient Rome and Heian-era gardens in Japan.) To wit, Wilson makes the claim that "given a completely free choice, people gravitate statistically toward a savanna-like environment," a claim which he illustrates with a North American anecdote: "on the

---

(June 1, 1988): 107–17; Byoung-e Yang and Rachel Kaplan, "The Perception of Landscape Style: A Cross-Cultural Comparison," *Landscape and Urban Planning* 19, no. 3 (June 1, 1990): 251–62.

159 Petrich, "Science and the Inherently Subjective: The Evolution of Aesthetic Assessment Since NEPA," 259.

160 Edward O. Wilson, *Biophilia* (Cambridge, MA: Harvard University Press, 1984), 111; Quoted in Petrich, "Science and the Inherently Subjective: The Evolution of Aesthetic Assessment Since NEPA," 263.

161 Petrich, "Science and the Inherently Subjective: The Evolution of Aesthetic Assessment Since NEPA," 263.

western frontier of the United States, explorers were given a brief opportunity to select the landscape to which their hearts led them"—that is, "a savanna, rolling gold and green, dissected by a sharp tracery of streams and lake, with clean dry air and clouds dappling a blue sky."[162] The purportedly "completely free choice" that led white settlers to purportedly savanna-like landscapes was then further illustrated with a quote from U.S. Army Captain Randolph B. Marcy on his 1849 "expedition" through the country's southern plains in which he attests to the landscapes' especial beauty.

If recourse to cognitivist psychology justified the experimental use of images, what might be made of the photomontage specifically? Art historical accounting for the photomontage might seek to associate the technique with an avant-gardist strategy of rupture, trafficking in an aggressive anti-realism. But rather than taking up *the* photomontage, here this chapter rather considers *some* photomontages, in line with the methodological postures put forth by media historians such as Lisa Gitelman or Bernhard Siegert and the notion of cultural techniques.[163] Gitelman, in her 2006 *Always Already New*, writes for example, "it is as much of a mistake to write broadly of 'the telephone,' 'the camera,' or 'the computer' as it is 'the media,' and of— now, somehow, 'the Internet' and 'the Web'—naturalizing or essentializing technologies as if they were unchanging, 'immutable objects with given, self-defining properties' around which changes swirl, and to or from which history proceeds."[164] The historiographic risk, she continues, "is to make a medium both evidence and cause of its own history."[165] In the specificity of the composite images produced for Greene County, then,

---

162 Wilson, *Biophilia*, 112.

163 Bernhard Siegert, "Cultural Techniques: Or the End of the Intellectual Postwar Era in German Media Theory," *Theory, Culture & Society* 30, no. 6 (2013): 48–65.

164 Here Gitelman quotes from James Lastra's *Sound Technology and the American Cinema: Perception, Representation, Modernity*. Lisa Gitelman, *Always Already New: Media, History, and the Data of Culture* (Cambridge, MA: MIT Press, 2006), 8.

165 Ibid., 10.

it might suffice to point out that these composite images were deployed to effect a fulsome Gestaltic smoothing—in stark contrast to the analogous avant-gardist use of such images earlier in the century.

The results of Petrich's visual survey employing these images affirmed strong opposition to nuclear power on aesthetic grounds. Mean scores for the composite images simulating the visual presence of a nuclear power plant were lowest; by comparison, mean scores for those images illustrating cement plants were marginally higher. The images without either were rated, by far, the highest. With these results in hand, Petrich concluded simply, "Aesthetics is important to these people."

Alongside demographic questions, questions of behavior and attitude were posed to the participants. Petrich wanted to be sure to correct as much as possible for antinuclear views in order to isolate "biases" from the aesthetic issue at hand, asking, was "aesthetic sensitivity… suddenly being embraced by the local population because of the opposition to the proposed facility or was there a long-standing, broad-based commitment to the arts, scenic quality, historical preservation and restoration, and recreation"?[166] This is to say, had the aesthetic become an alibi? In line then with the ambitions of both the Likert scale and the cognitivist information-processing model of perception, each in different ways, the aesthetic sensitivity of viewed scenes was tested in relation to ingrained attitudes toward nuclear power, recreation, history, and the arts. If the results of the visual survey seemed to suggest clear aesthetic preferences, questions of attitude and behavior revealed something altogether different. In response to the direct question "Are you opposed to the construction of a nuclear power plant in Cementon? In Athens?," which only came after the visual preference survey had been completed, 80% of respondents indicated they were opposed to both,

[166] U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-56, 5-72.

where 60% were opposed to a concrete plant in either location. Asked for their reasoning for this opposition, only 10% offered "visual blight" as their primary reason why. The results meanwhile seemingly confirmed the validity of compositing technique: photographs of actual cement plants were responded to in roughly the same manner as the composite images, "loosely suggesting that the process did not introduce too strong an artifact into the survey, if any."[167]

Notably, the as-found photographic view from Olana toward what had been identified as Church's "bend in the river" with no intervention depicted was ranked among the highest of all the images. For Petrich, this constituted evidence of the "universal recognition and agreement as to the high scenic quality of the existing view from Olana."[168] Perhaps this empirically confirmed the claims that the various art historical experts had already made—or, perhaps, this was simply a tautological recognition of the influence of received images.

III. Prescription

If Petrich had developed his particular, predictive method for the visual impact analysis at Greene County Nuclear Power Plant with a grounding in art historical thinking updated by way of recourse to cognitive psychology, the question soon became: how could one develop a general method? Which is to say: how could one devise a prescriptive method, rather than a predictive method? While some federal agencies labored to develop their own systematic processes for visual impact assessment and management—the Bureau of Land Management and the U.S. Forest Service chief among them—the Atomic Energy Commission, later reorganized as the Nuclear Regulatory Commission, by comparison, outsourced much of this work to private firms. For a time, the Commission contracted with the Battelle Pacific Northwest Laboratory to develop such a method,

[167] Ibid., N-18.

[168] Ibid., N-29.

and the Laboratory in turn outsourced this work to the Seattle-based planning and landscape architecture firm Jones and Jones. Landscape architects Ilze Jones and Grant Jones had founded their firm in 1969 and had, with relative speed, developed a reputation for their visual impact work for other state and federal agencies. In their research for the nuclear regulatory agencies, Jones and Jones put forth formulae for the quantification of aesthetic values as part of a broader method for calculating "social values" against "techno-economic values." Their scheme interpolated aesthetics as one of eight criteria to be placed under consideration, with the others comprising economics, water and air quality, flora and fauna, cultural and recreational resources, health, and land use.[169] Though their process, like Petrich's, deployed composite photography to allow comparisons between before-and-after views, their scoring system went further in the direction of quantification to yield a "numerical index of visual impact."[170] The visual quality of any location, they argued, could be measured following the formula:

$$VQ = {}^{1}/_{3}\ (I + V + U)$$

where visual quality (VQ) was determined to be a function of a landscape's *intactness* (I), or how "whole" a scene appears; *vividness* (V), or how memorable it is; and *unity* (U), or how harmonious its parts are. The variables Jones and Jones centered appeared to quantify some Gestalt criteria but were in fact sourced directly from the work of R. Burton Litton, however slightly altered.[171] By the early 1970s, Litton had identified three aesthetic criteria—namely *variety*, *vividness*, and *unity*—that he argued could be used for visual assessments founded upon his strategies of description and

[169] J. B. Burnham et al., "Technique for Environmental Decision Making Using Quantified Social and Aesthetic Values" (Richland, WA: Battelle Pacific Northwest Laboratories, 1974), 1.

[170] Brian A. Gray, John Ady, and Grant R. Jones, "Evolution of a Visual Impact Model to Evaluate Nuclear Plant Siting and Design Option," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 491.

[171] Ibid., 493.

inventorying. Litton's tripartite scheme was largely indebted to the critical aesthetics of Monroe Beardsley, in Litton's own telling, with criteria like *unity* informed by Kurt Koffka's Gestalt psychology, *vividness* by the pragmatist aesthetics of Stephen Pepper, and *variety* by Rudolf Arnheim's later Gestalt theories.[172] Adapting Litton's scheme, Grant Jones called the landscape a "Gestalt" and described it as "more than the sum of its parts," calling upon the landscape architect "to discover and reveal" the "fundamental structure" underlying all landscapes.[173]

Jones and Jones's method for quantification relied on expert judgment. Viewing before-and-after composite images, five evaluators, at minimum, were to score each view for overall quality on a scale of 1 to 100 and for each of the three variables on a scale of 1 to 7, in a manner deemed "objective and impartial."[174] Together, the evaluators, deemed a "special-competence group," brought to bear their expertise in landscape architecture and planning.[175] Total visual impact, then, Jones and Jones asserted, could be measured as the change in visual quality from the 'before' views to the 'after' views, multiplied by the total number of viewers estimated as likely to encounter these views. In other words, quantified expert judgment multiplied by exposure to the general public could account, the architects maintained, for general aesthetic impacts. The method was not only predictive, but so too, prescriptive: "the acceptable level of visual impact might be experimentally determined. This would set a numerical threshold beyond which an alternative would be designated with a red flag."[176]

---

172 R. Burton Litton and Kenneth H. Craik, "Aesthetic Dimensions of the Landscape" (Berkeley, CA: Department of Landscape Architecture, University of California, 1969), 138–62.

173 Grant R. Jones, *Design as Ecogram* (Seattle: University of Washington, College of Architecture and Urban Planning, 1975), n.p.

174 Grant R. Jones et al., "A Method for the Quantification of Aesthetic Values for Environmental Decision Making," *Nuclear Technology* 25, no. 4 (April 1, 1975): 696, 710.

175 Ibid., 683.

176 Ibid., 709.

The method was deployed in relatively few cases. In 1975, the Nuclear Regulatory Commission requested that the method be carried out in evaluating the proposed Indian Point Nuclear Generating Plant at Peekskill, New York "on a limited experimental basis" where it was used to calculate the relative impact of six alternatives for cooling towers and their plumes (fig. 1.14).[177] Perhaps worthy of note is that among the special-competence group asked to judge the composite images for this project was then-director of the Institute for Architecture and Urban Studies Peter Eisenman, who had also presented work at the fourth Environmental Design Research Association conference in 1973 where the likes of Rachel and Stephen Kaplan had presented their research, suggesting the intradisciplinary reach of this project of aesthetic quantification.[178] Nevertheless, the quantified aesthetic method proffered by Jones and Jones did not become standard practice for the regulatory commission.

For most of the 1970s, questions of aesthetic impact—and social impacts, more broadly—occupied somewhat unstable ground among the Nuclear Regulatory Commission's priorities. In-house sociologist Elizabeth Peelle at the Oak Ridge National Laboratory has shown that such impact analysis was at first only considered on an "ad hoc" basis in instances thought likely to produce controversy. The agency's first attempt at social impact analysis was for a proposed nuclear power generator in Mendocino County, California, in 1972; though the agency acknowledged that the affluent, largely white population was likely to organize against the proposal and that conflict was highly probable, the analysis only came very late in the process. In the majority of other cases, the sociologist points out, analysis of social impacts was deemed the lowest of priorities, and in

---

177 U.S. Nuclear Regulatory Commission, *Final Environmental Statement for Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 3, Docket No. 50-286* (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979), 6-33.

178 Jones & Jones et al., *Visual Impact Study: Statement of Findings, Alternative Closed Cycle Cooling Systems, Indian Point Nuclear Generating Plant* (Seattle: Jones & Jones, 1975), 68; Peter Eisenman, "Notes on Conceptual Architecture IIA," in *Environmental Design Research, Fourth International EDRA Conference*, ed. Wolfgang F.E. Preiser (Stroudsburg, PA: Dowden, Hutchinson & Ross, 1973), 319–23.

many instances the agency determined there was no need for such analysis at all. When addressed, matters of sociology and of aesthetics were largely handled by engineers with an almost exclusive focus on economic impacts. The necessary exception to the rule, the case of Greene County, marked a turning point in the agency's commitments, according to Peelle: over the course of the process, social impacts were increasingly prioritized, and aesthetic analysis was given its own dedicated specialist—Carl Petrich—for the first time, only after the controversy solidified following the issuance of the draft environmental statement. Similarly, increasing resources were directed to other forms of social impact analysis in this same moment, with a dedicated staff group formed at Oak Ridge National Laboratory very late in 1975.[179]

The Social Impact Analysis group, in Peelle's telling, maintained a conflictual relationship with Nuclear Regulatory Commission management. In one instance, social researchers at Oak Ridge pointed out that the proposed Virgil C. Summer Nuclear Power Station, a generator planned for Fairfield County, South Carolina, would have had disproportionately negative effects on Black residents. Supervisors at the Nuclear Regulatory Commission overseeing the production of the impact statement for the project "deleted all mention of the racial composition in the South Carolina population profile over continuing ORNL staff protests." The Commission finally relented, agreeing to allow the data to appear in the statement, but insisted that the term "minorities" replace the identifier "Black."[180] In other instances, management at the Commission accused staff on the Social Impact Analysis group of "anti-nuclear sentiment" outright.[181]

Responding however selectively to many of these pressures, the Commission's regulatory guidelines exhibited incremental changes in addressing the aesthetic matter after about 1970. The

---

179 Peelle, "Socioeconomic Impact Assessment and Nuclear Power Plant Licensing, Greene County, New York," 16–22.

180 Ibid., 20.

181 Ibid.

agency's guidelines for responding to the National Environmental Policy Act mandate for environmental impact reporting expanded exponentially between 1973 and 1979. The Atomic Energy Commission's largely economics-focused 1973 *Regulatory Guide 4.2 for the Preparation of Environmental Reports* centered a strategy of cost-benefit analysis in which aesthetic impacts were considered as both a potential cost and a potential benefit. Though aesthetics had been acknowledged there as difficult to quantify, the concluding cost-benefit analysis required aesthetics to be tabulated into a scheme of other "monetized costs" whose "unit of measure" was "qualified opinion."[182] The Nuclear Regulatory Commission's 1979 *Environmental Standard Review Plans* offered a marginally expanded handling of potential visual impacts. Particularly germane to this discussion were the changing requirements for image-production for proposed projects: the 1973 regulatory guide stipulated the inclusion of plans, elevations, and "a recent oblique aerial photograph" of the proposed site in the impact statement.[183] The expanded guidelines of 1979 stipulated the additional inclusion, for particularly sensitive sites, of "one or more ground-level photographs… on which major plant features are superimposed… [which] should be representative of potential visual impacts."[184]

A flurry of regulatory guides specifically dedicated to the matter of "site suitability" addressed the burgeoning controversy made most visible in the case of Greene County but which had also proliferated across the country in the same period. Regulatory Guide 4.7 laid out a number of general criteria used in determining a site's suitability, of which land use and aesthetics constituted one. Acknowledging a power station's "adverse visual impacts," the Commission offered as its

---

[182] U. S. Atomic Energy Commission Directorate of Regulatory Standards, *Preparation of Environmental Reports for Nuclear Power Plants*, Regulatory Guide 4.2 (U.S. Atomic Energy Commission, 1973), 4.2-55.

[183] Ibid., 4.2-12.

[184] U.S. Nuclear Regulatory Commission, *Environmental Standard Review Plans for the Environmental Review of Construction Permit Applications for Nuclear Power Plants*, NUREG-0555 (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979), 3.1-5.

regulatory position that such impacts could, somewhat simply, "be controlled by selecting sites where existing topography and forests can be utilized for screening." Further, the regulatory guidelines suggested the "restoration of natural vegetation, creative landscaping, and the use of architectural colors that are integrated with the environment" as other strategies to mitigate these impacts.[185] What the Commission had to offer, it seems, were strategies to make invisible.

In the case of the Greene County Nuclear Power Plant, the applicant, the Power Authority of the State of New York, had attempted a different method altogether—one which would become increasingly indicative of later strategies to mitigate visual impacts. Swapping Petrich's immersive views for the view from above, the Authority developed a mapping technique for determining where to locate power transmission lines.[186] Toward this end, the applicants retained geographers to inventory and map scenic areas and features, as had been designated either by governmental agencies or by direct field inspection, in the immediate vicinity of the project. The team then measured traffic volume along routes in the region as a general indicator of the magnitude of potential viewer exposure. Finally, they measured and mapped the distance from which any given transmission corridor might be visible, accounting for topography and other such factors. In much the same way as the Atomic Energy Commission's regulatory guides had, the mapping process helped the applicant identify strategies to obscure infrastructure development: what resulted from this process was a "sensitivity map" that could serve as the basis for comparing the potential visual impacts of various corridors. Transmission lines could be designed, the applicant maintained, to avoid highly trafficked routes and particularly visible sites—"except at those areas where existing

---

185 U. S. Atomic Energy Commission Directorate of Regulatory Standards, *General Site Suitability Criteria for Nuclear Power Stations (Draft)*, Regulatory Guide 4.7 (U.S. Atomic Energy Commission, 1974), 4.7-13.

186 For an in-depth historical overview of the application of views from above as well as immersive views to questions of planning and governance, see Jeanne Haffner, *The View from Above: The Science of Social Space* (Cambridge, MA: MIT Press, 2013).

topography, land-use patterns, and forest vegetation would help to screen or accommodate the structures." Accounting for this process in the impact statement, staff at Oak Ridge National Laboratory deemed the method "satisfactory."[187]

The Nuclear Regulatory Commission increasingly made use of an analogous mapping technique in the years immediately following this case. Petrich points out in a later essay that the agency had begun to turn to geographic data analysis to identify acceptable sites for infrastructure development by way of "some manual or automated screening algorithm," referencing the work of geographer Jerome Dobson at Oak Ridge National Laboratory.[188] Dobson's Land Use Screening Procedure, a method which had been sponsored by the Nuclear Regulatory Commission and developed specifically for siting energy facilities, put forth what the geographer characterized as an "automated" process "to identify the land use suitability of every land parcel within any candidate region" (fig. 1.15).[189] Dobson demonstrated the workings of his method in the context of the state of Maryland, where he found an already-demonstrated "commitment to predesignation of power plant sites."[190] For his purposes, the geographer adapted the Maryland Department of State Planning's geographic information system data that had subdivided the state into square units by way of a 2,000-foot-by-2,000-foot orthogonal grid and that had provided for each cell data for 52 variables including seismicity, water availability, population density, mineral resources, historic sites, and endangered species.[191] Dobson's study narrowed in on 31,234 cells representing eight counties in northern Maryland and highlighted no more than 29 variables considered particularly germane to

---

187 U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, 5-67.

188 Petrich, "Assessing Aesthetic Impacts in Siting a Nuclear Power Plant," 314.

189 Jerome E. Dobson, "A Regional Screening Procedure for Land Use Suitability Analysis," *Geographical Review* 69, no. 2 (1979): 224.

190 Jerome E. Dobson, "Maryland Power Plant Siting Project: An Application of the ORNL-Land Use Screening Procedure" (Oak Ridge, TN: Oak Ridge National Laboratory, 1977), 1.

191 Ibid., 12.

the question at hand.[192] Groups of specialists then identified these variables with one of four primary objectives for site suitability Dobson had sketched out: "minimization of construction and operating costs"; "minimization of adverse socioeconomic impact"; "minimization of adverse ecologic impact"; " a composite of all siting objectives."[193] Notably, neither the objectives nor any variable singled out visual impacts or aesthetic concerns; Dobson asserted however that aesthetics might be considered under the criterion of "ecologic impact" or that it could be added to the system if further development was provided for.[194] A computer program processed these data, measuring the quantified indices for each variable against the four objectives, yielding a measure of suitability, from unsuitable to highly suitable, for each cell in the region. The Land Use Screening Procedure then produced maps for each of the objectives, including the composite objective, which highlighted suitable candidate areas against areas of low or medium suitability. Dobson acknowledged the varying, and perhaps even opposing, motivations behind the use of his system. Describing the "advantage" that agencies have identified in considering impacts in advance of site selection, he writes:

> For some this represents a pragmatic desire to avoid the delays that can result from hearings, litigations, and detailed impact investigations. For others it represents a genuine concern for the environment and heightened awareness of detrimental impacts. In either case, it is important that the decision-maker be able to cast aside his own biases and apply the criteria of other interest groups even if he is philosophically opposed to their views. Moreover, the interests of other groups are best served if their opinions are considered before the utility has committed large sums of money to a specific site.[195]

The drive for consensus, it seems, was at times economically expedient.

---

[192] Ibid., 31.

[193] Ibid., 32.

[194] Ibid., 20, 69.

[195] Ibid., 19.

If Dobson's work had directly raised the lack of a quantitative metric accounting for the aesthetic, in the same period, across federal agencies and across diverse forms of practice, bureaucrats, managers, and practitioners—alongside intergovernmental agencies such as the UNESCO programme on Man and the Biosphere—implored the development of quantitative indices which could account specifically for the visual quality of landscapes.[196] Physically biased, public health-related environmental quality indicators had first been promulgated after about the mid-1960s, directly modeled on the purported success of analogous statistical indices in macroeconomics, which in the same years had witnessed the development of an increasingly extensive bevy of social indicators capturing new quality-of-life metrics.[197] The novel environmental quality indices, including the Air Quality Index and Water Quality Index, promised objective, comprehensive measures for quantitative environmental monitoring: each compiled a series of independent physical measures, such as, in the case of the former, particulate matter concentrations and nitrogen dioxide levels, weighted by statistical formula to furnish single-numerical evaluative metrics enabling comparative evaluations across locales and over time and to facilitate the analysis of the effectiveness of regulatory programs. Symptomatic of the effort to apply this indexing approach to the aesthetic matter at hand was, for example, the Perceived Environmental Quality Index, proffered by two key figures whose work appears throughout this dissertation, landscape architect Ervin Zube and personality psychologist-turned-environmental psychologist Kenneth Craik. The Perceived Environmental Quality Index sought to provide an objective measure of aggregate visual perception by identifying the constituent landscape elements that corresponded with a test sample's

---

[196] International Co-ordinating Council of the Programme on Man and the Biosphere, ed., *Expert Panel on Project 13: Perception of Environmental Quality, Final Report*, MAB Report, no. 9 (Paris: UNESCO, 1973); National Research Council, Commission on Natural Resources, Planning Committee on Environmental Indices, *Planning for Environmental Indices* (Washington, D.C.: National Academy of Sciences and National Academy of Engineering, 1975).
[197] Daniel B. Tunstall, "Developing Indicators of Environmental Quality: The Experience of the Council on Environmental Quality," *Social Indicators Research* 6, no. 3 (1979): 301–47. See United States Office of Management and Budget, Statistical Policy Division, *Social Indicators, 1973* (Washington, D.C.: U.S. Department of Commerce, Social and Economic Statistics Administration, 1973).

appraisals of landscape quality; statistically assayed and properly weighted, these appraisals yielded formulae for estimating perceived quality as a function of a landscape's physical attributes alone, thus affording a depersonalized, perceptual "basis for design standards and management guidelines."[198]

To be sure, Carl Petrich had attempted use of a computer-based mapping technique in studying the case for Greene County—the results of which the landscape architect deemed "inconclusive" at best.[199] Petrich and two unnamed geographers had divided the region into areas—non-orthogonal polygons, to be precise—of what they called "common scenic quality," based solely on their analysis of 14 physiographic variables such as percentage water area, percentage tree cover, mean elevation, and so on.[200] Those variables had been sourced from another key precedent employing perceptual responses to photographs, that of, once again, landscape architect Ervin Zube who was then the director of the Institute for Man and His Environment at the University of Massachusetts, Amherst. Some years earlier, Zube had attempted to draw direct links between the landscape's physical characteristics and the perception of scenic value, and his study of perceptual responses to scenes in the Connecticut River Valley identified 23 physiographic variables which could be understood as strong "determinants," according to him, "for predicting scenic resource values" (fig. 1.16).[201] Taking this physicalist method as precedent, Petrich's team identified and mapped 126 distinct units in the area, scored each for each of the 14 variables, aggregated those scores, and produced in this way a "total scenic quality score" for each polygon. The mapped units

---

198 Kenneth H. Craik and Ervin H. Zube, *Perceiving Environmental Quality: Research and Applications* (New York: Plenum Press, 1976), 19.

199 Petrich, "Assessing Aesthetic Impacts in Siting a Nuclear Power Plant," 323.

200 U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, M–44, M–46.

201 This study will be analyzed in further detail in chapter two of this dissertation. Ervin H. Zube, David G. Pitt, and Thomas W. Anderson, "Perception and Measurement of Scenic Resources in the Southern Connecticut River Valley" (Amherst, MA: Institute for Man and His Environment, University of Massachusetts, 1974), 1, 11.

were then each shaded to represent a spectrum of scenic quality, ranging from relatively high to relatively low (fig. 1.17).[202] The effort was in many ways anti-Gestaltic, and the results were mostly marginalized to an appendix in the impact statement, rather than the body text where the analysis of the composite images, for one, was to be found. And yet, this would nevertheless increasingly become the model for the Nuclear Regulatory Commission moving forward after this instance. If the Nuclear Regulatory Commission's aesthetic regulations had been somewhat terse in guiding decision making, and if the Commission had outsourced this work to private firms and the national laboratories for a time, later revisions to these regulations directed applicants to look instead to the influential work of another federal agency which had, by the mid-1980s, developed a robust, cartographic system for what they identified as "visual resource management."

While other state agencies largely measured visual impacts on a case-by-case basis as proposals arose, the Bureau of Land Management by comparison set out—and in fact in some way was legally compelled—to establish a system for managing visual resource impacts across all of the lands under its purview in advance of any individual project proposal. The method that the Bureau developed would become influential in the increasingly broad-based transformation which moved the aesthetic question toward new mapping strategies. The Bureau had been established in 1946 as the result of the consolidation of the U.S. General Land Office—founded in 1812 to oversee the surveying and sales of federally owned lands—and the U.S. Grazing Service—established in 1934 to oversee leases of public lands for livestock grazing. Charged with the management of federal lands primarily in the West, the Bureau came to oversee leasing, sales, and other license, fee, and permitting programs for timber production and harvesting, mineral extraction, energy generation, fish and wildlife development, infrastructural rights-of-way, grazing, and other such activities. The

[202] U.S. Nuclear Regulatory Commission, *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*, M-44, M-46.

Federal Land Policy and Management Act of 1976, considered the agency's organic act, radically expanded and redefined these responsibilities, updating the piecemeal authorizing acts, orders, and plans which had preceded the Act in the agency's formation and for the first time clarifying and codifying the federal agency's methods and objectives in a comprehensive manner.[203] Among other fundamental changes to the Bureau's charge, for the first time the protection of "scenic values" was placed on par with that of other resources. Section 102(8) of the Act clearly laid out these responsibilities, declaring it federal policy that:

> The public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use.[204]

The Act established in this way an explicit directive for the Bureau of Land Management to manage scenic values among its priorities. It further stipulated the development of management policies of "multiple use" and "sustained yield" which would guarantee the conservation of resources—whether material, physical, or aesthetic—for future generations.[205] To accomplish such a goal, the Act required that all Bureau holdings be "periodically and systematically inventoried" not only for resource values but so too for "outdoor recreation and scenic values."[206] This was no small undertaking: by 1979, the Bureau's remit oversaw about 60% of federally owned lands—about half of which was located in Alaska, and the remainder primarily in the West—where, by comparison,

---

203 Robert W. Ross, "The Bureau of Land Management and Visual Resource Management—An Overview," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 666.

204 Federal Land Policy and Management Act of 1976, 43 U.S.C. § 170.

205 Ibid.

206 Federal Land Policy and Management Act, 1976; Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1711.

the U.S. Forest Service held jurisdiction over about just 24% federally owned lands.[207] The Bureau's directive, then, in many ways became how to accommodate "acceptable levels of visual impact" without impairing extraction and commodity production.[208]

To this end, the Bureau implemented a comprehensive Visual Resource Management program in 1975. The goal for the management methodology was to inventory and categorize all Bureau of Land Management-administered lands into one of four visual resource classes that established thresholds of allowable visual change. Lands that had been deemed Class I and Class II, for example, were considered the most valued and allowed for little-to-no change; Class III lands represented those of moderate value and allowed for a moderate degree of change; and Class IV lands, considered least valued, allowed for a high degree of change (fig. 1.18). This classification system relied on a three-step process, which determined how aesthetic qualities could be "described and measured" and thus subjected to analysis "in objective terms."[209] Largely indebted to Litton and his work for the U.S. Forest Service, the system biased a physicalist and atomistic approach. As had been the case in Dobson's method and Litton's system alike, the Bureau's program was in many ways anti-Gestaltic in methodology, if not in its explicit aims. The system required analysts "to separate the existing landscape and the proposed project into their features and elements and to compare each part against the other in order to identify those parts which are not in harmony. Then, ways are sought to bring them back into harmony."[210]

The first step in this process entailed the production of an "inventory" of scenic quality. Areas were divided into relatively homogenous physiographic subunits, and interdisciplinary teams,

---

[207] Ross, "The Bureau of Land Management and Visual Resource Management—An Overview," 666.

[208] U.S. Bureau of Land Management, *Visual Resource Management Program* (Washington, D.C.: Department of the Interior, Bureau of Land Management, Division of Recreation and Cultural Resources, 1980), 11.

[209] Ibid., 13.

[210] U.S. Bureau of Land Management, *Visual Resource Management*, Manual Handbook 8400 (Washington, D.C.: Department of the Interior, Bureau of Land Management, 1984), 6.

with at least one member having a background in design, were to evaluate each.[211] These were to be rated for seven key factors—landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications—assessments of which were to be based on purely physical attributes. A landscape with "high vertical relief such as prominent cliffs, spires or massive rock outcrops," for example, would generate a score of five points, whereas "low, rolling hills, foothills or flat valley bottoms" would yield just one point.[212] Each of the seven factors had its own detailed rubric for evaluation following a standardized, physically biased point system (fig. 1.19). Scores from each category were then summed to produce a total rating of scenic quality. Based on this total score, the geographic unit could be assigned to one of three Scenic Quality Classes—A, B, or C—which would then be mapped and identified by color code or hatching (fig. 1.20).[213]

The next steps in this process entailed a sensitivity level analysis and a distance zone analysis, which could begin to account for the "subjective" component of visual impacts, here construed largely as use volume and visibility, among other factors.[214] Sensitivity was to be measured along a spectrum of high, medium, or low, derived from rates of use, types of users, and other such factors for any given area (fig. 1.21).[215] The distance zone analysis was to be carried out through a rubric categorizing areas as either foreground/middle ground, background, or seldom-seen, based on how visible they were from key locations in the field—primarily what was able to be seen when traveling along routes, trails, rivers, and highways in the region.[216] Assessments for the distance zone analysis took place primarily by way of field photography; for larger and more complex projects, however,

---

[211] U.S. Bureau of Land Management, *Visual Resource Inventory*, Manual Handbook 8410-1 (Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986), 2.

[212] U.S. Bureau of Land Management, *Visual Resource Management Program*, 19.

[213] Ibid., 18.

[214] Ibid., 20.

[215] U.S. Bureau of Land Management, *Visual Resource Inventory*, 3.

[216] Ibid., 5.

the Bureau employed computer graphic software developed by the U.S. Forest Service which automatically generated perspectival views from topographic data, as will be detailed in the third chapter of this dissertation. Based on such methods, both sensitivity and distance were likewise mapped for each area (fig. 1.22).

The tripartite analysis allowed areas to be readily assigned to one of the four management classes. A mapping overlay technique and data matrix combined the three data sets, identifying where there were marked convergences and divergences of factors to be considered (fig. 1.23). The compiled data then allowed for the area's classification into a management class, which both described the current state of affairs and directed future action. The resulting maps became in this way key documents explicitly charged with guiding the Bureau's land use planning decisions.[217] Individual project proposals could then be evaluated against the existing mapped classifications. The Bureau's Contrast Rating System served as the primary mechanism for conducting these evaluations. The system asked evaluators to describe each major feature of the landscape in terms of form, line, color, and texture, and to estimate its relative significance in the character of the viewed scene. Evaluators were to perform similar analyses on simulated images, too, whether employing composite photographs, models, projections, or other strategies to be detailed in later chapters. Degrees of contrast—from none, to weak, to moderate, and to strong—were to be estimated for each feature and for each of the four terms to yield an overall picture of contrast, a Contrast Rating (fig. 1.24).[218] This rating was measured against the area's classification: certain levels of contrast were considered allowable depending on what management class the area had been assigned to.[219] In this way, contrast served as a primary determinant in adjudicating visual impacts.

---

[217] U.S. Bureau of Land Management, *Visual Resource Management Program*, 24.

[218] U.S. Bureau of Land Management, *Visual Resource Contrast Rating*, Manual Handbook 8431-1 (Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986).

[219] U.S. Bureau of Land Management, *Visual Resource Management Program*, 33.

The method championed by the Bureau of Land Management represented a new strategy for managing landscapes that increasingly took hold across a number of bureaucratic agencies in the United States—one that cannot be untangled from an ongoing settler colonial project of territorial maintenance in the U.S. American West, as will be examined in closer detail in subsequent chapters. The emergence of this strategy represents, I argue, a fundamental inversion: through this long process "natural beauty" was recast as "visual quality," increasingly understood as a generalized condition—a suprageographic environmental quality—that could be managed across locales and across individuals akin to material, physical, or public health-related environmental factors. This actuarial approach sought to describe individual difference within a generalized system of standard accounting.

Amid these fundamental shifts in policy, the Nuclear Regulatory Commission published the Final Environmental Statement for the Greene County Nuclear Power Plant on February 9, 1979—apparently against the wishes of the Commission's own management. Historian David Schuyler has reported that after the Commission agreed to shelve the project for Greene County, it planned to withhold release of the final impact statement. Investigators at Oak Ridge, however, insisted on publishing the document, regardless; without the Commission's blessing, this "would have enabled critics to portray the commission as being in the thrall of the very industry it was supposed to regulate." Reluctantly, then, the Commission acquiesced and agreed to publish the statement recommending the denial of the license to the Power Authority of the State of New York.[220] The shift in the agency's position from the draft to the final statement represented, according to Peelle, an "unprecedented reversal."[221]

---

220 Schuyler, *Embattled River: The Hudson and Modern American Environmentalism*, 117.

221 Peelle, "Socioeconomic Impact Assessment and Nuclear Power Plant Licensing, Greene County, New York," 9.

Although public opposition to the Greene County project had been long-standing and widespread, and although the Final Environmental Statement had been published which recommended denying the license on aesthetic grounds, it was perhaps the meltdown of the Three Mile Island reactor on March 28, 1979, that spelled final doom for the project on the Hudson. On April 5, just eight days after the incident, the Power Authority of the State of New York announced it would finally drop its ongoing effort to retain support for the nuclear project. Officials for the Power Authority assured the public that the decision had been made "weeks" before the incident, pointing to cost overruns, rather than the aesthetic matter at hand.[222] The authority formally withdrew its application in 1980.

Nevertheless, the decade-plus project organized against infrastructure development on the Hudson both reflected and catalyzed a series of transformations by which expert, embodied description as testimony was traded for a form of public participation centering composite images and cognitivist theories of mind, which paralleled and participated in early disciplinary transformations of art history into visual studies. In turn, countervailing efforts on the part of federal agencies emerged in an attempt to short-circuit the process through new cartographic practices which could begin to govern—prescriptively—the aesthetic at the scale of the territory.

222 "N.Y. Scraps Huge Nuclear Power Plant," *Washington Post*, April 6, 1979.

Chapter 2 *Personality, Models, and Moving Images*

If dissensus around the proposed Greene County Nuclear Power Plant had, by about 1979, catalyzed fundamental transformations in practice and in policy concerning the role of aesthetic judgment in federal infrastructure development, the twin recourse to new forms of architectural visualization, on one hand, and recent developments in perceptual-psychological thinking, on the other, was by no means particular to the instance. Amid a period of broad-based reorganization of infrastructure development practices around newly charged notions of expertise, public participation, social-scientific methodologies, and architectural instrumentation, numerous other controversially proposed infrastructure projects across the United States and across infrastructure types each required recourse to distinct modes of visual representation and psychological schools of thought. This chapter centers the turn to moving image-based model simulations deployed alongside newly developed techniques in personality psychology in mediating the case of a contentious highway proposal to bridge Cross Lake to the northwest of Shreveport, Louisiana (fig. 2.1). Strategically coupled, the cross-disciplinary methods were considered uniquely capable, however briefly, of broadly adjudicating matters to do with roads and highways—with implications to be borne out not only in the specific instance of the Cross Lake bridge, but so too across new regulatory guidelines developed by the Federal Highway Administration and in architectural and psychological discourse, where an unprecedented inversion would effectively recast long-held relationships between personalities and the environment.

The contours of this fundamental reconstitution might be limned by way of contrast to an event convened in roughly the same years that the Cross Lake proposal had first been made public. In remarks delivered in late May 1965, U.S. President Lyndon B. Johnson and First Lady Lady Bird Johnson opened the White House Conference on Natural Beauty in an auditorium in the State Department headquarters in Washington, D.C. With the likes of Kevin Lynch, Ian McHarg, Lawrence Halprin, and William H. Whyte in attendance, Lyndon Johnson called for "a new conservation" which would momentarily set aside material concerns such as water pollution or deforestation. Instead, he implored the some 800 delegates to turn to what he deemed a spiritual effort—the effort to "rebuild and reclaim" the nation's beauty.[1] Johnson framed this matter of natural beauty as inextricable from the immediately pressing geopolitical concerns that marked the day:

> Today I worked and thought about problems in Viet-Nam and the Dominican Republic.
>
> I had to consider decisions which might affect the security of this country, the lives of Americans, and the destiny of other nations. Yet this may be the most important thing that I have done and am doing today, and I am confident that this is the most important group that I will see. For this is part of what all the rest is for.
>
> We have increased the wealth of our Nation and the prosperity of our people. Yet we did not do this simply to swell our bank deposits, or to raise our gross national product. The purpose of this Nation cannot be listed in the ledger of accounts. It is to enrich the quality of people's lives—to produce the great men and women which are the measure of a Great Society.
>
> And that is what you have been here trying to do.
>
> We have also built the most powerful defense in the world, and that power is now on guard in the Caribbean and in southeast Asia, and in a dozen other quieter places. But we did not forge this shield for freedom simply to be safe and secure, or free from risk or sacrifice. We built it to liberate our energies for a society where each person could use all of his full powers—a civilization for the flowering of man. And this, too, is what you are trying to do.[2]

Eliding matters of state into matters of taste, Johnson made the case for natural beauty by way of recourse to a liberal-humanist conception of "man" only made possible by global economic and military dominance. In his remarks, Johnson railed against the many factors he understood as contributing to the nation's ugliness—factors that precluded his liberation of "man." Chief among

---

[1] *Beauty for America: Proceedings of the White House Conference on Natural Beauty, May 24-25, 1965* (Washington, D.C.: U.S. Government Printing Office, 1965), 1, 15.

[2] *Report to the President and the President's Response: White House Conference on Natural Beauty* (Washington, D.C.: U.S. Government Printing Office, 1965), 41.

them for him was the highway. Admitting that, "More than any country ours is an automobile society," Johnson voiced displeasure that highway infrastructure all-too-often willfully disregarded natural landscapes and left conspicuous blemishes on the land. Johnson sought action: he saw not only a need to allay highways' negative visual impacts, but also an opportunity to remake "our roads highways [*sic*] to the enjoyment of nature and beauty."[3] Design experts were called to weigh in on the matter; in a session on "The Design of the Highway," Lawrence Halprin, for one, offered specific techniques for siting highways in urban contexts to better compose harmonious visual environments.

For some in attendance such matters weren't so straightforward. As Johnson himself admitted, "Beauty is not an easy thing to measure. It does not show up in the gross national product, in a weekly paycheck, or in profit and loss statements… Certainly no one would hazard a national definition of beauty." Despite the admission of doubt, Johnson went on to argue that beauty is more or less self-evident. "But we do know that nature is nearly always beautiful. We do, for the most part, know what is ugly."[4] Conference chairman Laurance Rockefeller tried to stave off any skepticism over this almost tautological non-definition of beauty, repeatedly warning in his opening remarks against "abstractions or theories" and "philosophizing." Instead, he insisted, the conference was for "action."[5]

Eighteen years later and some 1,200 miles southwest of the Capitol, evidence of a radically different political arrangement was on display. On a winter night in January 1983, some 200 local residents packed into an auditorium in downtown Shreveport, Louisiana, to view a series of 16mm films produced by UC Berkeley's Environmental Simulation Laboratory in the College of

---

[3] *Beauty for America: Proceedings of the White House Conference on Natural Beauty, May 24-25, 1965*, 6.

[4] Ibid., 2.

[5] Ibid., 18.

Environmental Design. On screen, footage simulated automobile rides along a proposed four-lane highway bypassing the city's center. Plans for the highway had been decidedly controversial since they were first made public twenty years earlier in April 1963, in the years immediately preceding the White House Conference.[6] Intended to constitute a key link in the longer proposal for a nearly 18-mile bypass, known as Highway I-220, the plan called for a nearly two-mile-long bridge cutting across Cross Lake, an artificial reservoir at Shreveport's northwestern edge constructed decades earlier to alleviate impacts of flooding in the region and to store the city's drinking water, which in the time since had been stocked with fish and lined with recreational facilities including parks, marinas, yacht clubs, and piers for fishing (fig. 2.2).[7] Initial public reaction to the highway proposal was swift. Members of the Shreveport community organized in opposition to the highway span over the reservoir, variously citing concerns around water pollution, impacts to public health, effects on home values, and the possibility that de facto, racialized segregation in the city would be undermined. To allay the growing dissension, the State Highway Board held public hearings for the project in 1964; the following year, a group of residents filed suit in state court, seeking injunctions to halt construction.[8] Ordered to trial in 1965, the plaintiffs' early case centered primarily on potential impacts to public health.[9] Critics of the highway project argued in litigation as well as in the local press that construction of the bridge could release sediments at the lake's bottom or disturb disused oil wells capped below the reservoir, and that vehicles traveling across the constructed

---

[6] William G. Allen, "Bass Outlines Busy Highway Program," *The Times*, April 26, 1963, 2.

[7] "Drought and Floods Taught City Need of Steady Water Supplies," *The Times*, June 28, 1935, 33; Shreveport Metropolitan Planning Commission, "The Shreveport Plan: A Long-Range Guide for the Future Development of Metropolitan Shreveport" (Shreveport, Louisiana, 1956); Louisiana Department of Highways, *Draft Environmental Impact Statement: I-220, Shreveport Bypass, Caddo/Bossier Parishes* (Baton Rouge, Louisiana, 1971).

[8] "63 File Suit Opposing I-220 Cross Lake Bypass Bridge," *The Times*, March 24, 1965, 7.

[9] "Court Orders Trial of Suit over Bridge," *The Times*, April 29, 1965, 10.

bridge might discharge synthetic chemicals onto the road, thereby threatening the city's primary supply of drinking water.[10]

If early claims against the project centered primarily on these material concerns—water-borne pollutants and their attendant public health effects—many of the very same transformations in discourse and in federal policy that shifted the terms of debate around the proposed Greene County Nuclear Power Plant effected analogous shifts in the case of the Cross Lake bridge by the first half of the 1970s—with, yet, important distinctions to be drawn. In litigation, in bureaucratic practice, and in policy—if not wholly in stakeholders' minds—perceptual concerns came to take precedence over material concerns: by the time the case had reached the U.S. Federal Court of Appeals, the legal argument against the bridge increasingly and to some degree out of necessity turned to the mutually constitutive matters of recreation, "natural beauty," and visual quality. Still, by 1983, much of the highway had been constructed; the final element left unsettled was the controversial span over the lake.

The Louisiana Department of Transportation and Development organized the film screening in an effort toward court-ordered conciliation. In the packed auditorium, viewers in folding chairs and on the floor watched as the frame of the camera, representing a driver's-eye view, traveled along three alternate routes for the proposed bridge. Footage also simulated boat rides across the lake.[11] Like the proposed highway, the Berkeley simulations were nothing if not controversial: after the public screening, one viewer leveled a critique asking, "Do you provide a fish's-eye view from the bottom of the lake…? Until that is done, this is incomplete." Another was resigned to the impotence of the films: "Everybody had his mind made up before he came."[12]

---

[10] Jim Montgomery, "Texas and the Cross Lake Bridge," *The Times*, June 4, 1978, 17.

[11] "Cross Lake Bridge Film to Be Shown," *The Times*, January 26, 1983, 20; Lee Ivory, "Bridge Film to Be Shown Today," *The Times*, January 27, 1983, 4.

[12] Kevin Doyle, "Cross Lake Bridge Film Draws 200," *The Times*, January 28, 1983, 14.

Few were surprised that the public screening had been met with such contention. Earlier that week, a series of closed-door, experimentally controlled "visual impact tests" saw the same, controversial films screened to nine groups of test subjects statistically determined to be a representative sample of populations likely to be affected by the bridge's construction.[13] Nearing 240 in total, subjects were paid $10 each for their participation in the study.[14] Viewing the Berkeley simulations in 15-second intervals, test participants filled out printed questionnaires asking them to rate each simulated proposal on five-point numerical scales for subjective concerns like "visual intrusion," "natural beauty," and "personal preference." The structured format for soliciting opinion allowed subjective response data to be quantified and aggregated—and it was this data, not the comments from the public screening, that were intended to be submitted as evidence in the ongoing litigation. Many community members and city officials were upset that they hadn't been invited to the private tests—some showed up uninvited and were allowed to participate—while others called into question the validity of the statistical measures used to determine the sample set. One op-ed writer in *The Shreveport Times* went so far as to accuse the sampling strategy of undermining the nation's "basic dedication… to democracy."[15] The public screening was offered then only as a compromise in response to this criticism. But unlike participants in the private tests, the general public received no opportunity to submit quantified feedback. Bill Blair, a consultant on the project, argued that similar data produced from the public screening wouldn't be "valid."[16]

[13] "Cross Lake Bridge Film to Be Shown," 20; Ivory, "Bridge Film to Be Shown Today," 4.

[14] A. Adler Hirsch, "Any Bridge at All Is an Intrusion," *The Times*, February 13, 1983, 29.

[15] Ibid.

[16] Ivory, "Bridge Film to Be Shown Today," 4.

Here then we have two federally mandated events, each contending with aesthetic judgment and the rapidly expanding federal highway program in the United States, separated by less than two decades: the 1965 conference of invited experts on one hand, and the 1983 studies of demographic samples on the other (figs. 2.3 and 2.4). Between the two, we find evidence of fundamental transformations in forms of political legitimation around questions of environment, infrastructure development, and visual judgment, with the design authority of experts giving way to the heterogenous aggregation of public feedback as mediated by new forms of visualization and psychological testing. The dissension over the Shreveport proposal represented something of an early test for a number of newly passed pieces of federal legislation in the United States, including the Department of Transportation Act of 1966; the update to the National Science Foundation's mandate in 1968; and the National Environmental Policy Act of 1969, each detailed in this chapter and elsewhere in the dissertation. The very possibility of a broad-based transformation in managerial practice to address these legislative charges rested upon new forms of architectural skilling coupled with psychometric techniques, together constituting a political technology to manage deep-seated tensions between federal and local control, between trained expertise and public preference, and between infrastructure development and the preservation of "nature," in order to fabricate consensus around the increasingly unmanageable problem of the visual environment.

At the nexus of many of these specific efforts was the Environmental Simulation Laboratory at Berkeley's College of Environmental Design, which would furnish the immersive simulations in the Cross Lake case. In room 119 at Wurster Hall, the architect Donald Appleyard and the psychologist Kenneth Craik had, by 1975, assembled an apparatus able to record moving perspectival views from within architectural models (figs. 2.5 and 2.6). Having amassed more than $1.3 million dollars in federal, state, and private funding—including more than $1.1 million from the National Science Foundation—the architect-psychologist pair developed what they described as "a state-of-the-art motion picture special-effects studio" capable of film, color video, closed-circuit television, and still photography, all made possible by a thin periscope—a tube outfitted with lenses—hung from a gantry.[17] The periscope relayed visual information from the surface of a model to a camera overhead, and the periscope-rigged camera, guided by joystick, moved freely at desired speeds within the modeled space. Carefully positioned at the correct height, the periscope produced to-scale, 'eye-level' views; moving at a reasonable clip, the apparatus suggested a sense of walking, driving, or, as would be in the case of Cross Lake, boating. The resulting immersive footage could be relayed in real time or recorded for future viewing.[18]

The architect and psychologist brought importantly distinct, though complementary ambitions to the project: Donald Appleyard, an architect and planner who studied under Kevin Lynch and later taught at Massachusetts Institute of Technology in the 1960s, sought to develop new forms of architectural representation which could incorporate movement and time duration in order to facilitate participatory planning processes and iterative design methods. Like others before him, Appleyard maintained that the general public didn't understand architectural drawings, and he hoped his "naturalistic" films and videos would provide architects with a medium to better communicate with the public.[19] Kenneth Craik, on the other hand, had trained as a personality psychologist at the University of California, Berkeley, and had by the mid-1960s developed an interest in investigating how distinct personality types engaged the environment differently. He

[17] Peter Bosselmann, *Dynamic Simulation of Urban Environments: Twenty Years of Environmental Simulation at Berkeley*, 509 (Berkeley: Institute of Urban and Regional Development, University of California at Berkeley, 1990), 5–6; Correspondence from Gay Englezos to Donald Appleyard and Melvin Webber, March 10, 1978, BANC MSS 83/165 c, Carton 11, Folder 12, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley; National Science Foundation Research Directorate, *Summary of Awards in Energy-Related General Research* (Washington, D.C.: National Science Foundation, 1974), 109.

[18] Donald Appleyard and Kenneth Craik, *Visual Simulation in Environmental Planning and Design* (Berkeley: Institute of Urban and Regional Development, University of California, 1979), 3; Peter Bosselmann and Kenneth Craik, *Perceptual Simulations of Environments* (Berkeley: Institute of Urban and Regional Development, University of California, 1985), 8.

[19] Appleyard and Craik, *Visual Simulation in Environmental Planning and Design*.

reasoned, too, that environmental response types might afford a reorganization of personality types as such around the newly identified concept of "environmental dispositions." In pursuit of these research interests, Craik sought a methodically controlled apparatus for testing the psychological and aesthetic effects of environmental variables on human subjects.[20] Afforded an interdisciplinary charge, the Environmental Simulation Laboratory deployed models and moving images to allow new possibilities for immersion—*simulation*, in their terms—accommodating these disparate aims bridging basic research on one hand and applied communication on the other.[21]

For a relatively brief moment, the Simulation Lab's televised, filmed, and photographed models attracted widespread interest: organizations as disparate as the Atomic Energy Commission, the California Coastal Commission, the National Institute of Law Enforcement and Criminal Justice, the New York Parks Council, and USC's Andrus Gerontology Center sought collaborations with the Lab, alongside countless architecture firms, developers, city plan commissions, neighborhood associations, activist groups, and redevelopment agencies who turned to its model simulations as powerful instruments toward differing, and often agonistic, ends.[22] Variously screened to private audiences, presented in public meetings and hearings, and broadcast over public-access and cable television, the visualizations produced at the Environmental Simulation Laboratory found varied

---

[20] Kenneth Craik, "Environmental Psychology," in *New Directions in Psychology 4* (New York: Holt, Rinehart and Winston, Inc., 1970), 6; Peter Bosselmann, "The Berkeley Environmental Simulation Laboratory: A 12 Year Anniversary," *Berkeley Planning Journal* 1, no. 1 (1984): 150.

[21] Donald Appleyard, Kenneth Craik, Merrie Klapp, Alcira Kreimer, "The Berkeley Environmental Simulation Laboratory: Its Use In Environmental Impact Assessment," Working Paper No. 206 (Berkeley: Institute of Urban & Regional Development, University of California, 1973).

[22] Donald Appleyard et al., "Amenity Impacts of Nuclear and Other Power Plants: Draft Outline for an Assessment Manual" (Teknekron, Inc. and US Atomic Energy Commission, January 1972), BANC MSS 83/165 c, Carton 11, Folder 20, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley; Sandra Blakeslee, "Envisioning the Truth without the Consequences," *The New York Times*, December 11, 1983; Donald Appleyard, "Periscoping Future Scenes: How to Use an Environmental Simulation Lab" (Berkeley: Institute of Urban & Regional Development, University of California, 1979); Bosselmann, "The Berkeley Environmental Simulation Laboratory: A 12 Year Anniversary."

uses as architect and developer renderings of proposed projects[23]; as participatory planning tools in public hearings for controversial schemes, land use gaming for redevelopment planning, and zoning code rewrites[24]; as persuasive tools for citizen activism and anti-development advocacy alongside telethons and other programs soliciting viewer response[25]; as illustrations in educational broadcasting[26]; as the basis for environmental impact studies[27]; and as a tool for basic psychological research into the perception of environments, buildings, and their contexts.[28]

But the immersive, moving simulations produced at Berkeley lent themselves especially well to the study of highways. Donald Appleyard had a long, demonstrated interest in the perception of roads which prefigured his work at Berkeley, and key technological precedents for the Lab were to be found in driving and tank simulators whose techniques were directly brought to bear in its development. So too did a significant source of funding, support, and commissioned projects for the Lab come from the likes of the California Department of Transportation, the Ford Motor Company, and General Motors.[29] To wit, the very first project produced by the Lab was a simulation

---

[23] Bosselmann, *Dynamic Simulation of Urban Environments*, 17.

[24] Barbara Bradley, "Projections of How Tomorrow's City Might Look Help in Development Fights," *The Baltimore Sun*, November 22, 1987, 151; Bosselmann, "The Berkeley Environmental Simulation Laboratory: A 12 Year Anniversary," 153, 154; Bosselmann and Craik, *Perceptual Simulations of Environments*, 15.

[25] CIVITAS, *No More Tall Stories*, color video (New York: Channel One, 1986); Susan Heller Anderson and David W. Dunlap, "Upper East Side Hubbub," *New York Times*, January 14, 1986, B3; Richard D. Lyons, "Midblock Zoning Victors Turn Sights on 5 East Side Avenues," *The New York Times*, April 13, 1986, R7; Joseph Giovannini, "Apartment Builders Return to Prewar Design," October 13, 1986, A1; Peter Bosselmann, *Filmscripts: Five Films Produced at the Environmental Simulation Laboratory* (Institute of Urban and Regional Development, University of California at Berkeley, 1990), 2; Genie Rice, "The Story of Paul Newman and East Side Zoning," *CIVITAS Newsletter*, 2008, 3.

[26] Bosselmann and Craik, *Perceptual Simulations of Environments*, 15; Bosselmann, "The Berkeley Environmental Simulation Laboratory: A 12 Year Anniversary," 159–60.

[27] Appleyard et al., "The Berkeley Environmental Simulation Laboratory: Its Use In Environmental Impact Assessment."

[28] Joachim F. Wohlwill, "What Belongs Where: Research on Fittingness of Man-Made Structures in Natural Settings," in *Assessing Amenity Resource Values*, ed. T. C. Daniel and Ervin H. Zube (Fort Collins, Colorado: US Department of Agriculture, Rocky Mountain Forest and Range Experiment Station, 1979).

[29] Donald Appleyard, "Traveller Perception and the Environmental Design of Highway Systems," March 1970, BANC MSS 83/165 c, Carton 8, Folder 38, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley; Donald Appleyard, "Proposal for the Degree of Doctor of Philosophy in Environmental Planning," January 12, 1971,

of a highway for Ford Motor Company, screened to the Ford Board of Directors and at a Highway Research Conference in 1970.[30] In another characteristic example, officials from the state of New York commissioned the Lab in the winter of 1986 to produce footage simulating driving along and walking nearby the proposed West Way, as part of New York City's West Side Highway replacement project; the resulting footage aired on public-access television with viewers encouraged to phone in to the studio to take part in live debates among community groups, state officials, and project designers.[31] The turn to moving images, as the chapter will show, in this way offered a medium charged with the possibility of mediation across difference, considered especially germane, however briefly, to adjudicating matters of the road.

The Environmental Simulation Lab was one among numerous model simulators that proliferated through the 1970s, emblematic, if unexceptionally so, of a broad-based, short-lived, and little accounted-for effort to render the architectural model a key site for the legal-aesthetic adjudication of matters of context and infrastructure development in built and natural environments. At once entangled in legal proceedings, zoning code rewrites, planning battles, citizen activism, public relations efforts, and psychological research, these immersive simulations subtended radically different forms of activity—public engagement, basic research, and advocacy—yet such entanglements were in many ways precisely what rendered the Lab capable of catalyzing broader

---

47, BANC MSS 83/165 c, Carton 10, Folder 30, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley; Appleyard and Craik, *Visual Simulation in Environmental Planning and Design*.

30 Donald Appleyard, *The Berkeley Environmental Simulation Laboratory: Technical Report*, May 1975, 3, BANC MSS 83/165 c, Carton 11, Folder 12, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

31 Bosselmann, *Filmscripts*, 3, 14; Bosselmann, *Dynamic Simulation of Urban Environments*, 3–4.

shifts in the political terrain in terms, especially and particularly, of the aesthetic governance of landscapes—as perhaps nowhere better evidenced than in the case of Cross Lake.[32]

This chapter tracks the processes by which moving image-based model simulation and techniques from personality psychology converged on the matter of the road. It first considers early responses in policy and in architecture discourse to the period's growing dissension around the federal highway program and its impacts to "natural beauty," which initially took the form of ameliorative design practices, then recuperative recreational programs, and, finally, new planning prescriptions to account for scenic quality across all highway proposals. The chapter then turns to the technical development of new forms of architectural simulation seeking to make possible the production of moving architectural images, explicitly charged in the period with a new political efficacy considered particularly pertinent to the study of highways. The chapter next considers the concomitant turn to methods and techniques developed in personality psychology which afforded a methodological framework taken to be uniquely capable of addressing differences in environmental perception across distinct personality types—and which would give rise to a redefinition of

---

[32] To date, Berkeley's Environmental Simulation Lab has received little historiographic attention, despite the fact that it was heavily funded and occupied a great deal of space—both literal and conceptual—within Berkeley's College of Environmental Design. The Lab warrants brief mention in Avigail Sachs's *Environmental Design: Architecture, Politics, and Science in Postwar America*, where she characterizes it as participating in a broader terrain of architects theorizing the notion of "ecology" by the mid-1960s. Other histories have tended to privilege the Lab's media output and their attendant technological development. The historian Anthony Raynsford places the Lab at the center of a teleology from filmic representation at MIT in the 1950s to contemporary CAD-based digital simulations, which, he argues, broached the terrain of the hyperreal and effectively replaced the ideal subject—a "Platonic knower of ideals"—with a pluralistic "cybernetic subject of endless feedback." In a later essay, Raynsford rejects this recourse to teleology and instead argues that the Simulation Lab connoted a refiguration of the subject into a passive, car-bound consumer, implicitly at odds with the ethos of participation espoused by Appleyard. In an ongoing book project, the architect Nicholas de Monchaux casts the Lab as a technological entanglement between Silicon Valley, the Hollywood film industry, and architecture. Against these readings which largely render the Lab something of a media curiosity whose politics, at best, are implied, this chapter seeks to address its direct engagements with infrastructure policy, psychological knowledge-making, and forms of governance in the period. Avigail Sachs, *Environmental Design: Architecture, Politics, and Science in Postwar America* (Charlottesville, VA: University of Virginia Press, 2018), 114; Anthony Raynsford, "Spectacle of the Hyper-Real: Environmental Simulation, Cybernetic Subjects, and Urban Design" (ACSA 100th Annual Meeting, Boston, Massachusetts, 2012); Anthony Raynsford, "Simulating Spatial Experience in the People's Berkeley," *Design and Culture* 6, no. 1 (March 1, 2014): 45–63; Nicholas de Monchaux, "Rebel Plans: Apple, Star Wars, and Architecture at Bay," Research Project, 2018.

personality as such through the newly identified notion of "environmental dispositions." And finally, the chapter interrogates how these developments in architectural instrumentation and psychological discourse together furnished the conditions for the codification of new visual impact guidelines by the Federal Highway Administration, which centered an expanded notion of "viewer sensitivity." In this way, the chapter argues that comprehensive reforms in federal policy around the judgment of beauty and the adjudication of environmental disputes with specific regard to highway infrastructure, borne of new developments in architectural visualization and psychological thinking, constituted distinctly new protocols for environmental decision-making, on one hand, and a radical redefinition of the relationship between individuals and the environment, on the other.

I. Highways and Natural Beauty

The specific conflict over the Cross Lake bridge came to the fore in a period of widespread dissension over the federal highway program. Across the United States, highways were increasingly shown to have had devastating impacts on communities on a number of registers: in material terms, they were understood to generate significant amounts of air, water, and noise pollution; in economic terms, they triggered pronounced impacts to land values; and, perhaps most consequentially, in social terms, they buttressed racialized segregation practices and the wholesale displacement of neighborhoods, which activists, scholars, and historians have shown to have had disproportionately negative effects on Black and Brown communities. This growing dissension was made visible in activism, in the popular press, and in scholarly production, and together this multivalent turn against the highway in the period characterized what was called "the freeway revolts."[33] The particular

[33] The literature on this topic is exceedingly large. For a small selection, see Raymond A. Mohl, "The Interstates and the Cities: Highways, Housing, and the Freeway Revolt," Civil Rights Research (Washington, D.C.: Poverty & Race Research Action Council, 2002); Raymond A. Mohl, "Stop the Road: Freeway Revolts in American Cities," *Journal of Urban History* 30, no. 5 (July 1, 2004): 674–706; Katherine M. Johnson, "Captain Blake versus the Highwaymen: Or, How

question of the highway's negative effects on the visual constituted one aspect of this broadly shared concern, often understood in the period by way of an oppositional relationship between roads and "natural beauty." Such positions were made clear through texts which reached popular audiences including Jane Jacobs's 1961 *The Death and Life of Great American Cities* and architect Peter Blake's 1964 *God's Own Junkyard*.[34] These positions in some sense triggered a reactionary response of sorts among a subset of architects which became visible by the mid-to-late 1960s: the idea of the road variously offered a source for a newly reformulated understanding of "what people actually want" and would lead to its recuperation by figures including Denise Scott Brown, Alison Smithson, and Reyner Banham, among others.[35]

If highways were understood in these manifold ways to have been the source of any number of social and cultural issues—landscape aesthetics among them—so too did they seemingly present an opportunity. Governmental responses in policy took the form of a number of programs and regulatory instruments enacted during Lyndon B. Johnson's second-term presidency, fundamentally reshaping strategies governing the interface between roads and visual perception. At first these took the form of ameliorative design standards and recreational programs intended to redistribute "natural beauty" across the country—currents that architects were well positioned to absorb. Soon following were substantive legal proscriptions against highway development through recreational

San Francisco Won the Freeway Revolt," *Journal of Planning History* 8, no. 1 (February 1, 2009): 56–83; Eric Avila, *The Folklore of the Freeway: Race and Revolt in the Modernist City* (Minneapolis: University of Minnesota Press, 2014).

[34] Jane Jacobs, *The Death and Life of Great American Cities* (New York: Random House, 1961); Peter Blake, *God's Own Junkyard: The Planned Deterioration of America's Landscape* (New York: Holt, Rinehart and Winston, Inc., 1964).

[35] Denise Scott Brown, "Learning from Pop," *Casabella*, no. 359/360 (1971): 15–23; Reyner Banham, *Los Angeles: The Architecture of Four Ecologies* (New York: Harper and Row, 1971); Alison Smithson, *As in DS: An Eye on the Road* (1983) (Baden: Lars Müller, 2001). In the same issue of *Casabella*, Frampton charges that these positions amount to no less than an apologist intensification of the workings of capital and a cynical recognition of the lack of agency for architecture. Kenneth Frampton, "America 1960–1970: Notes on Urban Images and Theory," *Casabella*, no. 359/360 (1971): 25–40. For more on these histories, see Gabrielle Esperdy, "Ugly America," *Places Journal*, November 20, 2014; Gabrielle Esperdy, *American Autopia: An Intellectual History of the American Roadside at MidCentury* (Charlottesville, VA: University of Virginia Press, 2019).

lands, the implementation of which was not only reflected in but in fact reshaped by the case of Cross Lake.

According to public accounts, matters of the visual impact of roads had become a source of concern for Lyndon B. Johnson and for Lady Bird Johnson while campaigning in 1964 for reelection. Largely travelling the country by car, Lady Bird Johnson expressed dismay at what she saw as the nation's intractable state of ugliness, made most visible along its highways, which she understood to have been deeply interconnected to an array of various social issues. In a diary entry dated Wednesday, February 3, 1965, just two weeks after Lyndon's inauguration for a second term, Lady Bird Johnson reflected on this state of affairs:

> Getting on the subject of beautification is like picking up a tangled skein of wool—all the threads are interwoven—recreation and pollution and mental health, and the crime rate, and rapid transit, and highway beautification, and the war on poverty, and parks—national, state, and local. It is hard to hitch the conversation into one straight line, because everything leads to something else.[36]

Over the next few months, Johnson devised strategies to bring national attention to matters of roadside beauty, of which her multi-day "Landscape-Landmark Tour" was a centerpiece. Piling into a large, chartered bus in early May 1965, she, along with administrators from the National Park Service and the Bureau of Public Roads and "all the Cabinet wives," traveled along highway I-95 and other major thoroughfares in Virginia, journeying from the White House to rest stops, roadside monuments, parks, gardens, highway plantings, Monticello, and the Blue Ridge Mountains.[37] A second bus filled with members of the press followed, and the caravan made highly publicized stops which sought to draw contrast between roads unimproved and beautified, thus highlighting specific

[36] Lady Bird Johnson, *A White House Diary* (New York: Holt, Rinehart and Winston, Inc., 1970), 253.

[37] Ibid., 294.

design strategies that Johnson argued could allay the widespread ugliness she, along with others, had identified as characteristic of the United States as seen from the road.[38]

In large part the result of Lady Bird's organizing efforts, President Lyndon B. Johnson enacted a series of policy reforms beginning later that year with the 1965 signing of the Highway Beautification Act. The Act sought to regulate the appearance of roadside billboards and the location of junkyards and landfills, and it authorized the use of funds generated by the federal fuel tax for landscaping and recreational programming around highways.[39] Championed by Lady Bird Johnson, the Act represented a concentrated effort to screen land uses deemed disagreeable from the view of drivers. Its results, however, were decidedly mixed, having been weakened largely as a result of lobbying efforts by billboard trade associations.[40]

The following year, Lyndon B. Johnson signed the Department of Transportation Act, a significantly more substantial piece of legislation which consolidated dozens of bureaus and agencies under the newly formed Department of Transportation. A key provision in the 1966 Act, section 4(f), not only required the new Department to "include measures to maintain or enhance the natural beauty of the lands traversed" in the development of new highways but, as would become critical in numerous trials triggered by contentious road projects, specified that the Department

> shall not approve any program or project which requires the use of any land from a public park, recreation area, wildlife and waterfowl refuge, or historic site unless (1) there is no feasible and prudent alternative to the use of such land, and (2) such program includes all possible planning to minimize harm to such park, recreational area, wildlife and waterfowl refuge, or historic site resulting from such use.[41]

---

[38] Johnson, 294–98; Richard F. Weingroff, "Lady Bird Johnson's I-95 Landscape-Landmark Tour," Highway History (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 2017); Lewis L. Gould, *Lady Bird Johnson and the Environment* (University Press of Kansas, 2021), 66–68.

[39] Highway Beautification Act of 1965, 23 U.S.C. § 131 et seq.

[40] For more on this history, see Carl A. Zimring, "'Neon, Junk, and Ruined Landscape': Competing Visions of America's Roadsides and the Highway Beautification Act of 1965," in *The World Beyond the Windshield: Roads and Landscapes in the United States and Europe*, ed. Christof Mauch and Thomas Zeller (Athens, OH: Ohio University Press, 2008), 94–107.

[41] Department of Transportation Act of 1966, 23 U.S.C. § 138.

The legal implications of section 4(f) were, in this way, not merely procedural, but rather substantive: unlike the later National Environmental Policy Act which would require, simply, the disclosure of impacts, the Department of Transportation Act instead specifically proscribed governmental actions resulting in impacts.[42] The barring of highway construction through existing parklands, excepted only in cases where the Department could categorically demonstrate there existed no reasonable alternative and that sufficient plans to minimize harm had been developed, would later take center stage in the litigation around the controversial Cross Lake project.

These various policy efforts coincided with public campaigns led by the president's administration to encourage automobile-based domestic tourism, of which Johnson's Landscape-Landmark Tour was explicitly in support. Under the banners "America the Beautiful," "See America," and "See America First," the express aim of these campaigns was in large part to ease the deficit in the balance of international payments through increased domestic spending, and the efforts were readily adopted and championed in the period by tourist industry associations, car manufacturers, oil suppliers, and other such interests.[43] To be sure, "See America" and "See America First" had longer histories as campaign slogans which dated as far back as 1905, if not earlier, as historian Marguerite Shaffer has shown, although these early efforts were more often than not linked to railroad companies.[44] Shaffer argues that by the early twentieth century domestic tourism was already afforded a patriotic charge understood as crucial in the construction of national identity, writing "Tourism, defined as a kind of virtuous consumption, promised to reconcile [the] national mythology, which celebrated nature, democracy, and liberty, with the realities of an urban-industrial

---

42 For more on the early history and legal implications of section 4(f), see Oscar S. Gray, "Section 4(f) of the Department of Transportation Act," *Maryland Law Review* 32, no. 4 (1973): 327–408.

43 Walter Carlson, "Advertising: Using 'See America' Theme," *The New York Times*, August 9, 1965.

44 Marguerite Shaffer, "See America First: Tourism and National Identity, 1905–1930" (Ph.D. Dissertation, Harvard University, 1994).

nation-state dependent on extraction, consumption, and hierarchy."[45] When Johnson revived these efforts in 1965 with his renewed "See America" campaign, he effected a switch: rather than railroad companies, it was now automobile interests who largely drove the cause.[46]

As part of this broader undertaking, the first coordinated efforts to develop a federal scenic roads program in the United States commenced in the 1960s immediately prior to Johnson's presidency.[47] The Outdoor Recreation Resources Review Commission, a congressional commission formed in 1958, issued its first findings in a 1962 report which concluded that the nation's growing population and its increasing levels of mobility, disposable income, and leisure time were placing new demands on recreation infrastructure, among which roads and highways were paramount.[48] Identifying driving for pleasure as the single most popular form of recreation in the country, the report recommended that "Federal and State governments should give explicit recognition to recreation values in the planning and design of highways," among other related directives.[49] Stemming in part from this effort, in 1962 a Recreation Advisory Council, composed of the U.S. Secretaries of the Interior, Agriculture, Defense, Commerce, Health, Education and Welfare; the Administrator of the Housing and Home Finance Agency; and the Chairman of the Tennessee

---

[45] Marguerite Shaffer, *See America First: Tourism and National Identity, 1880–1940* (Washington, D.C.: Smithsonian Institution, 2001), 5.

[46] For more on the mutually constitutive relationship between the development of automobile infrastructure and "nature tourism" primarily in the U.S., see Alexander Wilson, "The View from the Road: Recreation and Tourism," in *The Culture of Nature: North American Landscape from Disney to the Exxon Valdez* (Toronto: Between The Lines, 1991), 19–51.

[47] David R. Levin, *Scenic Byways* (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1988), 2-1.

[48] The forming of the ORRRC roughly corresponded with the emergence of recreation research as a field of study, which was nascent by the late 1950s and considered established by the 1960s. For more on the history of recreation research as a field of study, see Robert E. Manning, "Coming of Age: History and Trends in Outdoor Recreation Research," in *Trends in Outdoor Recreation, Leisure and Tourism*, ed. William C. Gartner and David W. Lime (Wallingford, UK: CABI Publishing, 2000), 121–30.

[49] United States Outdoor Recreation Resources Review Commission, *Outdoor Recreation for America: A Report to the President and to the Congress* (Washington, D.C.: U.S. Government Printing Office, 1962), 3, 136.

Valley Authority was established.[50] The Council issued *A Proposed Program for Scenic Roads and Parkways* in 1966, a report which detailed similar demographic trends—increased leisure time and rising disposable incomes—but placed especial emphasis on forecasts for growth in the tourism industry and a determination to keep dollars within the country, whether through automobile sales, gasoline purchases, hotel stays, the buying of recreational equipment, or other tourism-related outlays. The report promised that a federal scenic roads program could bring "many benefits to national defense, safety, health, conservation and the economic well-being of the Nation," not least of which was the "stimulation of interest in the history of the Nation and of pride in its development."[51] Toward these various ends, the Council recommended a $4-billion program for the construction of new scenic roads.[52]

Shifts in international geopolitics in part transformed the scope of these recommendations, if not the tenor of its discourse. In 1974, a follow-up report by the Federal Highway Administration, *An Assessment of the Feasibility of Developing a National Scenic Highway System*, detailed various proposals for a national scenic highway system, but in making its recommendations it took another tack. Citing the ongoing oil crisis, it deemed inadvisable the plan to establish new, dedicated funding streams to construct a system of scenic roads, as this was now considered not in line with "national objectives and priorities." Instead, the plan recommended smaller sources of funding to designate existing highways as scenic and to enhance these routes with "incremental scenic projects," and otherwise it suggested that the federal government should authorize states to redirect existing and already allocated funding to cover basic construction costs for any new scenic road

---

[50] Levin, 2-12.

[51] United States Department of Commerce, *A Proposed Program for Scenic Roads and Parkways* (Washington, D.C.: U.S. Government Printing Office, 1966), 2, 34.

[52] Ibid., 6.

proposals.[53] In some sense, it in this way incentivized, if not charged, new highway projects with demonstrating some degree of scenic capacity.

Fundamental to this array of federal legislation and programming, then, was a growing understanding of highways as directly antagonistic to matters of natural beauty and recreation, an understanding broadly understood in public discourse and championed in large part by Lady Bird Johnson's efforts. At once, however, an optimism that roads might yet serve as avenues toward economic, societal, and cultural "progress" persisted. That is, the issue of road development in the period produced a key conflict and promised its productive resolution: on one hand, roads and highways were understood as fundamentally counter to things like natural beauty and recreation, and yet they were increasingly charged with offering new opportunities for tourism and domestic consumption. In some sense, the latter might be understood as a compensatory, or even ameliorative, drive for the former. There is a well-documented history of the formulation of road development policies in the United States, and elsewhere, for their role in national defense to facilitate the movement of military forces.[54] But in this period in question, highways in the United States were increasingly afforded new charges: they were to absorb surplus leisure and disposable income, redirecting both toward various industries including automobile manufacturing, oil production, and tourism. At once there was an explicit effort to redistribute this activity across the country, encouraging individuals to become better able to find "natural beauty" anywhere—both facilitated by and directed to the road itself.

---

[53] United States Federal Highway Administration, *An Assessment of the Feasibility of Developing a National Scenic Highway System: Report to Congress* (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1974), i, 15.

[54] See for example Mark H. Rose, *Interstate: Express Highway Politics, 1939–1989* (Knoxville, TN: University of Tennessee Press, 1990); Tom Lewis, *Divided Highways: Building the Interstate Highways, Transforming American Life* (Ithaca: Cornell University Press, 2013).

Such matters had long been on the mind of Donald Appleyard—who attended hearings triggered by the Highway Beautification Act in 1966, who presented his research on roads to the Citizens' Advisory Committee on Recreation and Natural Beauty in 1967, and whose archive otherwise attests to his awareness of contemporary trends in things like the domestic sales of motorhomes and the road as a site for recreation—along with many other like-minded architects in the period.[55] Before Appleyard's arrival to Berkeley, where his interest in the general perception of environments would materialize in his work on the Simulation Lab, Appleyard had for a time focused his research on the specific perception of highway environments. Appleyard, along with his former advisor Kevin Lynch and architect John R. Myer, published the results of this line of investigation as *The View from the Road* in 1964—the same year that Lyndon and Lady Bird Johnson toured the States in their cross-country reelection campaign. Sponsored by a grant from the Rockefeller Foundation and later the Joint Center for Urban Studies of MIT and Harvard, the 1964 monograph centered an ambitious thesis: "Our highways are no mean achievements in the history of technology," they affirmed. But, they speculated, "Will they also be remembered as works of art?"[56] Elsewhere, the authors afforded a liberal-humanist (and, not to mention, masculine) charge to the cold infrastructure, echoing President Johnson's comments at the White House Conference on Natural Beauty: "Would it be possible to use the highway as a means of education, a way of making the driver aware of the function, history, and human values of his world?"[57]

[55] Donald Appleyard, "Scenic Driving on the Urban Road," Report to Citizens' Advisory Committee on Recreation and Natural Beauty, December 11, 1967, BANC MSS 83/165 c, Carton 11, Folder 20, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley; David R. Levin, "The 1966 Scenic Roads Proposal," Report to Citizens' Advisory Committee on Recreation and Natural Beauty (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, December 12, 1967), BANC MSS 83/165 c, Carton 8, Folder 49, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley; Recreational Vehicle Institute, "Recreational Vehicle Industry Facts and Trends" (Recreational Vehicle Institute, 1966), BANC MSS 83/165 c, Carton 8, Folder 49, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

[56] Donald Appleyard, Kevin Lynch, and John R. Myer, *The View from the Road* (Cambridge, MA: Joint Center for Urban Studies of the Massachusetts Institute of Technology and Harvard University, 1964), 63.

[57] Ibid., 17.

The View from the Road was the result of a yearslong project which saw Appleyard, Lynch, and Myer recruit a methodological grab bag of fieldwork, interviews, "artistic criticism," tape recording, photography, filming, and sketching (fig. 2.7). Their ambitions were multiple: they sought to generate new graphic languages for representing a driver's experience of the road; they advanced new design methods for highway projects sited in urban contexts; and, as a demonstration of these ideas, they developed an alternate scheme for Boston's controversially proposed Inner Belt Highway. Under this remit, the three investigators first set out to study individuals' reactions to existing roads. Conducted by MIT graduate student Richard Peterson, these "tests of the visual impact of the highway" entailed interviews with a "wider sample of people"—namely "twenty subjects: mostly, but not entirely, middle-class and professional"—who rode as passengers along Boston's Northeast Expressway. With sketchpads in hand, subjects were asked to record what they saw from the car. At breakneck pace each produced about three drawings a minute—"under such pressure that he cannot consciously control what he records." The sketches were to serve as evidence of preconscious response: what subjects drew, what they omitted, where their pens lingered, the intensity of their lines, and how they represented motion might offer indication of their perception of the roadscape, with an intuitive immediacy understood to precede the vagaries of language. Sketching at such a pace also allowed comparison across subjects. Laid out in rows, the sketches could be aligned in time and compared for what subjects, en masse, found notable and where views differed.[58] (The resulting data suggested that subjects were about five times more likely to draw the "shape of the road ahead" than things like "hills" or "lampposts."[59])

---

[58] Ibid., 27.

[59] Ibid., 36.

Amid such social-scientific strategies, however, Appleyard, Lynch, and Myer remained committed to understanding highways as "conscious works of art."[60] Throughout *The View from the Road*, the authors go to great lengths to analogize the highway to various artistic media: the road, for them, is akin to "large-scale architecture"; its "continuity and insistent temporal flow" liken it to music or cinema; its "kinesthetic sensations" are similar to that of dance or amusement parks; its episodic, fragmentary nature renders it akin to a "magazine serial" or an "'endless' composition, of the kind typified in jazz or medieval polyphony, or such tales as 'Br'er Rabbit.'"[61] The highway has a "tempo and rhythm," "tension" and "climax," "dissonances and distortions," and an "audience"—albeit a "captive" one.[62] Road transitions might operate like "the counterpoint of music" or "like a movie dissolve"; the roadside could be "a fascinating book to read on the run."[63] In the ecstasy of the mixed metaphor, the authors affirm the highway's status as art—regardless of medium, or perhaps, superseding media.

For Appleyard, Lynch, and Myer, rendering the highway a work of art compelled another form of judgment, on the surface markedly distinct to the social-scientific methodologies comprising the project's fieldwork. "The basic technique used," they wrote, "was the one common to all artistic criticism: numerous repetitions of the experience, and its analysis and evaluation both on the spot and from memory." The passive construction elides the actors tasked with passing such judgment—namely, Appleyard, Lynch, and Myer themselves, along with "several research personnel." Traveling along some of the same study routes that their twenty test subjects traversed, the primary investigators recorded their own impressions on tape recorders, cameras, and

---

60 Ibid., 37.

61 Ibid., 4, 18.

62 Ibid., 4, 17, 18.

63 Ibid., 18.

sketchpads. They "experimented" with stream-of-consciousness verbal feedback "given without pause and at such speed that the observer loses much conscious control of his observations and must say the first thing that comes into his head." Again taken as evidence of preconscious response, this commentary was thought to suggest where and how attention moves, as well as "the more obvious signs of emotional reaction." The conclusions that Appleyard, Lynch, and Myer drew were "therefore based largely on the reactions of alert and presumably sensitive and educated observers."[64] Presumed to be "sensitive" and therefore expert, the investigators authorized themselves to draw decisive conclusions about highways—*qua art*—from subjective impressions. The data-gathering effort was thus admittedly partial. But Appleyard, Lynch, and Myer defended their methods:

> The reactions of other subjects might be expected to be less sharp; but what scanty evidence we have indicates that they would not differ markedly in kind, at least among other middle-class people to whom the road is not a matter of long habit. The greatest divergences are likely to occur among people of another class or culture (about which we know nothing), or possibly among daily commuters along a highway, on whom we have extremely little data.[65]

Certain reactions, it seems, could be presumed; others were to be set aside, at least for the time being. To be sure, the authors suggest other modes of testing that should be pursued in the future, including physiological measures or, anticipating the Environmental Simulation Laboratory at Berkeley, "laboratory experiments in which the highway experience is simulated and varied in a more controlled fashion." They also affirm a desire to test other groups. "None of these other tests have been attempted by us," they admit.[66]

Here lies the tension at the core of *The View from the Road*, the very same tension which would be laid bare in the years between the 1965 White House Conference on Natural Beauty and

---

[64] Ibid., 27.

[65] Ibid.

[66] Ibid.

the 1983 screening in Shreveport, Louisiana: on one hand, the highway understood as at least analogous to an artwork, if not an artwork in se, rendering it available to forms of expert judgment and criticism; on the other, the highway taken as a site for fieldwork, available to social-scientific methodologies and subjective testing en masse. The temporary coexistence of these two modes of judgment would become less and less tenable by 1983. Still, in 1964, Appleyard, Lynch, and Myer could bridge these modes with seemingly little reservation.

If the controversially proposed nuclear power plant in Greene County, New York, lent itself to representation by way of static, composite imagery, the experience of highways by comparison seemed to resist the Gestalt and therefore demanded novel forms of representation for Appleyard, Lynch, and Myer. At the core of *The View from the Road* was a proposal for a new graphic language to represent moving visual sequences in both their "objective and subjective aspects." Committed to the agentic potential of architectural representation, the three argued that techniques for "recording, analyzing, and communicating" the experience of the road were prerequisite to the design of a better road: "Without such a technique, we are unable to express or refine design alternatives… This would be analogous to music without a notation, or architecture without drawings." The researchers argued that different modes of representation worked to construct different audiences. "Conventional" representational strategies like maps, ground and aerial photography, and perspectival sketching, they argued, were sufficient only "if the user has enough interpretative skill." But these modes risked flattening difference: "essential elements" become indecipherable from "the mass of things potentially perceivable"; the third dimension is left to imagination; and projects become static compositions rather than a "dynamic sequence." Models represented an improvement over such modes, but they suffered from the sense that the viewer is alienated from the scene. Appleyard, Lynch, and Myer remained optimistic that "if the eye is brought down by some optical means" to the model's surface, whether by a small mirror or handheld periscope, experience could be better simulated.[67] Still, this experience would be limited: only one viewer could use the periscope at a time, and what they view could not be recorded, compared, or communicated to larger groups.

Motion pictures, then, seemingly promised a way out of this representational quandary for Appleyard, Lynch, and Myer. Indeed, the experience of the road had already lent itself to filmic and televised representation: other forms of simulation developed for military and civilian applications had made use of moving images which were deployed for training tank drivers and for studying the actions of civilian drivers alike. But these early simulators largely tended to focus on overt behavior—whether that behavior was to be measured or, in many cases, retrained. Here, rather, just as would be the case elsewhere in the dissertation, the challenge was to repurpose the presumably behaviorist tool and turn it onto questions of environmental perception.[68] "The most serious difficulty" in such an effort, the authors clarify, "is the inherent difference between the camera and the human eye."[69] The human eye scans, and its focus is typically selective amid a "very broad angle of hazy vision." The film camera, by contrast, "is a staring eye of uniformly acute vision over an angle of moderate size. In one way, it records too much, if we want to simulate the workings of a human eye; in another way, it records too little by reducing peripheral vision." In order to ameliorate this difference, the investigators argue, filmmakers have codified certain formal techniques—"the panning shot, the dissolve, the close-up"—in order to naturalize the camera without disturbing the viewer. But, the researchers warn, "the result is a work of art (whether good or bad), which has

[67] Ibid., 19–20.

[68] An analogous trajectory might be sketched for any number of automobile-based simulation experiments in the period, including the work of Peter Kamnitzer at UCLA School of Architecture in the same period. See Peter Kamnitzer, *An Urban UCLA Laboratory* (Los Angeles: School of Architecture and Urban Planning, University of California, Los Angeles, 1966); Peter Kamnitzer, *Computers and Urban Problems* (Los Angeles: School of Architecture and Urban Planning, University of California, Los Angeles, 1977). For a historical account of Kamnitzer's work, see Curtis Roth, "Software Epigenetics and Architectures of Life," *e-flux*, February 2019.

[69] Appleyard, Lynch, and Myer, *The View from the Road*, 20.

already interpreted the scene." Of course, elsewhere *The View from the Road* had already gone to great lengths to liken the road to a form of cinema:

> The cinema tells its story with dramatic changes in the separation between camera and actor, from close-up to long shot depending on what is being said. So it is on the city highway: the designer can decide what he wants to emphasize—a total skyline, a distinct character, a single landmark—and adjust his viewing distance accordingly. As in the cinema, contrasting distances will keep his sequences legible and eventful.[70]

Analogizing the highway designer to a filmmaker and the road to a film, the architects argue that the road should, somewhat tautologically, be represented filmically. But this effort was not toward the sort of participatory end that would characterize Appleyard's later work with Kenneth Craik; instead, this was to offer a form of feedback to be fed back into the designer's process, to render them a better author. Most promising in this effort for Appleyard, Lynch, and Myer is the possibility of coupling the motion picture camera with the miniature periscope introduced earlier. They've "partially developed" such a device, they admit, but still it is limited in terms of light exposure and camera movement. The ambition for this instrument is far from modest: "the appearance of proposed new environments could be predicted as they would be seen by the moving observer."[71]

Given such limits, the authors set aside their technological ambitions for the moment and conclude their excursus on representation by proffering "a simple graphic technique of recording visual sequence, employing easily made, easily understood, reproducible drawings on paper, which could compress the essence of the experience into a small space."[72] In fact a highly complex system of symbols, marks, and sketched gestures, the diagramming strategy put forth was one among a number of similar visualization techniques attempting to represent experience over time which proliferated briefly in the period from the late 1950s into the early 1970s, including the work of

[70] Ibid., 11.

[71] Ibid., 20.

[72] Ibid., 21.

Philip Thiel, Lawrence Halprin, and others.[73] Though these have received some degree of historiographic attention, these representational strategies were in fact put to little use in the period.

As would become plainly clear in the case of Cross Lake, highways placed specific pressures on the question of subject positionality in a way that analogous infrastructure types, such as nuclear power generators, seemingly did not. If in their 1964 text Appleyard, Lynch, and Myer remained committed to understanding the road as artwork for a highly particular kind of subject—middle-class, professional, and presumably white and male (the text describes fourteen of the twenty external test subjects as "competent draftsmen")—they posited a specific relationship between artwork and audience, what they described as "the extension of self"[74]:

> One of the strongest visual sensations is a relation of scale between an observer and a large environment, a feeling of adequacy when confronted by a vast space: that even in the midst of such a world one is big enough, powerful enough, identifiable enough. In this regard, the automobile, with its speed and personal control, may be a way of establishing such a sense at a new level. At the very least, it begins to neutralize the disparity in size between a man and a city. The reverse sensation occurs when a car breaks down, and the driver must move on foot over the vast hills and endless tangents of the modern highway. The scale relation is gone.[75]

Their rhetoric played into an already well-established history of understanding the highway as a site for a particular kind of subject formation: roads and highways made available a technological-infrastructural fantasy whereby landscape, machine, and individual were irretrievably bound with notions of freedom, power, and masculinity to construct what was understood as a particularly U.S. American identity. Put another way, the ambition for *The View from the Road* could perhaps be

---

[73] For an investigation into these time-based architectural diagramming techniques which proliferated in the period particularly with regard to the experience of the highway, see Divya Rao Heffley, "Vision in Motion: Architectural Space Time Notation and Urban Design, 1950-1970" (Dissertation, Brown University, 2011); Lawrence Halprin, "Motation," *Progressive Architecture* 46, no. 7 (1965): 126–33; Philip Thiel, "Notes on the Description, Scaling, Notation, and Scoring of Some Perceptual and Cognitive Attributes of the Physical Environment," in *Environmental Psychology: Man and His Physical Setting*, ed. Harold M. Proshansky, William H. Ittelson, and Leanne G. Rivlin (New York: Holt, Rinehart and Winston, Inc., 1970).

[74] Appleyard, Lynch, and Myer, *The View from the Road*, 37, 13.

[75] Ibid., 13.

recapitulated as a strategy for better highway design made possible through expert, aesthetic knowledge in order to (re)produce certain kinds of subjects.

To be sure, the specifically aesthetic identification of car and "man" has a longer history not limited to the context of the United States: one may think immediately to any number of early twentieth-century avant-gardist groups from Japan to Italy who made something of a fetish out of the automobile.[76] But in the period in question, the road as landscape—rather than the automobile as machine—was increasingly charged as a privileged space of aesthetic experience, with a markedly distinct tenor. Highways figured centrally in artists' accounts of encounters with art objects, and roads increasingly became the object of artistic attention as such. Scholars have drawn attention to a robust range of this kind of production emerging in the period by numerous artists, a small sample of which includes the likes of Alice Aycock, Ingrid and Iain Baxter, Ed Ruscha, Tony Smith, Robert Smithson, and Suzuki Yoshikazu, to name a few who variously engaged roadways in importantly distinct ways.[77] In roughly the same period, the road likewise became the subject of broad-based, sustained architectural attention: highway design was the focus of a 1961 exhibition at the Museum of Modern Art entitled "Roads" curated by Bernard Rudofsky and Arthur Drexler. Dedicated to the "art of roadbuilding," the show featured photographs of realized highway projects in Caracas, Fort

[76] See Tim Benton, "Dreams of Machines: Futurism and l'Esprit Nouveau," *Journal of Design History* 3, no. 1 (January 1, 1990): 19–34; Toshiharu Omuka, "Futurism in Japan, 1909—1920," in *International Futurism in Arts and Literature*, ed. Günter Berghaus (Berlin: Walter de Gruyter, 2000), 244–70; Gennifer Weisenfeld, *MAVO: Japanese Artists and the Avant-Garde, 1905-1931* (University of California Press, 2002).

[77] For a selection of artists working with roads, see 木村荘八 (Kimura Sōhachi) and 鈴木芳一 (Suzuki Yoshikazu), *銀座界隈 / アルバム・銀座八丁 (Ginza Kaiwai / Arubamu Ginza Hatchō)* (Tōkyō: Tōhō Shobō, 1954); Edward Ruscha, *Every Building on the Sunset Strip* (Los Angeles: Ed Ruscha, 1966); Samuel Wagstaff, "Talking with Tony Smith," *Artforum* 5, no. 4 (December 1966); Robert Smithson, "The Monuments of Passaic," *Artforum* 7, no. 4 (December 1967): 48–51; Alice Aycock, "Work" (1975), in *Individuals: Post-Movement Art in America*, ed. Alan Sondheim (New York: E. P. Dutton, 1977), 105–8; For a selection of historical accounts, see Charissa N. Terranova, *Automotive Prosthetic: Technological Mediation and the Car in Conceptual Art* (Austin, TX: University of Texas Press, 2014); Christine Filippone, *Science, Technology, and Utopias: Women Artists and Cold War America* (New York: Routledge, 2017); Kuraya Mika and Ueseki Sen, eds., *路上 (Rojō) / On the Road* (Tōkyō: Tōkyō Kokuritsu Kindai Bijutsukan, 2011); David Campany, "Precedented Photography," *Aperture*, no. 206 (2012): 46–51; Nancy Shaw, "Siting the Banal: The Expanded Landscapes of the N.E. Thing Co.," in *You Are Now in the Middle of a N.E. Thing Co. Landscape* (Vancouver: UBC Fine Arts Gallery, 1993).

Worth, Los Angeles, and San Francisco and projects by Pier Luigi Nervi and Frank Lloyd Wright, alongside a sketch by Leonardo da Vinci.[78] Other architects in the period directly engaged governmental agencies in their efforts to develop roads: Lawrence Halprin, for example, was approached by the California State Division of Highways to address the "urban design problems" associated with freeways in the early to mid-1960s, where he argued that highways were "a form of art in the city"—an "urban sculpture for motion"—whose design was "an intuitive act."[79] In these various ways, architecture was understood as strategically positioned to bridge the technical universe of planning and the cultural ambitions of art practice, both of which had converged on questions of the road from the mid-1960s through the mid-1970s.

Like *The View from the Road* had, these projects largely if not exclusively concerned themselves with the point of view of the driver; but as made abundantly clear by the contention over the highway over Cross Lake and countless other projects like it, much of the dissension to do with the federal highway program had to do with the view *of* the road rather than the view *from* it. The authors of *The View from the Road*, for one, readily acknowledged these limits to their perspective. Immediately made apparent from the volume's title, their research interest admittedly lay solely with "the driver and his passengers," despite the fact that the highway "also exists as a static, bulky object in the landscape" confronting "those who live along its borders"—i.e. those who are not driving on it. The problem is thus "two-faced… much as if a theatrical designer had to be concerned with the visual form of his backstage apparatus," unlike the very many other artforms to which the authors analogize the road.[80] Other than this early admittance, the researchers expressly avoid the matter throughout the main body of the text, before acknowledging in its conclusion that the "inward view

[78] Museum of Modern Art, "Roads, New Exhibition at Museum of Modern Art," Press Release, 1961.

[79] Lawrence Halprin, *Freeways* (New York: Reinhold Publishing Company, 1966), 4–5.

[80] Appleyard, Lynch, and Myer, *The View from the Road*, 4.

must be integrated with the outward view." This very problematic was to be at the center of Appleyard and Craik's later investigations into simulation at Berkeley—perhaps made most clear in the case of the bridge over Cross Lake. "Unfortunately," Appleyard, Lynch, and Myer continue, "the two views are radically different by nature. How may they be co-ordinated, or at least prevented from conflicting with each other? When the driver wants an elevated platform from which to view his surroundings, while the stationary citizen wishes the road to be out of sight, how do we arbitrate the issue?"[81] It would be exactly this question of arbitration—the arbitration of multiple, distinct positionalities understood to be fundamentally at odds with one another—which would be borne out in the debates, trials, and various other conflicts mediated by the Simulation Laboratory by the mid-to-late 1970s. This effort toward arbitration would require recourse to forms of psychological theory that not only privileged individual actors, but instead attended to dynamics among multiple, distinct groups—namely, personality psychology, as will be detailed later in this chapter.

With these transformations in discourse and in policy in mind, the State of Louisiana Department of Highways issued a Draft Environmental Impact Statement for the controversial highway project in Shreveport in mid-1971 in keeping with the mandates outlined in the National Environmental Policy Act that had gone into effect just the year previous. The ten-page-long draft statement dismissed the material concerns that had been the initial object of local stakeholders' criticisms.[82] With some sense of certainty, the statement averred that "the probable impact of the proposed project on the environment will be minimal," offering straightforward assurances that contamination of the public water supply due to pollution remained only a "remote possibility" with a closed drainage system to be designed for the roadway and soil erosion control measures for the

[81] Ibid., 63.

[82] For more on the scope and length of early environmental impact statements, see chapter 1 of this dissertation.

reservoir bottom to mitigate such impacts.[83] Section 4(f) analyses determined there existed no "feasible and prudent alternative" to the proposed route due to significant cost increases and impacts to "valuable" real estate associated with the alternate routes studied. Notably however the statement did acknowledge, "There will be a visual effect on Cross Lake," in light of which the state agency earmarked funds for the "aesthetic treatment" of the bridge design in order to not only mitigate visual impacts but "to enhance the general beauty of the lake area."[84] The impact reporting process itself had not been without controversy: an earlier attempt at a statement had been rejected for addressing only the controversial bridge rather than the entire length of the bypass.[85] As something of an overcorrection, the state highway department submitted a redrafted statement to numerous organizations and federal agencies for comment; the U.S. State Department, for one, responded, "In the future, we will be pleased to be of assistance to you on such matters which involve other countries or have an international environmental effect."[86] Only through trial and error, it seemed, could the issue of how to contend with the still-new slate of environmental regulations and policies be worked out in real time.

Assurances that the project would have minimal environmental effect were deemed insufficient by critics of the impact reporting process. The process did little to account for difference across users of the highway and its neighbors, and among these failings was the conspicuous omission of any address of the especially racialized geographies of the city of Shreveport. In 1976, one federal metric deemed Shreveport the most segregated city with a population exceeding 50,000

---

[83] Louisiana Department of Highways, *Draft Environmental Impact Statement: I-220, Shreveport Bypass, Caddo/Bossier Parishes*, 2–3.

[84] Ibid., 2, 7; Correspondence from Leon Gary, Director of Louisiana Department of Highways, to Department of Transportation Federal Highway Administration, June 3, 1971, in Draft Environmental Impact Statement: I-220, Shreveport Bypass, Caddo/Bossier Parishes.

[85] Stanley Tiner, "State I-220 Report Under Federal Study," *The Times*, June 27, 1971, 1.

[86] Edgar Coltharp, "Route of I-220 Bypass Still Up in the Air," *The Times*, August 1, 1971, 16.

in the United States, having shown a steady increase from already high levels of segregation in 1940 throughout the 70s.[87] Bypassing the city center, the highway was to cut through and alongside the predominantly Black neighborhoods of Cooper Road, Lakeside, and Allendale on the northeastern shores of the reservoir—the 1970 census estimated the Cooper Road tract to be 96.5% Black and the Lakeside tract to be 99.3% Black—which then bridged Cross Lake to connect to the largely white, sparsely populated southwestern outskirts of the city.[88] In the time since—following the ultimate construction of the highway—the latter neighborhoods have also become majority Black.[89] These racialized spatial politics attending the highway bypass were already made explicit when early plans for the circumferential arterial system were first detailed in master plans for the city developed from 1952 to 1956 by Arch Winter and Ralph Bender, a graduate of the Cranbrook Academy of Arts.[90] In the press, opposition to the plan was levied at least in part along racialized lines: a white developer, Lionel L. Meyer, argued that the inner loop road would "destroy segregation" and encourage Black Shreveporters—referred to with a slur and a threat of retaliatory violence—to picnic and swim by the lake, thereby imperiling real estate values.[91]

To address the various inadequacies of the impact reporting process, teams of consultants were brought on to the project, turning to new techniques in visualization, demographic analysis, and psychometrics to provide new evidentiary forms. Among these consultants were Jones & Jones,

---

[87] United States Commission on Civil Rights Louisiana Advisory Committee, *Fair Housing in America: Community Development in Louisiana* (Washington, D.C.: United States Commission on Civil Rights, 1981), 27.

[88] United States Department of Commerce Bureau of the Census, *1970 Census of Population and Housing: Census Tracts. Shreveport, Louisiana, Standard Metropolitan Statistical Area*, Final Report PHC(1)-197 (Washington, D.C.: U.S. Government Printing Office, 1972), P-1–P-8.

[89] United States Department of Commerce, Bureau of the Census, *1990 Census of Population and Housing: Population and Housing Characteristics for Census Tracts and Block Numbering Areas. Shreveport, Louisiana, Metropolitan Statistical Area* (Washington, D.C.: U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census, 1993), 45.

[90] "Architect Is Appointed for Master Plan," *The Times*, May 23, 1953, 3.

[91] "Master Plan Authors Are Challenged," *The Times*, May 30, 1956, 4.

the Seattle-based planning and landscape firm introduced in chapter one who had developed expertise in assessing visual impacts for the Nuclear Regulatory Commission, which would partner with the local firm Urban Analytics, Inc., and Berkeley's Environmental Simulation Laboratory.

II. Instruments and Commitments of Architectural Visualization

By the period in question, the production of new forms of architectural representation, and moving perspectival images in particular, promised to afford the discipline a newfound political efficacy. To be sure, 'improved' forms of architectural representation had long been considered among the key desiderata of the field. To cite one characteristic, if unexceptional, example: in a rousing February 1885 address to the Royal Institute of British Architects, architect and critic Maurice B. Adams opined that "half the troubles of the architect are due to careless drawings." Expanding on the thought, he continued, "we must, if we aim at good architecture, have correspondingly able and sympathetic draughtsmanship."[92] Adams was a typical Victorian-era reformer, and like others in the period he'd argued that the public couldn't read architectural drawings, that drawing was formative to the development of a discerning eye, and that 'false' representation could amount to willful deception on the part of the architect. A teleological historiography might seek to situate Appleyard and Craik's film and television experiments as a direct inheritor to this line of thought, as something of an answer to a centuries-long effort to produce better architecture through better representation—as though any basis for judgment, the very possibility of a "better" architecture, weren't exactly the thing under pressure in this period. A related yet distinct line of historiographic inquiry might trace the roots of Appleyard and Craik's immersive simulations back to eighteenth- and nineteenth-century forms of spectacle such as the

[92] Maurice B. Adams, "Architectural Drawing," *Transactions of the Royal Institute of British Architects* Vol. I. New Series (1885): 77.

panorama or the diorama, arguing a transhistorical and transgeographic formal homology. But rather than trace a teleological history of the ambition, whether representational or immersive, this section traces a media-historical approach of the techniques, practices, and effects constituted by the disparate set of instruments specifically and intentionally brought together to produce the Environmental Simulation Laboratory.

To be sure, Donald Appleyard *was* himself interested in producing a teleology, important here only to understand what he understood to be at stake in his project. In a 1977 essay "Understanding Professional Media," the architect sought to substantiate the Simulation Lab's ambitions by recourse to a history of architectural representation that reached as far back as the Middle Ages. In something of a prelapsarian moment, he suggests, medieval maps once afforded landmarks and monuments sensory details to communicate to illiterate publics. In a similar vein, Antonio da Sangallo's model of St. Peter's basilica, executed in wood, was large enough to be occupied and judged through bodily experience. Appleyard categorizes both representational modes as *experiential*—that is, they traffic in "concrete" depiction of sensory experience, "usually visual." The architect opposes this experiential mode with another that he identifies as *conceptual*, which privileges "abstractions of underlying systems or structures" whether physical, functional, social, economic, or ecological.[93] (A fixation on the dichotomy between the perceptual and the conceptual seems to have been widely shared in the historical moment.) Appleyard bemoans what he considers a centuries-long project to prioritize the conceptual over the experiential. His loose teleology, linking medieval maps to Sangallo's model, culminates with the purported Renaissance achievement of perspective as a form of experiential simulation, a culmination which for him also represents a

93 Donald Appleyard, "Understanding Professional Media," in *Human Behavior and Environment*, ed. Irwin Altman and Joachim F. Wohlwill (New York: Plenum Press, 1977), 44.

moment of imminent loss.[94] In the centuries following the Renaissance, Appleyard argues, conceptual simulation steadily gained dominance over the experiential. Perspective was displaced in favor of formats like the plan, the axonometric, abstract symbolic systems, and, later, data modeling. For the architect, this turn toward conceptual representation was no less than a symptom of architecture's loss of purchase over society. He attributes the trend to the increasing professionalization and siloization of the design disciplines, where disciplinary instruments like journals and academies conspired to establish "powerful and extensive subcultures" that effectively alienated architecture from its public. At once recalling C. P. Snow's 1959 *The Two Cultures* and anticipating Jean-François Lyotard's 1979 *The Postmodern Condition*, Appleyard argues that design practice had thus been relegated to "closed cultures," broadly aligned into two camps: the "hard-nosed realists" who privilege engineering, technology, construction, and computing; and the "soft aesthetes" merely concerned with appearance. Representations produced by one group say little to members of the other—to say nothing of the general public. In this turn, Appleyard suggests, architects risk a fundamental "loss in credibility," where built projects fall short of promises made to the public in presentation drawings and models.[95]

Others in the period like architect John Maxwell Anderson, director of studies at University of Glasgow's Mackintosh School of Architecture, were less interested in distinguishing among these representational types. In a 1970 essay detailing experiments with television as an aid to the design process, Anderson argued that "traditional" models and drawings, whether orthographic or perspectival, continued to "assume too much importance in the designer's processes." These all too often served as "tour de force" demonstrations of architectural invention, he lamented, and "[the

---

94 It is perhaps plainly obvious that here Appleyard produces an irretrievably Eurocentric historiography. cf. George Saliba, *Islamic Science and the Making of the European Renaissance* (MIT Press, 2007); Hans Belting, "The Double Perspective: Arab Mathematics and Renaissance Art," *Third Text* 24, no. 5 (September 1, 2010): 521–27.

95 Appleyard, "Understanding Professional Media," 45.

designer] invests too much of himself in their creation"—suggesting that drawings could amount to little more than vehicles for the affirmation of strong authorship.[96] (Though he makes no explicit reference, one might consider here the contemporaneous emergence of an art market for precisely these kinds of architectural drawings, corresponding with Leo Castelli Gallery's first shows dedicated solely to architecture in 1977 and the inauguration of the Max Protetch Gallery in New York in 1979 with an exhibition of architecture drawings.[97]) Like other architects in the period inclined toward participatory design, Anderson encouraged designers to reject *tour-de-force* image-making in favor of representation as "a dialogue," establishing an opposition between drawing as the site of authorial intent and drawing as a site of communicative exchange. He attributes the latter charge to an ameliorative drive to address the erosion of shared foundations for aesthetic judgment: "In the absence of design criteria generally acceptable to designers, users, or the public at large, new ways of demonstrating architectural intentions, before buildings are built, are becoming increasingly important."[98]

This was the period immediately following the emergence of communications studies as a discipline, which historians typically date to the mid-1950s, and, perhaps having absorbed the lessons of these extradisciplinary discourses, Appleyard and Anderson recast architecture as a problem of communication—just as numerous other architects and theorists in the period had and would continue to do.[99] But for them this problem remained at the level of representation as much

[96] J.M. Anderson, "A Television Aid to Design Presentation," *Architectural Research and Training* 1, no. 2 (November 1970): 20.

[97] For more on the history of the development of an art market for architectural drawings in the 1970s, see Jordan Kauffman, "Architecture in the Art Market: The Max Protetch Gallery," *Journal of Architectural Education* 70, no. 2 (July 2, 2016): 257–68; Martin Hartung, "Collection Building: Making Architecture Public in the Art Market," *OASE*, no. 99: The Architecture Museum Effect (2017): 56–65; Jordan Kauffman, *Drawing on Architecture: The Object of Lines, 1970–1990* (Cambridge, MA: MIT Press, 2019).

[98] Anderson, "A Television Aid to Design Presentation," 20.

[99] For an overview of the history of communications studies, see David W. Park and Jefferson Pooley, *The History of Media and Communication Research: Contested Memories* (New York: Peter Lang, 2008).

as it did of the building itself. As Appleyard contended, "the issue of public communication" remains in "the foreground."[100] In his essay, the architect cites the codification and "proliferation" of environmental impact reporting in the U.S. after 1970, described in chapter 1 of this dissertation, as having held some promise in addressing this concern, but he argues that impact reports haven't yet "improved public communications as much as intended."[101] Architectural representation, in this way, was strategically positioned to absorb the dictates of discourses in communication and to address information asymmetries considered symptomatic of the contemporary condition.

Thus understood uniquely and explicitly as political matters in this period, the varying modes of architectural representation were for those in the circle of Appleyard and Craik each charged with constituting specific political effects. Appleyard, for example, cites the anecdote of planner Robert Moses's proposal for a bridge connecting Manhattan to Brooklyn. Official representations, Appleyard explains, were presented only in aerial views so as to obscure the project's effect on local communities. Ole Singstad, chief engineer of the New York City Tunnel Authority and an opponent of the bridge proposal, produced competing representations which portrayed the bridge at eye-level, dramatizing the effect of its presence where Moses minimized it.[102] Architectural drawings could serve in this way, Appleyard maintained, as potent instruments in debates over the built environment, as sites where relations in the built environment were to be managed—and perhaps even manipulated. If certain systems of governance turned toward the aerial view in the period, Appleyard encouraged a return to perspective as a site of engagement, dialogue, and public

[100] Appleyard, "Understanding Professional Media," 46.

[101] Ibid.

[102] Ibid., 50, 53.

communication.[103] The perspectival image, for him, had a capacity to mediate across divergent political positions and effect a new politics of consensus.[104]

Foundational to this promise to effect such a politics was the specific coupling of the periscope with moving-image cameras to produce a media system capable of immersive, time-based simulations. The periscope afforded the possibility of immersive, perspectival views; moving images, meanwhile, afforded the possibility of time-based representation and movement. The specific use of film as a medium to record these images was championed for its high degrees of fidelity, while television and video were endorsed for their immediacy of production, ease of reproducibility and transmission, and familiarity to the general public.

As an architectural viewing device, the use of the periscope was by no means unique to Appleyard and Craik's experiments. Already by the late 1930s the periscope had found limited use in urban planning. Just before World War II, French planner Gaston Bardet began employing small, inverted periscopes, adapted from military and medical applications, to allow planners to view architectural models in person. As chief of the architecture agency charged with planning the International Exposition of 1937 in Paris, Bardet offered the handheld devices to planners and other officials to convey an immersive visual experience of the planned spaces and to facilitate design development. The French architect and urbanist Robert Auzelle, for a time chief urban planner for

---

[103] Haffner argues that the turn to aerial photography as a research technique in the social sciences and in urban planning in the postwar French context contributed to the emergence of a concept of "social space" which at once imbricated 'bottom-up' approaches. She briefly touches on the relationship of street-level photography and immersive model photography to aerial photography in this historical context. Jeanne Haffner, *The View from Above: The Science of Social Space* (Cambridge, MA: MIT Press, 2013); Jeanne Haffner, "Historicizing the View from Below: Aerial Photography and the Emergence of a Social Conception of Space," *The Proceedings of Spaces of History / Histories of Space: Emerging Approaches to the Study of the Built Environment A Conference at the University of California, Berkeley, April 30 & May 1, 2010*, September 15, 2010; See also Anthony Vidler, "Photourbanism: Planning the City from Above and from Below," in *A Companion to the City*, ed. Gary Bridge and Sophie Watson (Malden, MA: Blackwell Publishing, 2000).

[104] For more on the idea of consensus in Appleyard's work, see M. Ijlal Muzaffar, "Fuzzy Images: The Problem of Third World Development and the New Ethics of Open-Ended Planning at the MIT-Harvard Joint Center for Urban Studies," in *A Second Modernism: MIT, Architecture, and the "Techno-Social" Moment*, ed. Arindam Dutta (Cambridge, MA: MIT Press, 2013).

the French Ministère de la Reconstruction et de l'Urbanisme, knew of Bardet's work with the periscope, but described the resulting views as "gross and cumbersome."[105] Auzelle was particularly dissatisfied that the narrow instruments didn't allow enough light to permit photographic recording, thus hindering replicability and any wider communication of the projected views. In 1949 he teamed with two engineers at the Institut d'Optique in Paris, Huguette and Jacques Vulmière, who had contributed to the development of an innovative medical endoscope outfitted with a reflective quartz tube which transmitted enough light to make possible the first televised bronchoscopy in 1956 (fig. 2.8).[106] The team traded Bardet's inverted periscopes for the cystoscope—a specialized endoscopic tool for viewing the urinary bladder via the urethra—and adapted it to Auzelle's architectural needs. Rechristened the "maquettoscope," the architectural viewing device was affixed to a camera and allowed for successful photographic recording by the mid-1950s (figs. 2.9 and 2.10).[107] Auzelle argued that the resulting photographic views would facilitate a form of *kinetic* observation ("*une observation cinétique*") in contradistinction to the static forms engendered by other representational strategies. The study of sun exposure, for one, was thought to be a dimension of experience that could be particularly well served by such dynamic representation. The maquettoscope's free movement along the horizontal however required the models to be either open from above or below, and confined spaces within models were particularly difficult to capture. The technology was for this reason considered largely better suited to engaging building exteriors rather than interiors, and it was therefore particularly germane to the study of large-scale urban projects, many of which were explicitly tied to postwar reconstruction efforts. The intended primary

---

105 Robert Auzelle, *323 Citations Sur l'Urbanisme Par Robert Auzelle Avec La Collaboration de Jean Gohler et Pierre Vetter* (Paris: Vincent, Freal, 1964), 690; Haffner, *The View from Above: The Science of Social Space*, 88–90.

106 Fourestier Max, Gladu Amedee Joseph, and Vulmiere Jacques Claude, Endoscope, US2699770 A, filed May 9, 1952, and issued January 18, 1955; George Berci and J. Davids, "Endoscopy and Television," *British Medical Journal* 1, no. 5292 (June 9, 1962): 1610–13.

107 Auzelle, *323 Citations Sur l'Urbanisme Par Robert Auzelle Avec La Collaboration de Jean Gohler et Pierre Vetter*, 690–93.

users for both Bardet's and Auzelle's tools were architects, planners, and government officials who were thought to benefit from better techniques for study as part of an expanded design toolkit—only later was a participatory, and often explicitly democratic, ethos afforded to the instrument, where future users, rather than designers, would be made able to view projected spaces often by way of its coupling with other media. The technology wasn't widely used in the period: in a 1958 article detailing the use of models in architectural practice and the recent emergence of the "professionalized mechanized modelmaker," critic Jane Jacobs culminated her survey with a discussion of "a sort of reverse periscope" that offers "the illusion of looking at an actual full-size project." These "old devices," she contends, are "suprisingly [*sic*] little known."[108]

By the middle of the following decade, the audience for the medical-cum-architectural viewing device had grown large enough that the general-audience magazine *Popular Science* devoted a half-page write-up to a maquettoscope strikingly similar to Auzelle's under the headline "Lilliputian's-Eye Viewer Puts You Inside Tiny Model" (figs. 2.11 and 2.12). Marketed by Optec Reactors of London, the commercial "modelscope" was outfitted with eighteen lenses and allowed for both handheld viewing and photographic recording with a camera and adapter. The device promised realistic views for models at 1:200 scale—the viewing aperture sat at a fixed 0.3 inches from the model surface which would correspond to eye level only at that scale.[109] By 1971, Optec's modelscope cost approximately $300—a fraction of the total cost for the production of a typical model in the period.[110]

---

[108] Jane Jacobs, "The Miniature Boom," *Architectural Forum* 108 (May 1958): 109, 196.

[109] "Lilliputian's-Eye Viewer Puts You Inside Tiny Model," *Popular Science* 185, no. 2 (August 1964): 85.

[110] Writing in 1958, Jacobs cites the cost of a "meticulous" model as ranging from about $2,000 to $30,000. Jacobs, "The Miniature Boom," 107; Ronald Holmes, "A Study of Vertical and Horizontal Scales for Highway Design Models" (unpublished Master's thesis, Kansas State University, 1972).

Some years after Auzelle's efforts but largely in keeping with his ambitions, at the University of Glasgow J.M. Anderson undertook a series of investigations into the applicability of the commercial modelscope by late 1970.[111] Again invoking *Gulliver's Travels*, Anderson argued that using the handheld modelscope "paradoxically… gives one a sharp, intrusive awareness of his own bulk in relation to the model"—a feeling he called "the Gulliver gap." The device, he suggested, merely reinforced the model's fictive quality and produced alienation rather than the intended immersion. Seeking to overcome this problematic, colleagues at the university first began to develop a flexible "space simulator" that would allow students to test their designs at full scale, but this was quickly scrapped as too resource-intensive. They turned instead to television: the modelscope could be adapted to a closed-circuit television camera, Anderson suggested, such that it would overcome the alienation of the handheld device alone. It is unclear if Anderson was aware of Auzelle's efforts, but for Anderson, it was television in particular that held an especial efficacy. Television, for Anderson, had three distinct advantages: it offered "instant feedback," it was "flexible" and "moveable," and it "[took] advantage of a 'popular' technology." The last point was particularly germane to the problem of bodily detachment. Calling television "a universally accepted 'viewing' technique with a well known [*sic*] framework of conventions by which, among other things, one can isolate, magnify, or reduce images without losing the viewer's personal involvement," Anderson suggested that conventions of televised presentation would successfully yield immersion.[112]

With cooperation from the University of Glasgow television service, Anderson and his colleague T.E. Odling at the Glasgow School of Art commenced a battery of tests pairing the modelscope with closed-circuit television, seeking to experimentally demonstrate the validity of the

---

[111] For more on the work of J.M. Anderson, see Tom Porter, *The Architect's Eye: Visualization and Depiction of Space in Architecture* (London: E & FN Spon, 1997), 111; Samuel Dodd, *Televising Architecture: Media, Public Engagement, and Design in America* (Unpublished Dissertation, University of Texas at Austin, 2014), 67–92.

[112] Anderson, "A Television Aid to Design Presentation," 20.

device in ways in which Auzelle had not been demonstrably interested. Anderson and Odling's studies centered a specific ambition: "Did the system… unduly influence the viewers' information gathering?," they asked, setting out to measure similarities between simulated and in-person views. "The veracity of the camera is often—and rightly—suspect."[113] The results of these tests affirmed a strong correspondence between their sample's responses to actual spaces in Charles Rennie Mackintosh's School of Art building and responses to the same spaces as modeled on television (fig. 2.13). Anderson and Odling in turn screened these simulations to unwitting audiences at a working group on teaching methods at the Institute of Advanced Architectural Studies at York. The audience, in Anderson's words, "universally accepted" the simulated views "as a television film of real spaces." With the 'real' as control, the pair concluded that "apparently, the system bridges the Gulliver Gap for most people."[114]

Charged with developing national standards and technical specifications for housing design, the Housing Development Directorate of the UK's Department of the Environment saw promise in Anderson and Odling's ambition. The simulation strategy, the agency hoped, could allow for the aesthetic evaluation of spaces in advance of their realization, and they tested the application of the modelscope system in the design development of a housing project on Granby Street in East London. Among other factors, the Directorate had been particularly interested in issues of massing, scale, elevation, and landscaping—the factors that most directly correlated to tenant satisfaction, their in-house sociological research had shown. Anderson and Odling produced moving images from an already-built physical model of the proposed housing project in both color film and black-and-white videotape. Screened at another conference at the Institute of Advanced Architectural Studies at York, the films were divisive: some in the audience held that color afforded a greater sense

[113] Ibid., 22.

[114] Ibid., 23.

of realism, where others maintained that the lower definition of the black-and-white televised images "help[ed] to remove the unnatural crispness of architectural models" and "[made] presentation less of an occasion."[115] Though Anderson insists that the collaboration demonstrated "fairly conclusively" the promise of television in the design process, he admits that "as an aid to the actual [Department of the Environment] design process the project was less successful." Design decisions, he explains, had to be made more quickly than could be mocked-up and tested in the television or film evaluations.[116] Time lag challenged the system's applicability, if not its very *raison d'être*.

Regardless of these purportedly practical failings, Anderson was resolute in his scientific-aesthetic ambitions for the apparatus:

> The systematic, scientific investigation of the effect of the visual environment on human beings has always been hampered by the difficulty of manipulating more than a few isolated variables in very simple laboratory situations. What might be discovered if a large selection of highly controllable visual 'environments' could be presented to large numbers of individuals in controlled and variable circumstances? Could we ever come to understand the constituents of 'good' environment—and if so perhaps elevate architectural aesthetics to the point of being once again a worthwhile pursuit for intelligent people?[117]

In much the same way as Appleyard, Craik, and others detailed throughout this dissertation would, Anderson understood his work as compensating for a loss: he sought to recuperate a shared foundation for aesthetic judgment in a historical moment that seemingly had disallowed such possibility. If only mass communication could be paired with the dictates of scientific experimentality, these researchers maintained, aesthetics could be recuperated as a science and architecture, therefore, as a social good.

The researchers at Berkeley's Simulation Laboratory were well acquainted with Anderson's work, along with an array of analogous efforts to pair what had been variously deemed an

---

[115] J.M. Anderson, "Simulating Architecture," *Architects' Journal* 156 (December 6, 1972): 1328.

[116] Ibid., 1329.

[117] Ibid.

endoscope, periscope, maquettoscope, modelscope, urbanoscope, or relatoscope with some form of film, television, or still camera in an effort to expand the architect's toolkit.[118] A brief accounting of the uses of such devices in the period might suggest an emerging crop of modelscope- and moving image-based simulators of which Berkeley's Lab was in some sense unexceptional: possibly as early as the late 1950s just after Auzelle began developing his maquettoscope, German architect Martin Schulz van Treeck began developing what he called a "relatoscope" which he'd put to use for large-scale projects by the 1970s[119]; from the mid-1960s Hendrik van Leeuwen at the Landbouwhogeschool in Wageningen, Netherlands developed a similar apparatus centered on an *entheskoop*[120]; in the early 1970s Carl-Axel Acking, Rikard Küller, and other colleagues in the Department of Theoretical and Applied Aesthetics at the Lund Institute in Sweden developed a comparable simulator which included an eye-tracking device and a "semantic lever" allowing mechanized recording of subjective feedback in numerical form (figs. 2.14 and 2.15)[121]; and by the mid-to late 1970s the Finnish architect Antero Markelin developed a related device at the University

118 Bosselmann and Craik, *Perceptual Simulations of Environments*.

119 Schulz van Treeck's 1957 article is often cited as evidence of his precedence in this effort. Its earliest citation appears in Rolfe Janke's 1962 *Architekturmodelle*, but the article is in fact not currently locatable, as pointed out in Sarine Waltenspül's essay. Martin Schulz van Treeck, "Reale Modellphotographie Als Neue Darstellungsmethode in Der Architekturplanung," *Bauen + Wohnen*, 1957; Rolf Janke, *Architekturmodelle* (Stuttgart: Hatje Cantz, 1962); Martin Schulz van Treeck, "Möglichkeiten Der Darstellung Und Abklärung Architektonischer Projekte," *Detail*, no. 4 (August 1974): 636, 642; François Loyer, "Pour Bien Lire Une Maquette d'Architecture: Le Relatoscope," *Communication & Langages* 23, no. 1 (1974): 56–75; Sarine Waltenspül, "'Qu'importe Qui Regarde?' Zu Der Rolle Und Den Konsequenzen Des 'Point-of-View' in Architektonischen Modellsimulationen Zwischen 1939 Und 1990," in *Artefakte Des Entwerfens: Skizzieren, Zeichnen, Skripten, Modellieren: 2., Aktualisierte Auflage*, ed. Lyngsø Christensen Rikke et al. (Berlin: Universitätsverlag der TU Berlin, 2022), 283.

120 Hendrik van Leeuwen and Wim van Ingen, "Ontwikkeling En Gebruik van de Entheskoop" (Wageningen, Netherlands: Afdeling Wonen, Landbouwhogeschool, 1965); Hendrik van Leeuwen and Wim van Ingen, "Ontwikkeling En Gebruik van de Entheskoop" (Wageningen, Netherlands: Vakgroep Wonen, Landbouwhogeschool, 1968); M. J. A. Bouwman, "De Waarde Van Het Gebruik Van De Entheskoop in Relatie Tot Andere Presentatie-Technieken Voor De Gebouwde Omgeving" (Ph.D., Wageningen, Netherlands, Landbouwhogeschool, 1979).

121 For more on the simulation work at the Lund Institute, see Carl-Axel Acking and Rikard Küller, "Presentation and Judgment of Planned Environment and the Hypothesis of Arousal," in *Environmental Design Research, Fourth International EDRA Conference*, ed. Wolfgang F.E. Preiser, vol. 1 (Stroudsburg, PA: Dowden, Hutchinson & Ross, 1973), 72–83; Carl-Axel Acking, Christer Ohlsson, and Ulf Sjögren, *Environmental Simulating Methods and Public Communication* (Stockholm: Statens rad för byggnadsforskning, 1976); Jan Janssens and Rikard Küller, "Utilizing an Environmental Simulation Laboratory in Sweden," in *Foundations for Visual Project Analysis*, ed. Richard C. Smardon, James F. Palmer, and John P. Felleman (New York: John Wiley & Sons, 1986); Cited in Bosselmann, *Dynamic Simulation of Urban Environments*.

of Stuttgart.[122] Similar systems were developed at Adelaide University, the Bouwcentrum in Rotterdam, the New School for Social Research in New York, Rice University, the Technion in Haifa, Tokyo University, the University of Buenos Aires, the University of Nebraska, and elsewhere.[123]

Aware of many of these earlier and contemporaneous efforts, Appleyard and Craik began developing their Simulation Lab in earnest around 1969. A key challenge they foresaw was not simply the matter of enabling film or video cameras to move through physical models at simulated eye-level, which others had been able to achieve, but rather how to do so with reliable and replicable precision. Such precision was considered requisite in order to allow scenes to be compared in an otherwise controlled fashion, understood as critical for the design of controlled psychological studies and for alternatives analyses in environmental disputes alike. By the mid-1970s Berkeley's Simulation Lab would represent what Rikard Küller at the Lund Institute called the "largest and most advanced" of this emerging class of simulators in the period.[124]

The architect Donald Appleyard had first met the psychologist Kenneth Craik a few years earlier in 1965 in the context of a yearlong professional seminar at the Massachusetts Institute of Technology titled "Psychology and the Form of the Environment" organized by Stephen Carr, an architect who later partnered with Kevin Lynch to form Carr/Lynch Associates. Then a member of the faculty in the department of City and Regional Planning at MIT, Appleyard had received his graduate degree in planning some years earlier in 1958 under Kevin Lynch with his thesis, *Toward an Imageable Structure for Residential Areas*, which took issue with what he considered to be the failures of

---

122 Antero Markelin, "Erfahrungen Bei Der Anwendung Sensorischer Simulation Im Städtebau," *Bauwelt* 25 (July 1977): 872–78; Antero Markelin and Bernd Fahle, *Umweltsimulation: sensorische Simulation im Städtebau* (Stuttgart: Krämer, 1979).

123 Acking, Ohlsson, and Sjögren, *Environmental Simulating Methods and Public Communication*; Bouwman, "De Waarde Van Het Gebruik Van De Entheskoop in Relatie Tot Andere Presentatie-Technieken Voor De Gebouwde Omgeving."

124 Janssens and Küller, "Utilizing an Environmental Simulation Laboratory in Sweden," 266.

the built environment. "The real failure," he wrote in the introduction to the report, "is still to be faced, and it is a psychological one." The thesis took up three case studies—Levittown, New York; Radburn, New Jersey; and Boston's Back Bay—each of which Appleyard "evaluated subjectively" following Lynch's notion of imageability. Describing how "the perceiver moves" or "one sees," Appleyard made no recourse to the surveys, user observation studies, or other methods to account for individual difference that he would employ in his later studies. Instead, his "perceptual method of analysis" centered his experience as privileged analyst. To illustrate his analyses, Appleyard developed techniques to represent viewers' (read: his) movement and time's passage in two dimensions. Across dozens of spreads, the planner deployed black-and-white photographs, arrayed at various angles and connected by a symbolic language of circles and lines in marker, to represent views along paths of movement, anticipating what he and his collaborators would later term "dynamic simulation" (fig. 2.16).[125]

If Appleyard brought to the seminar this longer standing interest in understanding how people perceived space, Kenneth Craik's interest in environmental perception was of a slightly more recent vintage. A personality psychologist by training and professor of psychology at UC Berkeley, Craik had for a time worked as a research apprentice at Berkeley's Institute of Personality Assessment and Research while still pursuing his Ph.D. The Institute was then in the midst of an intensive study led by Wallace Hall and Donald MacKinnon attempting to identify the personality characteristics that distinguished "creative" architects from those considered less inventive.[126] At the completion of the study, MacKinnon persuaded Craik to conduct a series of follow-up, in-depth

---

[125] Donald Appleyard, "Toward an Imageable Structure for Residential Areas" (Master's Thesis, Massachusetts Institute of Technology, 1958), BANC MSS 83/165 c, Carton 11, Folder 11, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

[126] See Pierluigi Serraino, *The Creative Architect: Inside the Great Midcentury Personality Study* (New York: The Monacelli Press, 2016).

field studies investigating one of the participating architects, Charles Warren Callister, principal of prominent bay-area firm, Callister, Payne & Rosse.[127] Craik's "sociopsychological study" noted that the firm was then in the midst of transitioning from smaller-scale commissions to increasingly larger scaled projects, including the planning of a retirement village for several thousand projected residents, which had resulted in a commensurate loss of designers' ability to interface directly with future residents. As a result of the increased "social distance" from buildings' future inhabitants, Craik observed that some designers had taken to regularly inquiring with him as to the psychological principles of perception, while others turned to "psychological assumptions"—often "empirically naive"—concerning the environment's effect on behavior and visual perception.[128]

These observations raised for Craik two related, yet distinct lines of questioning which bore directly on his training in personality psychology: how do different types of people perceive environments differently, on one hand, and how might different environments condition perception differently, on the other. Craik had been exposed to the early development of the field that would come to be known for some as environmental psychology, having been aware of the work of some of its earliest champions at Berkeley during the time of his studies.[129] But Craik's experience at Callister, Payne & Rosse convinced him that his background in personality psychology might uniquely prime him to make important contributions to the emerging subdiscipline: the psychologist surmised that the conceptual framework he'd developed for the study of personality which

---

[127] Kenneth Craik, "A Sociopsychological Study of an Architectural Firm," Unpublished Report (Berkeley, CA: Institute of Personality Assessment and Research, University of California, 1968).

[128] Kenneth Craik, "Environmental and Personality Psychology: Two Collective Narratives and Four Individual Story Lines," in *Environment and Behavior Studies: Emergence of Intellectual Traditions*, ed. Irwin Altman and Kathleen Christensen (Springer Science & Business Media, 2012), 144–45; Craik, "Environmental Psychology," 20.

[129] To be sure, there was little agreement on the denomination "environmental psychology," which was taken to mean very different things by different actors in the period. At Berkeley, however, this was the agreed-upon term, which, as Craik points out, had the advantage of corresponding with the relatively recently reorganized and rechristened College of Environmental Design. For more, see dissertation introduction and Craik, "Environmental and Personality Psychology: Two Collective Narratives and Four Individual Story Lines," 145.

aggressively foregrounded the relationship between the observer (that is, the personality psychologist) and the observed (the test subject) could be applied to the study of impressions of the environment, too. Craik had argued that the personality of a subject could not be understood without taking into account the personality characteristics of the observer, and he drew important distinctions between what he identified as *trait attribution* and *trait designation*. A single observer may attribute a trait to a subject, he explained, which would necessarily and productively raise questions to do with both the traits of the subject and those of the observer which led to such attribution; if enough observers however independently made a similar attribution, this would amount to a trait designation denoting objective properties of the subject assessed. Craik also encouraged personality psychologists studying under him to consider the methods by which "the assessed person was presented to the observers"—that is, in person, in writing, filmically, or otherwise; the methods by which observers' impressions were to be recorded; and the criteria used to appraise the validity of these observations.[130] Craik argued that these methodological frameworks developed for the assessment of personality could be adapted to the study of the environment, affording the possibility not only of understanding environmental quality in its objective dimensions (trait designation), but also identifying the individual personality dispositions that might prime different people to make different types of judgment with regard to the environment (trait attribution).

Not long after the seminar at MIT culminated in 1966, Donald Appleyard received a joint appointment to the Department of City and Regional Planning and the Department of Landscape Architecture at UC Berkeley, where he and Craik could resume their dialogue and develop a collaboration which would last more than a decade in order to realize their shared, though, importantly divergent research interests. In Craik, Appleyard found a powerful, cross-disciplinary

[130] Craik, 147–48.

ally. Like Appleyard, Craik had become convinced of the need for new forms of architectural representation, but with a slightly different valence. If Appleyard's ultimate commitment was to public communication, Craik's commitments were of the "basic" knowledge-making sort. In a 1968 article for *The Journal of the American Institute of Planners*, Craik wrote that defining and establishing differences between the media of architectural representation amounted to a "practical priority" in environmental psychology research. "Standardized and technically sound" modes of gauging response must be tested in simulation and in the real "before stable and reliable generalizations" could be established.[131] The development of "a mature branch of research" rested on this sort of "methodological and empirical groundwork," Craik maintained, and it was only through this groundwork that environmental psychology might begin "to place the process of design and planning more directly under rational guidance" to gain its "predictive power."[132]

At once projective and predictive, Appleyard and Craik's apparatus would be charged with producing superlative forms of representation—"the most accurate and comprehensible simulations possible," as described in the Lab's mission statement—which, they maintained, could yield equally robust forms of public engagement.[133] Ambitions for the project nevertheless started small: Appleyard had been familiar with the use of handheld modelscopes, as they were not uncommon at MIT by the mid-1960s, and in 1967, Appleyard briefly considered purchasing the commercially available modelscope from Optec.[134] Instead, the pair purchased a larger system in 1969 that had been developed at Yale University with approximately $100,000 in funding from the Department of Transportation and the Connecticut State Department of Highways. Part of the Yale Transportation

---

131 Kenneth Craik, "The Comprehension of the Everyday Physical Environment," in *Environmental Psychology: Man and His Physical Setting* (New York: Holt, Rinehart and Winston, Inc., 1970), 653–54.

132 Craik, 656–57.

133 Bosselmann, *Dynamic Simulation of Urban Environments*, 15.

134 Correspondence from Donald Appleyard to Garrett Eckbo, October 19, 1967, BANC MSS 83/165 c, Carton 9, Folder 4, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

Project, the simulator consisted of a relatively small gantry—just ten feet wide—a static camera, and a periscope, all "housed in an air inflated tent."[135] Installed at Berkeley in what had been a ground-floor storage room, Room 119, in Wurster Hall, with the support of the extra-departmental Institute of Urban and Regional Development, the rudimentary simulator was quickly enhanced with a larger aluminum gantry whose span reached twenty-two feet.

Appleyard and Craik sought to build out the simulator's film and television capabilities. A successful application to the National Science Foundation in 1971, made under the aegis of both the Institute of Urban and Regional Planning and the Institute of Personality Assessment and Research, together with a smaller California Department of Transportation grant, brought nearly $300,000 to the project and allowed the pair to enrich their simulator with evermore representational force.[136] A series of follow-up grants brought that total to nearly $1,300,000 in federal, state, and private funding by the mid-1970s, with support from institutions ranging from the National Institute of Mental Health to the Graham Foundation and the Fulbright.[137]

The bulk of this windfall had come from the National Science Foundation, where project costs were justified in large part by way of recourse to the Lab's promise to study the relationship between personality and environmental perception. Titled "Environmental Dispositions and the Simulation of Environments," the application to the NSF's Social Science program foregrounded the Lab's role as an instrument for basic research into personality types. Their successful application to this program had only been made possible a few years earlier when, in 1968, the National Science

135 Correspondence from Donald Appleyard to Harmer Davis, undated, BANC MSS 83/165 c, Carton 8, Folder 17, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley; George McKechnie, "Simulation Techniques in Environmental Psychology," in *Perspectives on Environment and Behavior: Theory, Research, and Applications*, ed. Daniel Stokols (New York: Plenum Press, 1976), 174.

136 McKechnie, "Simulation Techniques in Environmental Psychology," 174; Appleyard and Craik, *Visual Simulation in Environmental Planning and Design*.

137 Correspondence from Gay Englezos to Donald Appleyard and Melvin Webber, 10 March 1978, BANC MSS 83/165 c, Carton 11, Folder 12, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley; National Science Foundation Research Directorate, *Summary of Awards in Energy-Related General Research*, 109.

Foundation's federal authorization bill was formally revised to allow the funding of the social sciences. Prior to the NSF's founding in 1950, Congress had been deeply divided as to whether psychology and the social sciences should qualify for federal funds. Conservative politicians and a number of prominent natural scientists publicly accused the social sciences of being inherently ideological in nature, and despite the Social Sciences Research Council's lobbying efforts, the social sciences were explicitly excluded from the first NSF authorization bill in 1950. With the aim of supporting basic research and an explicit proscription against applied research, the National Science Foundation sought to offer a counterbalance against the emphasis placed on applied research that had characterized wartime priorities in the years immediately previous. In the early years of the foundation, very limited amounts of social science funding were made possible only under the category of "other sciences."[138] The social sciences were afforded second-rate status in this way until about 1967, when Democratic Senator Fred Harris of Oklahoma proposed an independent National Social Science Foundation. His proposal was made redundant when Representative Emilio Daddario, a Connecticut Democrat, proposed an amendment to the NSF bill in the following year.[139] Signed by President Lyndon B. Johnson in 1968, Public Law 90-407 amended the NSF authorization act to explicitly authorize support of the social sciences. Funding in this area increased exponentially as a result, and it was just three years later that the Environmental Simulation Lab received the NSF grant that marked its birth.[140] The federal battle over the status of the social sciences remained unsettled well into the next decade, with Democratic Senator William Proxmire of

---

138 Mark Solovey and Jefferson Pooley, "The Price of Success: Sociologist Harry Alpert, the NSF's First Social Science Policy Architect," *Annals of Science*, 2010, 12–13; George T. Mazuzan, *The National Science Foundation: A Brief History* (Washington, D.C.: National Science Foundation, 1988), 3.

139 Mark Solovey, "Senator Fred Harris's National Social Science Foundation Proposal: Reconsidering Federal Science Policy, Natural Science–Social Science Relations, and American Liberalism during the 1960s," *Isis* 103, no. 1 (2012): 55.

140 Library of Congress and Genevieve Johanna Knezo, *The Psychological and Social Sciences Research Support Programs of the National Science Foundation: A Background Report*, House Committee on Science and Technology, No. 95-I (Washington, D.C.: U.S. Government Printing Office, 1977), 36.

Wisconsin becoming its loudest challenger by the mid-1970s, highlighting in the press examples of what he saw as wasteful government spending.[141] These broad-based challenges figured directly into what had been identified in the period as a distinct strain of intertwined anti-intellectualism, anti-elitism, and a suspicion of the humanities which had long characterized political and cultural discourse in the United States.[142] After 1975, NSF funding for the Environmental Simulation Laboratory at Berkeley had dried up, and already by 1976, NSF funding for psychological and social research consistently declined year-over-year as a percentage of total NSF funding.[143]

With these resources in hand, Appleyard and Craik adapted the small, static periscope they'd purchased from Yale and set out to augment it with new techniques in film and television that would allow the cameras to move through models with a high degree of reliable precision.[144] Appleyard and Craik located the necessary expertise a few hundred miles south in Hollywood. The pair first recruited the Los Angeles-based cinematographer Paul Kenworthy to the effort. During WWII, Kenworthy had been enlisted by the U.S. Armed Forces to develop a periscopic camera system to simulate tank warfare.[145] After the war, Kenworthy adapted his periscope-based system to commercial use, rebranding it the "snorkel camera." Likened to a "miniature helicopter or butterfly," Kenworthy's commercial apparatus featured a thin, inverted periscope which could attach to existing camera bodies, allowing the lens to enter and exit shooting areas without the bulk of the camera

---

141 Constance Holden, "Social Science at NSF Needs Pruning, Says Proxmire," *Science* 185, no. 4151 (August 16, 1974): 597.

142 For more on these histories, see C. Wright Mills, *The Power Elite* (New York: Oxford University Press, 1956); Richard Hofstadter, *Anti-Intellectualism in American Life* (New York: Vintage Books, 1963); William John Bennett, *To Reclaim a Legacy: A Report on the Humanities in Higher Education* (Washington, D.C.: National Endowment for the Humanities, 1984).

143 Library of Congress and Knezo, *The Psychological and Social Sciences Research Support Programs of the National Science Foundation: A Background Report*, 3.

144 McKechnie, "Simulation Techniques in Environmental Psychology," 174.

145 Blakeslee, "Envisioning the Truth without the Consequences."

following behind.[146] Operated by remote control, the periscope's ability to twist and turn and to produce sweeping close-ups within tight spaces effected what Kenworthy described as a "special intimacy… subtly engender[ing] a liquidy, caressing sensual camera movement."[147] Kenworthy initially found some interest for his work among architects. Prominent Philadelphia-based architect Vincent Kling first approached the cinematographer sometime in the 1960s to develop a moving camera which could effectively place viewers within architectural models.[148] Kling understood the power of films: "They really do communicate," he averred in an article for the *AIA Journal*. Citing Marshall McLuhan, Kling argued that films not only fostered client and user involvement in order "to sell a project," but that their advantage lay in their replicability and transmissibility, which afforded a degree of "ubiquitousness" over the direct display of a model. "And then," he asserted, "there is control: Once made, a film doesn't change; it can't give halting or wrong answers to questions." Properly packaged in the context of public relations footage or recontextualized to address "a current social problem," such films could be broadcast to general television audiences, Kling argued, citing the AIA's recently developed technique for producing "highly acclaimed TV film spots."[149] Though Kenworthy thought his apparatus to be particularly germane to the development of large-scale urban renewal projects—it was used in this way for I.M. Pei's plan for Oklahoma City and for a promotional video for the Horton Square development in San Diego—it soon became apparent that greater demand for the technology was to be found outside the discipline.[150] By 1967, Kenworthy argued that the camera system afforded marketers in particular

146 N. Paul Kenworthy, "The Kenworthy Snorkel Camera System Today," *American Cinematographer* 54, no. 8 (August 1973): 1002.

147 Ibid., 1051.

148 N. Paul Kenworthy, "The Techniques of Filming with the Snorkel Camera," *American Cinematographer*, September 1967, 634.

149 Vincent Kling, "The Architect as Film Maker," *AIA Journal*, February 1971, 23, 24, 25.

150 Kenworthy, "The Techniques of Filming with the Snorkel Camera," 635–36; Paul Kenworthy, "The Development Of Kenworthy's Snorkel Camera System," *Back Stage*, May 6, 1988, 18.

with "new and exciting visual opportunities to reveal and explore their client's products as they never could in the past."[151] The technique found primary use in television commercial production and was employed for key sequences in *Mission Impossible*, *Land of the Giants*, *The Green Mile*, and *Gone in 60 Seconds*. The cinematographer went on to win an Oscar in 1978 for his camera system.[152]

After Kenworthy's expertise with the snorkel lens was recruited toward the Simulation Lab's immersive ends early in the 1970s, special-effects artist John Dykstra was brought on to the team in 1971.[153] Dykstra—whom Kenneth Craik endearingly refers to in an essay as "our filmmaker"—had developed a technique for Stanley Kubrick's *2001: A Space Odyssey* using small-scale models to simulate immersive, fictive scenes.[154] Dykstra's technical innovation involved stitching together still frames from these scaled views to produce continuous, special-effects sequences. Having just completed work on Robert Wise's 1971 *Andromeda Strain*, the special-effects artist brought his expertise to the Berkeley project, where he perfected a stop-frame technique in which stills were stitched together and smoothed via a PDP-11 computer to produce continuous moving footage. Dykstra notes that the camera system he later developed as head of George Lucas's Industrial Light and Magic, the Dykstraflex, had its start in his work for the Lab. First deployed for the dogfight sequences in *Star Wars*, Dykstraflex enabled the camera to move along pre-programmed sequences in seven axes of motion, allowing shots to be repeated and composited.[155] Dykstra later won an Oscar for his work on *Star Wars*—the same year that Kenworthy received his.

---

151 Kenworthy, "The Techniques of Filming with the Snorkel Camera," 635–37.

152 "Academy Tech Awards Announced by Koch," *BoxOffice*, February 27, 1978, 9.

153 Bosselmann, "The Berkeley Environmental Simulation Laboratory: A 12 Year Anniversary," 152; Appleyard and Craik, *Visual Simulation in Environmental Planning and Design*, 4–5.

154 Irwin Altman and Kathleen Christensen, *Environment and Behavior Studies: Emergence of Intellectual Traditions* (Springer Science & Business Media, 2012), 149.

155 Richard Trenholm, "'Star Wars' Pioneer John Dykstra on How Those Visual Effects Came to Be," CNET, May 4, 2017, https://www.cnet.com/news/john-dykstra-star-wars-anniversary-industrial-light-and-magic-special-effects/.

Citing as precedents these novel techniques, as well as the medical endoscopes and flying and driving simulators before them, Appleyard and Craik's system allowed for immersive camera movement to be manually directed within models and, at once, programmed for subsequent replication by way of computer-directed camera movement.[156] The pair acknowledged their at least partial indebtedness to techniques developed for fictive story-telling, in some (perhaps reductive) sense at odds with the dictates of scientific experimentality which informed their ambitions for the instrument. Acknowledging the fact that many of these key techniques had been developed for evoking "vivid and exciting experiences of imaginary worlds and extraordinary events" with "the goal of generating entertaining thrills and adventures," the pair rather celebrated the simulator's potential entertainment value for what they saw as a promised political efficacy.[157] Describing "the politics of simulation," the project team argued that the Lab represented "a tool for realizing a more democratic urban form" by virtue of its ability to connect with audiences not typically engaged in discussions over the built environment.[158] Elsewhere, Appleyard admitted, "simulations should be *engaging*: they should not bore an audience."[159] A later laboratory report expanded on the idea: "Besides, it is a lot of fun. People… light up when they see movies of model worlds. It relieves some of the grimness and seriousness with which many planners and designers treat their work."[160] The stakes here were disciplinary as much as they were sociopolitical: the simulator's immersive simulations were understood to amount to a repudiation of the axonometric, contemporaneously in vogue among a more 'avant-garde' set of practitioners. Appleyard made this point explicit: "the whole east coast intellectual jaunt into abstract drawing is an ivory tower retreat," he lamented in a

---

156 Appleyard and Craik, *Visual Simulation in Environmental Planning and Design*, 4–5.

157 Ibid., 2.

158 Bosselmann and Craik, *Perceptual Simulations of Environments*, 14.

159 Appleyard, "Understanding Professional Media," 57. Emphasis his.

160 Bosselmann, "The Berkeley Environmental Simulation Laboratory: A 12 Year Anniversary," 152.

letter to Dean of the College of Environmental Design Richard Bender.[161] A later laboratory report argues that by comparison "the familiar media of film and television" afford "a more experiential mode" allowing members of the public "to participate more confidently."[162]

By the period in question, the perceived promises—and pitfalls—of moving images and their effect on society and culture had proven broadly shared concerns which attracted a great deal of wide-ranging approbation, theorization, and criticism, which were necessarily brought to bear on discourses in architecture.[163] A body of theory and practice supported Appleyard's position, perhaps most notably the work of Marshall McLuhan which was oft-cited in much of the literature around television-based environmental simulation in particular, affirming the medium's capacity to compel participation and viewer involvement.[164] Television had been afforded a particular pedagogical role in the period, blurring entertainment and education: in the mid-1970s, the National Science Foundation debuted a series of educational television programs as a centerpiece to its Public Understanding of Science program. NSF administrators understood television to be a uniquely efficacious means of public education: an investment of $200,000 could return "an audience of about one million," a program director maintained.[165] Television was also charged in the period with a newly robust democratic ethos and conscripted into planning debates and decision-making—in many ways in keeping with the ambitions of the contemporaneous participatory project in architecture. In the years prior to the use of moving images in the case of Cross Lake, public-access television was deployed by the New York Regional Planning Association to query viewers, polled by

---

[161] Correspondence from Donald Appleyard to Richard Bender, ca. 1979–1980, BANC MSS 83/165 c, Carton 2, Folder 13, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

[162] Bosselmann, *Filmscripts*, 6.

[163] For more on the history of moving images as a cultural concern, see Lynn Spigel, *Make Room for TV: Television and the Family Ideal in Postwar America* (Chicago: University of Chicago Press, 1992).

[164] Marshall McLuhan, *Understanding Media* (New York: McGraw-Hill, 1964).

[165] George Tressel, "Science on the Air: NSF's Role," *Physics Today* 43, no. 11 (January 11, 2008): 28.

mail, for land-use determinations.[166] In this way, television offered architecture—or at least, some architects—a ripe opportunity to construct new audiences at increasingly large scales; over the course of the first decade of its existence, the Environmental Simulation Laboratory would follow suit and increasingly turn away from the use of film and instead to the use of television.[167]

Such attestations to the pedagogical and democratic capacities of television ran counter, unsurprisingly, to much of mainline critical theory which emerged both before and alongside this history, along with the not insignificant segment of largely academically inclined architects who subscribed to such theorization, on one hand, and more often than not were demonstrably committed to the use of axonometric drawing, on the other. Critiques over the role of moving images in constructing certain sociocultural arrangements date back to decades earlier; by the period in question, notions of mass culture, the culture industry, spectacle, and hyperreality, to name just a few, had gained currency in broader discourse, largely the result of Marxian and later postmodern theorists ranging from Theodor Adorno and Max Horkheimer to Guy Debord, Jean Baudrillard, and Fredric Jameson.[168] Architects demonstrably influenced by such theories in the period did not hesitate to voice their objections to the work of Appleyard, Craik, and others like them.

166 Kristian Taketomo, "'Town Meetings by Television': Regional Plan Association's 'CHOICES for '76'," *The Gotham Center for New York City History*, October 4, 2018, https://www.gothamcenter.org/blog/town-meetings-by-television-regional-plan-associations-choices-for-76; Appleyard, "Understanding Professional Media," 63; For more examples, see Thomas B. Sheridan, "Citizen Feedback: New Technology for Social Choice," *MIT Technology Review* 73, no. 3 (January 1971): 47–51.

167 For an overview of the history of television as a tool in architectural practice, see Dodd, *Televising Architecture: Media, Public Engagement, and Design in America*. Though Dodd dedicates a chapter to television and spatial simulation, his discussion emphasizes television's role in the architect's design process, for the most part setting aside its engagement in political battles and psychological testing in the period. See also Samuel Dodd, "Televising Architecture: Spatial Simulations and the 'Scanning Finger,'" *Art Journal* 78, no. 1 (Spring 2019): 18–29.

168 For a small selection of this material, see Max Horkheimer and Theodor Adorno, "The Culture Industry: Enlightenment as Mass Deception" (1947), in *Dialectic of Enlightenment* (New York: Herder and Herder, 1972); Guy Debord, *Society of the Spectacle* (1967) (Detroit: Black & Red Press, 1970); Jean Baudrillard, *Simulacra and Simulation* (1981) (New York: Semiotext(e), 1983); Fredric Jameson, "Postmodernism, or The Cultural Logic of Late Capitalism," *New Left Review*, no. I/146 (August 1, 1984): 53–92.

At the Lab, then, the representation of realistic futures, requisite for public engagement and perceptual-psychological knowledge-making alike, required the expertise gained from the production of fantastical alterities and commercial desire. And in turn, the production of fantastical alterities and commercial desire required the expertise gained from the representation of realistic futures in the simulator. This would prove a controversial proposition to be borne out through a series of validation studies charged with demonstrating the Lab's methodological soundness.

III. Personality Psychology and Instrumental Validation

If the highway had been cast as an issue compounding problems of design, psychology, and society by the mid-1960s, the moving image-based simulations produced at the Environmental Simulation Laboratory represented one among a number of new techniques called upon to conciliate these imbricated concerns. The turn to novel techniques of this kind however first required demonstration of their research validity—well in advance of any application in legal contexts. To manage both the demand for the technique's validation and its application in the specific matter of the highway, Appleyard and Craik identified a double task to be addressed by way of particular recourse to personality psychology, whose methodological framework had been extended into the newly emergent field of environmental psychology by the period in question.

Personality psychology had emerged as a distinct field of inquiry some decades earlier by about the mid-1930s.[169] Charting a course between behaviorism on one hand, which had privileged observable actions thought to result largely from external stimuli, and psychoanalysis on the other,

[169] A selection of key texts typically identified as marking the emergence of this field includes Gordon W. Allport, *Personality: A Psychological Interpretation*, Personality: A Psychological Interpretation (Oxford, England: Holt, 1937); Ross Stagner, *Psychology of Personality* (New York: McGraw-Hill, 1937); Henry A. Murray, *Explorations in Personality* (Oxford: Oxford University Press, 1938); Donald W. MacKinnon, "The Structure of Personality," in *Personality and the Behavior Disorders: A Handbook Based on Experimental and Clinical Research*, ed. Joseph McVicker Hunt, vol. 1 (New York: The Ronald Press Company, 1944), 3–48; Theodor W. Adorno et al., *The Authoritarian Personality* (New York: Harper & Brothers, 1950).

with its fixation on the resolutely individual role of the unconscious, personality psychology turned to motivation as a key concept, seeking instead to identify the purportedly more fundamental forces that directed outward behavior, whether biological or, later, cognitive in origin, which in their totality were thought to uniquely comprise individuals but also were to some extent shared across subjects.[170] Seeking at once in this way to account for both the individuality and generality of subjects, personality psychologists largely privileged multidimensional approaches to personological description, identifying a multiplicity of ever dynamic variables at work in constructing personality. Kenneth Craik argued these approaches contained a distinct predictive capacity, analogizing this work to that of art criticism, botany, and zoology:

> The scientific study of personality begins with the recognition that persons are extraordinarily complex and multidimensional entities. Indeed, personality assessors delight in the diversity of persons and they are connoisseurs of individuality. In this respect, personality assessment is somewhat akin to aesthetic criticism, which asks, 'How can a work of art be appreciated and appraised?' and 'Along what dimensions can two or more works of art be compared?' Personality assessment addresses itself to the same questions but asks them about persons. At the same time, these appreciative and analytic impulses are joined to a sterner effort to attain objective descriptions and a comprehensive taxonomy of persons, thus displaying a kinship with botany and zoology. Once the means are available to measure personality dimensions objectively, research can be undertaken to monitor the interrelationships among the attributes of persons, and to gauge the utility of using personal attributes to predict significant behavioral and social outcomes.[171]

Appleyard and Craik were well aware of the cultural debates that attended the layers of artifice involved in their pursuit of visual realism, and a series of validation studies to experimentally demonstrate the validity of their laboratory instrument represented what the pair identified as their "first major undertaking."[172] Largely completed by 1974, the multiyear effort required especial

---

170 See Dan P. McAdams, "A Conceptual History of Personality Psychology," in *Handbook of Personality Psychology*, ed. R. Hogan, J. Johnson, and S. Briggs (San Diego, CA: Academic Press, 1997), 3–39; Frank Dumont, *A History of Personality Psychology: Theory, Science, and Research from Hellenism to the Twenty-First Century* (Cambridge: Cambridge University Press, 2010).

171 Kenneth H. Craik, "The Personality Research Paradigm in Environmental Psychology," in *Experiencing the Environment*, ed. Seymour Wapner, Saul B. Cohen, and Bernard Kaplan (Boston, MA: Plenum Press, 1976), 60.

172 Appleyard and Craik, *Visual Simulation in Environmental Planning and Design*, 4.

recourse to techniques derived both directly and indirectly from personality psychology in order to differentiate the effects of media and to establish the degree of fidelity between the simulated and the real. At once, the very same studies also generated a wealth of data that, in turn, afforded some of the earliest opportunities to study the relationships between environmental perception and personality dimensions, pertinent to Craik's interests in particular, in his effort to redefine personality as such in environmental terms—what Craik would identify as "an ecological conception of personality."[173]

For these validation tests, the Berkeley researchers developed a twenty-foot-by-twenty-foot polyurethane model of an eight-square mile area in nearby Marin County, California, at a scale of thirty feet to one inch. Produced from existing aerial photographs and new field photography and film recording, the highly detailed model was furnished with scale figures, cars, and trees set amid buildings and signage with photographic reproductions pasted atop for realistic effect, all of which was encircled by a hand-painted cycloramic backdrop. Marin was selected a site for study not only due to its proximity to Berkeley but, importantly, for its generalizability: directly adjacent to the 101, the inland site was considered a "better representative" of the region, with its array of land uses including suburban residential areas, sprawling shopping centers and industrial parks, office complexes, commercial developments along the highway, pasturelands, and undeveloped hills. Placing the model under the modelscope, the research team developed two immersive simulations following the same path in the model: a 16mm color film made with stop-frame cinematography, and a black-and-white videotape converted from this model film.[174] The process of building the

---

173 Kenneth H. Craik and George E. McKechnie, "Personality and the Environment," *Environment and Behavior* 9, no. 2 (1977): 164.

174 Bosselmann and Craik, *Perceptual Simulations of Environments*, 8–9; Nickolaus Reinholt Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements" (Ph.D. Dissertation, University of California, Berkeley, 1979), 27.

model and producing the simulated footage represented two years of labor.[175] The two "media of presentation," as they'd termed them, were to be compared against two others. Following the same route was a real-world, 25-minute, 9-mile driving tour through the study site "in contemporary sedans," and a 16mm color film representing the real-world auto tour produced from a camera mounted to the passenger side of a car whose windshield had been removed.[176] The four media of presentation—model film, model video, real-world drive, and film of real-world drive—were to be compared to test multiple effects: the researchers sought to understand not only how the model differed from the real, but also how film compared to videotape, the latter of which lent itself to "live, direct feedback uses" in the laboratory (fig. 2.17).[177]

Appleyard and Craik convened more than 1,100 test subjects local to the region, the majority of whom had been selected at random from public directories and then solicited for participation by mail and telephone. To ensure a broader socioeconomic and geographic distribution, the team systematically oversampled from areas characterized by lower socioeconomic status and undersampled from areas with higher degrees of affluence.[178] Participating subjects were then assigned at random to one of the four media. Testing days comprised a brief welcome and continental breakfast, followed by an in-depth series of instructions, which conditioned the subjects to expect they were taking a "Sunday drive" in Marin and that there was an upcoming public hearing for a proposed project. Subjects were asked to not smoke, to not take notes during the tour, and, for those on the real-world drive, to maintain "a minimal yet comfortable level of social conversation, rather than complete, awkward silence," but "were admonished not to talk about the area being

---

[175] Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements," 132.

[176] Appleyard and Craik, *Visual Simulation in Environmental Planning and Design*, 6.

[177] Bosselmann and Craik, *Perceptual Simulations of Environments*, 9.

[178] Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements," 28–29.

toured nor to allow the discourse to become so interesting that attention was diverted from the research site." Subjects in this latter group were made to wear opaque glasses or keep their eyes closed while driving to the tour's official starting point; subjects viewing the films sat in a projection studio in groups of 20, while those viewing the videotapes gathered in groups of eight in front of a television monitor. The sample was otherwise instructed "that they were to take a good look at it, to note what impressions it makes upon them, what catches their attention and what they like and dislike about it, and in general, to size up the place."[179] Roughly 40 minutes were allotted to the tour, whether simulated or real, before participants commenced a full day of psychometric analysis, with breaks only for coffee and lunch (fig. 2.18).

The "extensive battery of procedures" which followed the tours solicited very different types of response data from test participants, ranging from "descriptions," to "cognitions," and "evaluations."[180] These responses were structured following some twenty distinct psychometric formats, roughly sorted into two major categories: before lunch, subjects took tests which sought to account for their impressions of and judgments on the specific environment in question. Following lunch, the experiment's focus turned onto participants themselves, who were subjected to personality measures in order to discern their backgrounds, interests, attitudes, lifestyles, and dispositions toward environments in general, along with other related personological information.[181] A number of these tests before lunch employed five-point Likert scales, which, just as had been the case with the dispute over the proposed nuclear power plant in Greene County, New York, afforded the possibility of discerning intensities of feeling along a linear spectrum and allowed comparison and aggregation across subjects. As detailed in the previous chapter, the Likert scale was one among

---

[179] Bosselmann and Craik, *Perceptual Simulations of Environments*, 10; Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements," 31.

[180] Bosselmann and Craik, *Perceptual Simulations of Environments*, 10.

[181] Bosselmann and Craik, 10.

a number of methods developed in personality psychology by the 1930s which had been importantly brought to bear on environmental-perceptual questions by the 1970s, with the goal of rendering subjective data quantifiable and comparable. In the case of the Berkeley validation studies, Likert scales were employed for an Environmental Evaluation Form, which asked participants to rate their satisfaction with the tour area for 26 attributes including "nearness to freeway," "good climate," and "safety from attacks."[182] Elsewhere the sample was queried for general preferences, having been prompted: "On a completely personal basis, how much did you like the region as a whole?" This item was similarly to be answered on a five-point scale ranging from "liked very much" to "disliked very much." Participants likewise were tasked with comparing their overall satisfaction with the area in question to other suburban areas in the state using the scale.[183]

The vast majority of other tests deployed in the validation studies however were of a more recent vintage, locating their origins in personality psychology in the decades following the Likert scale's 1932 debut. If the Likert scale had promised the ability to measure intensities of feeling, by at least the mid-1950s, if not earlier, its linearity had come to be increasingly understood as a basic limit to its utility. Personality psychologists desired alternate systems that would allow for more complex arrays of variability and which were less prescriptive in their terms. Through the mid-1960s, personality psychologists pursued the novel development of numerous psychometric techniques, turning in particular to the development of new inventories and scales which increasingly dominated research output.[184] Some of the most notable of these which would be brought to bear in the case of Simulation Lab's validation studies were the Adjective Check List which debuted in 1952 and the q-

---

182 Appleyard and Craik, *Visual Simulation in Environmental Planning and Design*, 7.

183 Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements," 36–37.

184 Craik, "Environmental and Personality Psychology: Two Collective Narratives and Four Individual Story Lines," 153; For overviews of these various types of test, see Craik, "The Comprehension of the Everyday Physical Environment."

sort methodology in 1953. Like the Likert scale, these structured response formats developed for the study of personality sought a standardization of language which could solicit the type of data that could be aggregated and compared across subjects and across experimental conditions in some way—in contradistinction to open-ended tests such as the Rorscharch.[185] These types of test would be adapted en masse to research in environmental psychology throughout the 1970s, where observed subjects were swapped out for observed landscapes; in the case of Berkeley Simulation Lab, the development of these "standard devices" was considered a prerequisite to the effective comparison of subjects' impressions based on the different media of presentation.[186]

Among the novel devices for environmental description deployed in the validation studies whose origins lay in personality psychology were two tests that Kenneth Craik had himself developed and championed: the Environmental Adjective Checklist and the Landscape Adjective Checklist. Craik had adapted these checklists from prominent personality psychologist Harrison Gough's Adjective Check List, first issued in 1952, which remains a key method deployed in personality research. Gough, a senior colleague of Craik's at the Institute of Personality Assessment and Research, sought to compile a structured list of terms capable of describing all aspects of personality, employing what he called "the language of everyday life" to constitute "a library of descriptive terms, covering the widest possible range of behavior, self-conceptions, and personal values."[187] Presented with a list of some 300 adjectives including "intelligent," "idealistic," "individualistic," "reflective," "resourceful," "sexy," and "unconventional," subjects could offer self-reported personality profiles by simply marking the adjectives they believed to accurately describe

---

[185] On the early use of structured tests in personality research, see Paul E. Meehl, "The Dynamics of 'Structured' Personality Tests," *Journal of Clinical Psychology* 1, no. 4 (1945): 296–303.

[186] Bosselmann and Craik, *Perceptual Simulations of Environments*, 4.

[187] Harrison G. Gough, "The Adjective Check List as a Personality Assessment Research Technique," *Psychological Reports* 6 (1960): 108, 109.

themselves; or, observers could analyze and record their reactions to a subject in the structured form. At once addressing multiple distinct domains of personality, Gough's multidimensional technique clustered the hundreds of adjectival variables into specific scales such as "self-confidence," "aggression," "heterosexuality," "abasement," or "creativity," for which subjects received scores based on the adjectives selected.[188]

One among a number of such adjectival checklists developed in the period, Gough's ambition for the checklist was in large part to standardize the vocabulary for personological description to make comparisons across subjects, across observers, and across studies possible.[189] As other personality psychologists in the period had argued, the idiosyncratic use of language by test subjects and by observers was thought to make observations and study results unreliable and therefore noncomparable. Gough sought to make language available to "systematic analysis," made possible in part by his structured list of terms each of which were "immediately meaningful" and en masse were to be exhaustive of all possible ways to describe personality.[190] If a similar justification, at least in part, had yielded the Likert scale two decades earlier, Gough, as well as other psychologists in the period, identified a demand to move past the limits of the type of linear thinking which necessarily characterized the use of bipolar scales. As Gough described, "Certain kinds of either-or (or dimensional) distinctions may certainly be worth making (e.g., male-female, integrate-

---

188 Harrison G. Gough, "A Creative Personality Scale for the Adjective Check List," *Journal of Personality and Social Psychology* 37, no. 8 (1979): 1398–1405; Gough, "The Adjective Check List as a Personality Assessment Research Technique."

189 For a selection of early adjectival check lists, see Hugh Hartshorne, Mark A. May, and Frank K. Shuttleworth, *Studies in the Nature of Character: III. Studies in the Organization of Character* (New York: The Macmillan Company, 1930); Gordon W. Allport and Henry S. Odbert, "Trait-Names: A Psycho-Lexical Study," *Psychological Monographs* 47, no. 1 (1936): i–171; Raymond B. Cattell, "The Description of Personality: Basic Traits Resolved into Clusters," *Journal of Abnormal & Social Psychology* 38, no. 4 (January 1943): 476–506. Allport and Odbert's list catalogued 17,953 terms; Gough built his checklist off of Cattell's initial list.

190 Gough, "The Adjective Check List as a Personality Assessment Research Technique," 107–8.

disintegrate, internalizer-externalizer), but a descriptive system which is limited to such points of reference is too restricted to be used as a general tool in personality assessment."[191]

The multidimensional technique offered a wide range of uses. One might study descriptions of individuals made with the checklist, for example, against the results of other psychological tests, against external indices (income, say), or simply to confirm assessments of subjects across multiple observers. In one instance, "a study of military leadership" at IPAR sponsored by the United States Air Force, military officers' self-reported adjectives were measured against a performance index generated from personnel files and performance reviews to reveal the adjectives checked most frequently by highly and lowly rated officers. "Less highly rated officers," the study showed, had disproportionately selected adjectives such as "sensitive," "easy going," "affectionate," "anxious," "superstitious," and "peaceable."[192] Gough, who had for some years previous during World War II worked for the United States Armed Forces' Air Crew Selection Program, in this way sought to demonstrate how personality assessment could be applied to forecast professional success.[193] Military officers were also administered Rorschach tests alongside the adjectival check list procedure; those who gave the greatest number of "popular" responses—that is, responses shared with about a third or more of the test subjects, understood by psychologists as indicative of a tendency to participate in collective thinking—were more frequently described by observers (who had been unaware of the Rorschach test responses) as "shallow," "meek," "unintelligent," and "reserved," while those who gave fewest popular responses were characterized as "arrogant," "forceful," "healthy," "emotional," "resourceful," "immature," and "impatient."[194]

---

191 Ibid., 107.

192 Ibid., 111–12.

193 "Dr. Harrison G. Gough," *San Francisco Chronicle*, May 25, 2014, sec. C4.

194 Gough, "The Adjective Check List as a Personality Assessment Research Technique," 112–13; For more on the Rorschach test, see Hermann Rorschach, "The Application of the Interpretation of Form to Psychoanalysis," *Journal of Nervous and Mental Disease* 60, no. 3 (1924): 225–48, 359–79; For more on the "popular" response in Rorschach testing,

Craik, along with other environmental psychologists in the period, adapted this tool designed initially for the multidimensional description of personality and turned it onto the study of the environment. Craik's Environmental Adjective Checklist, for one, deployed some 300 "every-day" descriptors that could characterize an environment, whether developed or undeveloped—with terms such as "beautiful," "chaotic," "cheap," "historic," "harsh," and "urban" (fig. 2.19)[195] Subjects taking part in the Simulation Lab's validation studies placed check marks next to adjectives they felt accurately described their experience of the environment toured, and rates at which terms were checked for each medium of presentation were to be compared against the other. Factor analysis of the response data, in turn, identified the underlying, latent correlations, called factors, among superficial variables that organized the sample's response.[196] The sample also performed another descriptive task which had likewise been adapted from Gough's personality checklist: the Landscape Adjective Check List, in comparison to the Environmental Adjective Check List, had been developed by 1972 to facilitate the description of *undeveloped* landscapes, comprising 240 variables identified as exhaustive of any possible descriptive response to an environment. This latter checklist had been developed by Craik in conjunction with two colleagues in the Department of Landscape Architecture at Berkeley, Robert Twiss and R. Burton Litton, whose work was briefly introduced in chapter one for its physicalist and atomistic biases toward landscape description, and whose work will be central in different ways in the next chapter.[197]

In addition to these checklist tasks was the q-sort, a method which, like the Likert scale and the Adjective Check List, had been sourced directly from personality psychology. Psychologist

---

see Marguerite R. Hertz, "The 'Popular' Response Factor in the Rorschach Scoring," *The Journal of Psychology* 6, no. 1 (July 1, 1938): 3–31.

195 Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements," 142.

196 Ibid., 32–33.

197 Craik, "Environmental and Personality Psychology: Two Collective Narratives and Four Individual Story Lines," 148.

William Stephenson had first published on the q-sort methodology in 1953, the year after the Adjective Check List made its debut. Thought to better account for multidimensionality and to be more open to a subject's cognitive framework rather than the experimenter's predetermination, the method tasked subjects with sorting prewritten statements or images into a set number of piles along any manner of criteria. Stephenson offered an example for how this methodology for personological research might be deployed in a "typical study": in June 1951, a sample of college students were surveyed for attitudes toward selective service in the United States Armed Forces. Researchers had collected some two or three hundred statements of opinion and attitude which had appeared in letters, in the press, and in writing exercises. These statements ranged from "The young man must wave his flag, but with a firm purpose," to "The individual does not count—more serious matters lie ahead" and "Patriotism is not a sufficient excuse for war and excess," to name a few.[198] A sample of 18 students was asked to sort these statements, which had been printed on cards, from most representative of their opinions to least. Factor analysis revealed groupings of statements that tended to be selected together across subjects and allowed subjects to be organized into multidimensional matrices. Some groupings of statements, for example, indicated for the experimenters an attitude characterized by "reasonableness and good sense," where a second factor, by comparison, indicated "emotionality." Subjects could be organized along an axis from reasonable to emotional, in one dimension, and along another, such as impersonal to personal, to produce a matrix of personological possibilities.[199] These efforts fed explicitly into a longer history of the expansion of psychology's purview beyond the immediate dictates of the then-prevailing behaviorist school of thinking. No longer constrained to the study of outward behavior, Stephenson wrote

198 William Stephenson, *The Study of Behavior: Q-Technique and Its Methodology* (Chicago: University of Chicago Press, 1953), 117, 118.

199 Ibid., 119–22.

"introspective psychology"—"our preferences, sentiments, motives and ideals"—are "now open for the technique to explore," positing that contra a strict behaviorist insistence on holding the objective apart from the subjective, there was no longer any "valid basis for their separation."[200]

Recurrent among this discourse was evidence of a disciplinary self-doubt around the problem of language, a doubt that had likewise pervaded other disciplines, including architecture, in the years following. Psychologist Paul Meehl, who had been Gough's doctoral advisor and an important proponent of structured response formats, argued that language should be understood as but one form of behavior—"verbal behavior," he termed it—which might not afford a perfectly transparent view onto the inner nature of the subject, but rather would produce an observable data point that could be measured against others. That is, the strength of a structured response, he suggested, lay in its capacity to shed light on the personological tendency to answer in certain ways, rather than in any sort of direct indexicality between the verbal and the subject's actual personality.[201] A later champion of the q-sort method (a method about which Meehl, to be sure, expressed reservations) and a colleague in the Department of Psychology at Berkeley, Jack Block posed the question around this problem of language: "In all the talk about the 'creative personality' or the 'authoritarian personality,' just what have people meant by these terms?" As something of an answer to this problematic, the q-sort, he argued, was "a language instrument… which aims to permit the comprehensive description… of an individual's personality in a form suitable for quantitative comparison and analysis." This sort of "effective communication" among peers, he argued, constituted "a pre-condition" to scientific advance.[202]

---

200 Ibid., 10, 25.

201 Meehl, "The Dynamics of 'Structured' Personality Tests."

202 Jack Block, *The Q-Sort Method in Personality Assessment and Psychiatric Research* (Springfield, Ill.: Charles C. Thomas, 1961), 5.

If structured response formats offered one answer for psychologists to the problem of language broadly construed in the period, the devices were brought to bear in the study of landscape and architecture for this very same capacity. Director of the Institute for Man and His Environment at the University of Massachusetts, Amherst, landscape architect Ervin Zube, whose study of perceptual responses to landscape photographs of the Connecticut River Valley was briefly introduced as a precedent in Carl Petrich's studies in chapter one, referred extensively to Jack Block's diagnosis of this problem of language. In his report on the Connecticut studies, Zube quoted Block at length on the "highly variable" use of language, the "non-comparability of language usage," and the deployment of "free description… with only casual regard for the claims of truth" in personality research.[203] Crediting Craik with bringing these concerns from personality psychology into environmental psychology, Zube turned to the q-sort methodology, among other structured response formats, in order to ascertain the degree of agreement across subjects in evaluating and describing landscapes, both in the field and via photograph.[204] If Zube's studies had served as precedent for Petrich for having shown scenic values to be a direct function of independent physical variables, Zube had also investigated in these same studies the relationship between personality attributes and environmental perception, asking if differences in the latter might be attributed to "socio-economic or cultural variables."[205] At the crux of the question was an anxiety around the possibility for the designer to speak broadly for multiple demographics. Zube asked, in a related study, if designers' opinions "represent those of a professional elite" or "the more general values of the public," and toward this end he sought to study the "degree of agreement" across groups

[203] Block, 43; Quoted in Ervin H. Zube, David G. Pitt, and Thomas W. Anderson, "Perception and Measurement of Scenic Resources in the Southern Connecticut River Valley" (Amherst, MA: Institute for Man and His Environment, University of Massachusetts, 1974), 25–26.

[204] Zube, Pitt, and Anderson, "Perception and Measurement of Scenic Resources in the Southern Connecticut River Valley," 26.

[205] Ibid., 1, 6.

including designers, resource managers, and technicians, with "wives and teachers" and "secretaries" as "control groups" construed as being "without specific environmental interests or skills."[206] Zube's studies of photographs of the Connecticut River Valley, developed for the Northeast Utilities Service Company based in Hartford, Connecticut, deployed multiple structured responses formats, including adjectival check lists, semantic differentials, environmental response inventories, and, notably, the q-sort methodology, to identify consensus and dissensus across demographic groups.[207] Performing the q-sort, the sample sorted 56 enlarged photographs of the landscape which had been mounted onto cards into seven piles according to scenic value.[208] The results of Zube's investigation demonstrated "generally impressive levels of agreement" across groups, with the notable exception of "Inner City Hartford, Conn. Residents."[209] Noting that this exception "merits further study," the matter was of central importance for Zube: "if planning is to be responsive to the needs and values of those being planned for, it is important to determine if differences exist and, if so, what the nature of the difference is."[210] Still, Zube was confident: despite the exception, he described elsewhere that the overall "high degrees of agreement… offer reason for optimism," indicating that the architect could yet be an "articulate and skilled spokesman representing at least some publics beyond his own profession within our pluralistic society."[211] Extrapolating the results of the test in

206 Ervin H. Zube, "Rating Everyday Rural Landscapes of the Northeastern U.S.," *Landscape Architecture* 63, no. 4 (July 1973): 371.

207 Zube, Pitt, and Anderson, "Perception and Measurement of Scenic Resources in the Southern Connecticut River Valley," 23.

208 David G. Pitt and Ervin H. Zube, "The Q-Sort Method: Use in Landscape Assessment Research and Landscape Planning," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 227–34.

209 Zube, Pitt, and Anderson, "Perception and Measurement of Scenic Resources in the Southern Connecticut River Valley," 2, 7.

210 Ibid., 11.

211 Zube, "Rating Everyday Rural Landscapes of the Northeastern U.S.," 375.

this way, Zube made possible the claim that scenic values were a direct function of independent physical variables—rather than personological characteristics—briefly important to one aspect of Petrich's work at Greene County.

Personality psychology had thus not only come to inform methods and practices in environmental psychology in the period; rather, the two traditions remained in robust, co-productive dialogue alongside one another to facilitate the study of both environmental perception alone *and* the relationship between perception and personality together. Some years after Zube's studies, beginning in the late 1970s architect Linda Groat at the University of Wisconsin-Milwaukee similarly argued for an "empirical" approach to the problem of "the communication of meaning" that had characterized much discourse in the discipline over the previous years.[212] Groat made use of the q-sort methodology to test if postmodernism's profession to meaning across diverse groups was in fact borne out in evidence. Taking exception with claims that certain postmodern buildings were necessarily "more meaningful" to the general public, and explicitly taking aim at the work of Charles Jencks in particular, in 1978 Groat asked twenty accountants and twenty architects in the San Francisco Bay Area to sort photographs of 24 buildings according to similarity along criteria of their own invention. Groat sought to compare the responses of the two professional groups, taking accountants as compelling foils to architects: both were professionally licensed and required a great deal of education, Groat argued, but were presumably at opposite ends of the spectrum in terms of creativity.[213] The 24 buildings Groat selected had been characterized in architecture discourse as variously "modern," "transitional," or "postmodern," based on her readings of Jencks and Vincent

[212] Linda Groat, "The Past and Future of Research on Meaning in Architecture: The Case for Architectural Theory as a Basis for Future Research," in *EDRA 1983: Proceedings of the 14th Annual Conference of the Environmental Design Research Association*, ed. Douglas Amadeo, James Griffin, and James Potter (Washington, D.C.: EDRA, 1983), 29–35.

[213] Linda Groat, "Meaning in Post-Modern Architecture: An Examination Using the Multiple Sorting Task," *Journal of Environmental Psychology* 2, no. 1 (March 1, 1982): 8.

Scully and her having consulted with other critics; these buildings ranged from Mies van der Rohe's chapel at Illinois Institute of Technology, Tange Kenzo's Tokyo City Hall, Paul Rudolph's Crawford Manor, Venturi Scott Brown Associates' Guild House, Ralph Erskine's Byker Wall, and Peter Eisenman's House VI, among others (figs. 2.20 and 2.21). The free-sort task instructed the sample to group images of these buildings into piles on a table according to their own categorizations. Once participants were satisfied with the groupings, they were asked to name each pile and offer explanations of their criteria for inclusion or exclusion.[214] The results of the study demonstrated that accountants and architects sorted the buildings according to wholly distinct "codes," contra, perhaps, Jencks' notion of double coding.[215] Some of the architects, to be sure, organized the images according to modern/postmodern stylistic distinctions, but about half did not; such distinctions, on the other hand, were "not perceived by any accountants," demonstrating for Groat that the architects' 'elite code' remained elite even with regard to postmodernist appeals to the contrary.[216] That is to say, whereas Zube saw cause for optimism, Groat found confirmation of insurmountable difference across demographic groups, and she pointedly raised doubts as to architects' abilities to effectively engage these various codes.

In this way, the q-sort, along with other structured psychometric response formats, came to manage questions of environmental perception and personological difference in this period. Appleyard and Craik's use of the q-sort for the validation studies tasked the sample with organizing 67 prewritten statements, printed on cards, describing the environments they'd toured. The statements included "has busy streets or highways," "has notable smells and odors," and "is a dangerous place for children," which were to be organized in a forced distribution of seven piles

---

[214] Linda Groat and David Canter, "Does Post-Modern Architecture Communicate?," *Progressive Architecture* 60, no. 12 (December 1979): 84–87.

[215] Groat, "Meaning in Post-Modern Architecture: An Examination Using the Multiple Sorting Task," 3.

[216] Ibid., 15.

from most to least characteristic (fig. 2.22).[217] The results of these tests allowed both a study of the effects of media on response and, importantly, a mechanism to delineate a new understanding of personality types.

If during the first half of the day the sample in the validation studies were administered these novel techniques for the study of the environmental perception which had been adapted in the preceding decade from psychometric techniques, after lunch the focus turned in earnest onto the study of the subjects themselves. The sample not only was asked to produce "socio-demographic" and "environmental" background information—e.g., age, education level, income, marital status, political orientation, professional status, sex, and familiarity with the toured area—but also was subject to tests accounting for "personality dispositions, environmental dispositions, cognitive-spatial ability, and aesthetic preference."[218]

Among the techniques to measure personality deployed here were Gough's original adjective checklist, which was self-administered, as well as a "social attitude scale" adapted from the work of personality psychologist Julian Rotter which sought to account for "the tendency of persons to perceive the things that happen to them as being either beyond their control and outside their personal influence ('external locus of control') or a consequence of their own actions and within the sphere of their personal influence ('internal locus of control')."[219] Assessments to determine the sample's "aesthetic sensitivity" included the Barron-Welsh Art Scale, which appraised sensitivity as the degree of similarity between a subject's preferences for "simple" and "complex" line drawings

---

217 Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements," 34–36, 149–50.

218 Feimer, 37–38; Kenneth H. Craik, "Individual Variations in Landscape Description," in *Landscape Assessment: Values, Perceptions and Resources*, ed. Ervin H. Zube, Robert O. Brush, and Julius G. Fabos (Stroudsburg, PA: Dowden, Hutchinson & Ross, 1975), 136.

219 Craik, "Individual Variations in Landscape Description," 139; Julian B. Rotter, "Generalized Expectancies for Internal versus External Control of Reinforcement," *Psychological Monographs: General and Applied* 80, no. 1 (1966): 1–28.

against those of a control group of artists.[220] Tests to measure "cognitive-spatial ability" included the Gottschaldt Figures Test, a Gestalt psychological technique in which subjects were tasked with locating "simple figures" within "complex geometrical" forms under time restrictions, therefore thought to "reflect the manner in which the individual's cognitive processes are impaired by stress."[221] The sample also had their eyes tested with a Snellen eye chart.[222]

Alongside these broad measures of personality, cognitive functioning, and physiology, the sample's attitudes toward the environment were subject to particular attention. A number of more recently developed psychometric techniques sought to directly account for habits, interests, and attitudes around the environment—what came to be called in the period "environmental dispositions." An environmental attitude survey, which Craik developed in consultation with planners in the Marin County Planning Department, assessed attitudes toward the conservation of open space and development.[223] The Leisure Activities Blank, put forth by George McKechnie, a psychologist specializing in outdoor recreation research who had trained at Berkeley, measured how the sample spent their free time, identifying factors indicating interests including "intellectual," "crafts," and "neighborhood sports" activities, among others.[224] Yet another technique McKechnie had developed and was deployed in the validation studies was the Environmental Response

---

[220] Frank Barron and George S. Welsh, "Artistic Perception as a Possible Factor in Personality Style: Its Measurement by a Figure Preference Test," *The Journal of Psychology: Interdisciplinary and Applied* 33 (1952): 199–203; Cited in Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements," 38; Craik, "Individual Variations in Landscape Description," 139.

[221] Kurt Gottschaldt, "Über den Einfluß der Erfahrung auf die Wahrnehmung von Figuren," *Psychologische Forschung* 8, no. 1 (December 1, 1926): 261–317; Kurt Gottschaldt, "Über den Einfluß der Erfahrung auf die Wahrnehmung von Figuren," *Psychologische Forschung* 12, no. 1 (December 1, 1929): 1–87; Craik, "Individual Variations in Landscape Description," 137–38; Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements," 38.

[222] Craik, "Individual Variations in Landscape Description," 139.

[223] Ibid., 137.

[224] Ibid.; George E. McKechnie, "The Psychological Structure of Leisure: Past Behavior," *Journal of Leisure Research* 6, no. 1 (January 1, 1974): 27–45; George E. McKechnie, *Leisure Activities Blank* (Palo Alto, CA: Consulting Psychologists Press, 1975).

Inventory. On Kenneth Craik's encouragement and working closely with Harrison Gough at the Institute of Personality Assessment and Research, McKechnie had advanced a device that could account for a range of behavior, interests, sentiments, preferences, attitudes, and beliefs concerning matters of the environment. Comprising roughly 200 self-reported, true-false questions, and later updated to five-point scales, the test asked subjects to assess whether items accurately described their behavior, interests, or beliefs.[225] These items included statements such as: "Whenever I enter a large city, I think of death"; "I understand the architectural maxim that form follows function"; "The information value of highway billboards outweighs the artificiality they impose on our landscape"; and "I occasionally take a walk in the rain just for the experience."[226] Based on these responses, the Environmental Response Inventory yielded scores for nine environmental attitude types—termed "environmental dispositions," or "the configurations of attitudes, beliefs, values, and sentiments" that predisposed individuals to certain ways of engaging environments.[227] A subject's answers, for example, might indicate a high *Urbanism* score, pointing to a predilection for cities, with a series of corresponding personality traits: "The male Urbanism scale appears to be positively related to social ascendancy, flexibility and resourcefulness. The high-urban male likes the city and knows how to enjoy it. He is a dominant person but not pushy. His ascendancy is mediated by tact and consideration for others. He is, in a word, charming." Answers might indicate a penchant for *Conservationism*, or a "doctrinaire anti-technological, conservationist stance" and at once a "preference for urban life over the pastoral." A high score here "appears to identify the woman who is shrewd, dissatisfied, self-centered, impatient, and self-pitying. She is critical of plans and projects,

225 George E. McKechnie, *ERI Manual: Environmental Response Inventory* (Palo Alto, CA: Consulting Psychologists Press, 1974), n.p.

226 George E. McKechnie, "Measuring Environmental Dispositions with the Environmental Response Inventory," in *EDRA 2: Proceedings of the Second Annual Environmental Design Research Association Conference*, ed. John Archea and Charles M. Eastman (Stroudsburg, PA: Dowden, Hutchinson & Ross, 1970), 322–23.

227 Ibid., 320.

but seldom does anything constructive herself. She talks about conservation rather than actually participating in projects."[228] The sample received scores for each of these multiple scales; other scales accounted for in the validation study were *pastoralism*, *need for privacy*, *stimulus seeking*, and *communality*, among others.

"Dispositions" had long been a watchword for personality psychologists, often credited as a concept foundational to the very emergence of personality psychology as a distinct field of inquiry. Beginning in the 1920s, psychologist Gordon Allport sought to identify the relatively stable traits that predisposed individuals to certain types of behavior across specific situations, calling these traits the "fundamental and dynamic forces underlying behavior."[229] Allport later identified traits as "the existential unit of personality," before adopting the term "disposition" as less ambiguous in meaning.[230] Among the dispositions identified by personality psychologists after Allport were those including dominance, nurturance, sociability, tolerance, and hostility, which would variously indicate a propensity to certain types of behavior either with relation to the self or with relation to others.

By the early 1970s, this notion of dispositions availed itself to the study of the environment, addressing a gap in research: George McKechnie argued that studies under the aegis of "environmental perception" had up to that point tended to draw direct relationships between preference and discrete physical variables of the environment, on one hand, or between preference and demographic variables, on the other—"leaving the individual observer essentially undescribed." By contrast, dispositions he defined as constituting "meaningful configurations of attitudes, sentiments, beliefs, and values which cut across demographic variables and which possess deeper

---

228 Ibid., 323–25.

229 Floyd H. Allport and Gordon W. Allport, "Personality Traits: Their Classification and Measurement," *The Journal of Abnormal Psychology and Social Psychology* 16, no. 1 (1921): 6–40.

230 Gordon W. Allport, "Concepts of Trait and Personality," *Psychological Bulletin* 24, no. 5 (1927): 284–93.

personological meaning and predictive validity than the variables employed to date."[231] Craik similarly understood environmental dispositions as describing "individual variations in fairly enduring styles of relating to the everyday physical environment."[232] If the concept of dispositions had made possible, in Craik's estimation, "the comprehensive description of a person's interpersonal traits," this broad-based effort sought to identify "an array of environmental dispositions… to afford an equally comprehensive description of this heretofore neglected realm of personality."[233] In this way, Craik, McKechnie, and others in the period suggested that environmental dispositions amounted to a key, yet understudied aspect constitutive of personality as such.

In these multiple ways, then, the validation studies afforded an array of opportunities for research. Craik averred that one might study the objective properties of the toured landscapes by way of "consensual observer descriptions," or that one could study the characteristics of observers themselves by way of their individual response patterns arranged into dispositional types.[234] But the validation studies' stated goal, of course, was to study the veracity of the representational media, as was made subject in numerous reports and publications on the Lab. Mobilizing the various response formats sourced from personality psychology—the Likert scale, the Adjective Check List, and the q-sort, in particular—Appleyard and Craik measured structured responses in their simulator against those made in the real for degrees of correlation. The Environmental Adjective Check List procedure yielded a "general consensus" across the media formats that the areas toured were considered "accessible, convenient, clean, and well-maintained," resulting in a similarity of

---

231 McKechnie, "Measuring Environmental Dispositions with the Environmental Response Inventory," 320.

232 Craik, "The Personality Research Paradigm in Environmental Psychology," 60.

233 Kenneth H. Craik, "The Environmental Dispositions of Environmental Decision-Makers," *Annals of the American Academy of Political and Social Science* 389, no. 1 (1970): 91. Among the precedents for bringing these ideas into environmental research was John C. Hendee et al., *Wilderness Users in the Pacific Northwest: Their Characteristics, Values, and Management Preferences*, USDA Forest Service Research Paper PNW-61 (Portland, OR: Pacific Northwest Forest and Range Experiment Station, 1968).

234 Craik, "Individual Variations in Landscape Description," 131.

description which was, in Appleyard and Craik's words, "striking."[235] The q-sort task similarly suggested favorable results: among the statements rated as most characteristic of the tour area across the media were "possesses considerable natural beauty" and "has people mostly of one social class," while rated as least characteristic across the formats was "creates a gaudy, vulgar, or tasteless impression."[236]

To be sure, the pair demonstrated that the simulator's fidelity to the real wasn't total: Likert scale response data showed that the color film simulation, for example, tended to undervalue satisfaction with the "maintenance of public areas," the "attractiveness of houses," and the "abundance of vegetation," when compared against the real-world tour, while it overvalued satisfaction for items like "nearness to churches," "access to natural areas," the "resale value of houses," and, perhaps especially germane to this discussion, "nearness to freeways."[237] Environmental Adjective Check List response data, subjected to a multivariate analysis of variance to locate variables dependent on media of presentation, demonstrated that the film of the real-world drive resulted in "significantly" lower scores on the checklist's "beautiful-scenic" scale, which experimenters attributed to the film's "atmospheric haze and glare" which were noticeably "absent from the brightly lighted laboratory conditions" of the simulations.[238] Q-sort response data, on the other hand, suggested that the simulations generated a slight impression among viewers that the area had an "impersonal, cold, barren, lifeless atmosphere," while the auto tour conveyed a distinct sense that the area "has dramatic or unusually designed buildings" and "has busy streets or highways."[239]

---

[235] Appleyard and Craik, *Visual Simulation in Environmental Planning and Design*, 8.

[236] Ibid., 11–12.

[237] Ibid., 6–7.

[238] Bosselmann and Craik, *Perceptual Simulations of Environments*, 12.

[239] Appleyard and Craik, *Visual Simulation in Environmental Planning and Design*, 10, 13.

Still, statistical analysis of the sample's response data in aggregate affirmed for the Berkeley team a "high level of congruence" between the real and the simulations.[240] Significant correlations across Likert-scale data, across adjectival check list responses, and across q-sort descriptions suggested the validity of their tool: "the character of the region conveyed by the direct and simulated presentations… is essentially identical."[241] Subjectivity, in aggregate, thus made the case for the tool's objectivity. The validation studies, in this way, authorized a new kind of technical image: the technical set-up paired with structured psychometric techniques now affirmed that the simulations were not only immersive and projective, but indeed veracious.

Wrapped up in these investigations was an ulterior goal, little addressed in publications on the Simulation Laboratory, but central to Craik in his research output. For Craik, the validation studies not only made possible, but in fact necessitated, the study of individual difference in the perception of environments: if the validation studies had shown the simulated and real to have had a largely similar effect on viewer response, for Craik, instead, "Observer characteristics… were revealed to exert far more influence upon environmental impressions than did media of presentation."[242] In his dissertation in psychology under Craik (with Gough and Appleyard on his committee), Nickolaus Feimer performed statistical analyses on the validation study data which led to the conclusion that effects of media accounted for only about 3% of the variance in the sample's response, whereas personality variables accounted for 17% of variance in evaluation and for 34% of variance in judgments of aesthetic quality.[243] In contradistinction to positions advanced by the likes

---

240 Appleyard and Craik, 15; Anthony Raynsford argues that such studies "did not address the degree to which popular understandings of the 'real' were already coded by film." Raynsford, "Spectacle of the Hyper-Real: Environmental Simulation, Cybernetic Subjects, and Urban Design," 658.

241 Appleyard and Craik, *Visual Simulation in Environmental Planning and Design*, 10.

242 Craik, "Environmental and Personality Psychology: Two Collective Narratives and Four Individual Story Lines," 149.

243 Kenneth H. Craik, "The Psychology of the Large-Scale Environment," in *Environmental Psychology: Directions and Perspectives*, ed. Nickolaus Reinholt Feimer and E. Scott Geller (New York: Praeger, 1983), 84–85.

of Ervin Zube, then, who'd argued the landscape's physicalist determinants of perceptual response to have had mostly the same impact across demographic difference, Craik undertook an effort to draw attention to the effects of difference across personality and sociodemographic variables. Performing a multiple linear regression analysis on these variables, Feimer concluded that each "embody predictive power" for environmental perception, and together "the combination of the two predictor sets provides the best prediction."[244]

Craik offered two ways into addressing this question of the relationship between personality variables and perception: subsets of the sample might be organized around demographic and self-reported personal data, and the landscape evaluations and judgments associated with each of these predetermined groups could then be measured; or, subsets could be organized first by similarity of response to the landscape, with an assessment of observer characteristics then to follow. This was a matter not only of prioritization but, for Craik, of overdetermination. The former approach led to relatively straightforward conclusions, including that party affiliation exerts a strong effect on preferential judgment, in this case of suburban Marin County in the negative for democratic observers and in the positive for republican subjects. As Craik explained, "Liking the particular suburban region that constitutes the research site is positively related to being married and conservative," while "disliking the area is positively related to being single and liberal."[245] Craik however was interested in the latter approach, inverting the question: rather than asking how demographic and personality variables determine response, he sought instead to reorganize response types as the determining variable. The question for him was what personality profiles might emerge when landscape description and evaluation modes are given primacy in organizing the sample. Craik

[244] Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements," 67–68.

[245] Craik, "The Psychology of the Large-Scale Environment," 82.

asked, "Do individuals who rendered the same type of landscape description display other distinctive characteristics?"[246] Isolating the effects of media, Craik turned his attention here solely to the Landscape Adjective Check List data produced from the auto tour in the summer of 1972. Factor analysis, followed by cluster analysis, of these data revealed for him a typology organizing the sample into 16 distinct groupings of similar response. Each group was then compared against the entire sample across all of the measures for observers' characteristics, including background, personality, aesthetic sensitivity, cognitive-spatial ability, and environmental disposition.[247]

These analyses allowed Craik to outline "brief character sketches for each type."[248] Craik argued, for example, groups which expressed negative views toward the area toured tended toward "intellectual and cultural forms of leisure activity" and higher degrees of "aesthetic sensitivity."[249] Elsewhere Craik produced longer, in-depth portraits of each of these groups, characterizing for example "Type 05," a group which disproportionately described the area toured as low in beauty, low in serenity, and high in barrenness, largely having elected adjectives like "brown," "burned," "dry," "bare," and "eroded," at the expense of adjectives including "quiet," "lovely," "flowery," or "blooming" on the structured checklist procedure. Craik argues an "evident psychological coherence" established between these landscape descriptions and the group's general personality characteristics, which "all appear to fit with the touch of landscape snobbery entailed in their unflattering description of the site."[250] He goes on to characterize the type in detail:

> The fathers of Type 05 members had a higher educational attainment and higher occupational status than those of the complement sample. Type 05 members are more likely to engage in glamour sports and to be gadabouts, with leisure activities scattered widely

[246] Craik, "Individual Variations in Landscape Description," 142.

[247] Ibid., 131–32, 142.

[248] Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements," 16–17.

[249] Craik, "The Psychology of the Large-Scale Environment," 84.

[250] Craik, "Individual Variations in Landscape Description," 150.

> throughout the county and beyond its boundaries. They are more familiar with the research site from the vantage point of roadway views and less familiar with it in terms of use of the area's facilities. They place higher priority on scenic highway improvement as a transportation goal, and rank recreation higher as a countywide issue while ranking public education and air and water pollution lower. They are less inclined to prohibit by law resort development along the Marin coastline. In personality, Type 05 members are below average on 'abasement' and 'succorance,' and lower than the complement sample. That is, they tend not to feel inferior nor to seek emotional support from others; instead, they are alert, poised, and decisive, with a quiet confidence in their own worth.
>
> The wide discretionary home range, concern about scenic travel, and selective recreational pursuits of this type suggest the operation of unusually high standards of landscape appraisal, leading to broad-based comparative judgments that highlight the area's dry, barren features and play down the more appealing attributes conveyed by the other three factor dimensions.[251]

In this way, Craik proffered a radical reorientation in the relationship between environment and observer characteristics, where responses to environment were afforded primacy in constructing notions of personality, in order to produce new personality types as such.

Appleyard, likely influenced by Craik but also by wider discourse in the period, argued for a similar reorientation around the question of difference across subjects. If in his 1958 master's thesis under Kevin Lynch Appleyard deployed universalizing phrases like "the perceiver moves" or "one sees" to describe the experience of space, by 1970, Appleyard's subjects were already splintered and more narrowly recast as "college subjects," "less educated subjects," "female subjects," and "male subjects" (figs. 2.23 and 2.24).[252] Elsewhere he posed the question regarding the Simulation Lab: "Whose reality are we trying to reproduce? Since reality is constructed differently by each person, this is a difficult question."[253] As others have argued, the "ideal subject" that characterized much of discourse, if not practice, gave way in this period to "users" who were understood as broadly distinct types and were to be observed and measured in aggregate; less studied is the concomitant turn to

[251] Craik, 145.

[252] Computed Data from BART Studies, ca. 1969, BANC MSS 83/165 c, Carton 8, Folder 26, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

[253] Appleyard, "Understanding Professional Media," 58.

techniques in personality psychology that at least in part made this possible.[254] Craik, for one, took this position to its logical extreme, asking:

> In what way would architects, corporate presidents, janitors, Sierra Club members, and opera singers differ in their comprehensions of [a typical] subway station? Would Democrats differ from Republicans in their descriptions? Or children from adults? Or males from females?... Would extraverts differ from introverts? Dominant persons from submissive persons? Would groups who differ in their motivation for achievement, or their cognitive flexibility, or their level of anxiety also differ in their description of the subway station?[255]

This matter was not simply a curiosity of psychological research for Craik—it at once struck at the very heart of the validation studies' ambitions and had direct sociopolitical implications for architecture and landscape practice. Craik points out that most psychological studies in architecture to that point had almost exclusively employed samples comprising university students, and students of architecture and design in particular, thus impeding the studies' "generalizability." The very validity of the Berkeley simulations rested, for him, on the sample deployed for the validation effort, which, in his estimation, amounted to one of "the most broadly representative samples thus far recruited to appraise perceptual simulation."[256] In a journal article for the American Academy of Political and Social Science, Craik wrote of the political implications on the built landscape of this mode of address that was at once environmental-psychological and personological:

> In modern technological societies, responsibility for environmental policy-formation and decision-making is concentrated, to an unknown extent, within professional and institutional roles and positions. Remarkably little is known about environmental decision-makers such as architects, urban designers, transportation planners, landscape architects, natural-resources managers, and conservationists. Does their comprehension of the physical environment differ from that of their clients and other constituents, and, if so, what are the implications of these differences? What working assumptions about man-environment relations guide their decisions, and how accurate are they? What behavioral and social goals, if any, do they seek by means of what physical designs and management policies and with what success? What unintended behavioral, social, and environmental consequences result from their decisions?

[254] cf. Kenny Cupers, *Use Matters: An Alternative History of Architecture* (London: Routledge, 2014).

[255] Craik, "The Comprehension of the Everyday Physical Environment," 655.

[256] Bosselmann and Craik, *Perceptual Simulations of Environments*, 7.

> There are plenty of reasons for advancing the hypothesis that environmental decision-makers differ from their clients in their perception, interpretation, and evaluation of the everyday physical environment.[257]

Such sentiments were broadly shared in the period, having already been echoed in the work of Ervin Zube, but also in different ways in the work of Herbert Gans and Clare Cooper Marcus, whom Craik cites as precedents for bringing research attention to discrepancies among architects, planners, and inhabitants.[258] But here Craik, along with others in the period, offered a particular set of cross-disciplinary techniques as a solution. "The personality paradigm," Craik suggests, has successfully demonstrated a capacity for "forecasting" behavior and social outcomes; its current extension into questions of the environment promises "significant implications and consequences for the use and form of the everyday physical environment," with its capacity to forecast "significant environmental behaviors and outcomes."[259]

The development of participatory, immersive forms of representation, then, strategically coupled with psychometric strategies in personality psychology, yielded a cross-disciplinary, predictive technique considered capable, for Appleyard and Craik, of confronting the question of difference across subjects—that is, a technique which could accommodate and possibly produce forms of consensus around the environment. To wit, Craik posited that such methods might be further developed to allow for "fully automated Environmental Assessment Centers" where randomly sampled community members could view local simulations and record their responses en masse—"a system much like jury duty."[260] The Lab in this way offered what was understood as a particularly efficacious medium for public engagement around the built environment, and for a time

---

[257] Craik, "The Environmental Dispositions of Environmental Decision-Makers," 89.

[258] Herbert J. Gans, *The Urban Villagers: Group and Class in the Life of Italian-Americans* (New York: The Free Press of Glencoe, 1962); Clare Cooper Marcus, *Easter Hill Village: Some Social Implications of Design* (New York: Free Press, 1975).

[259] Kenneth H. Craik, "Multiple Scientific Paradigms in Environmental Psychology," *International Journal of Psychology* 12, no. 2 (January 1, 1977): 151; Craik and McKechnie, "Personality and the Environment," 159.

[260] Craik, "Environmental Psychology," 84.

architects, psychologists, activists, and governmental agencies turned to its simulations as sites for contestation, negotiation, and conciliation. But it was the highway, as had already been suggested by 1964's *The View from the Road*, that was thought to uniquely necessitate the study of the perceptions of and the relationships among fundamentally distinct parties—to a degree perhaps not applicable for other infrastructure types whose visual impact would primarily be from without. The coupling of moving image-based model simulation with new theories of personality redefining the individual in terms of the environment promised to afford highway planners and government officials new possibilities, it was hoped, for coordination and arbitration.

IV. Viewer Sensitivity and Highway Policy

The Environmental Simulation Laboratory's promise to accommodate, account for, and mediate across multiple environmental personality types bought the device its purchase in infrastructural debates and in federal policy decisions in the period, especially and particularly around the matter of highways. In the years following their work with the Nuclear Regulatory Commission, the Seattle-based planning firm Jones & Jones led the effort to develop visual impact assessment techniques for another federal agency, the Department of Transportation's Federal Highway Administration, working in conjunction with R. Burton Litton at UC Berkeley and with the Washington State Department of Transportation. Together the team developed a five-day professional training seminar titled *Esthetics and Visual Resource Management for Highways* which they delivered dozens of times beginning in the late 1970s and for which they received a National Merit Award from the American Society of Landscape Architects in 1979 (fig. 2.25).[261] The methods developed for the seminar resulted in a 1981 set of recommendations that continued to govern

[261] William G.E. Blair, Peter Harvard, and Jones & Jones, *Esthetics and Visual Resource Management for Highways: Seminar Notes, 1979–1980* (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1979), 4.

aesthetic impact determinations for federal highway projects until updated guidelines were issued in 2015 as a result of a yearslong review process—which nevertheless retained many of these early principles.[262] Jones & Jones' 1981 guidelines for the Federal Highway Administration were in many ways the direct result of their work for the Nuclear Regulatory Commission, while also drawing on the related work of the Bureau of Land Management as was detailed in the last chapter, but here in the case of the highway significantly greater attention was afforded to this problem of difference across users—both in terms of rhetoric and of method. The perceived need to better account for such difference was certainly the result of the changing tenor of discourse that had been made widely visible across disciplines and practices over the course of the decade, but it was also at least in part understood to be necessitated by specific condition of the highway. Echoing Appleyard, Lynch, and Myer, Jones & Jones' guidelines for the Federal Highway Administration sought to account for visual impacts "positive as well as negative" both in terms of "the view *from* the road and the view *of* the road," acknowledging that the former had long been prioritized at the expense of the latter.[263]

The framework put forward by Jones & Jones broadly schematized visual experience as comprising a stimulus and a response—or, "visual resources" and "viewers" (fig. 2.26). Echoing the Bureau of Land Management's methodology, the former was to be measured by dividing the region into coherent "landscape units," performing viewshed mapping, and analyzing units for their descriptive character and evaluative quality based on a notion of "excellence." By comparison, the latter—"viewers"—was here fundamentally recast and expanded in scope. Viewers now were to be accounted for in two distinct ways: not only were they to be calculated in terms of *exposure* (that is,

---

262 U.S. Department of Transportation Federal Highway Administration, "Guidelines for the Visual Impact Assessment of Highway Projects," FHWA-HEP-15-029 (Washington, DC: U.S. Department of Transportation, Federal Highway Administration, 2015), 1-3.

263 Emphasis theirs. Jones & Jones, *Visual Impact Assessment for Highway Projects*, ed. American Society of Landscape Architects and Federal Highway Administration (Washington, D.C.: Federal Highway Administration, 1981), 2.

the cold facts of their quantities and proximities), but also they were to be addressed by way of a newly central concept, that of *viewer sensitivity* (fig. 2.27).[264] If Jones & Jones' earlier work, as exemplified perhaps by their 1975 visual impact study for the Indian Point Nuclear Generating Plant, had largely reduced the question of viewership to exposure, here by about the end of the 1970s sensitivity had been importantly separated out as a distinct matter of concern.[265] Defined as the "variable receptivity" to the visual environment across different groups of viewers, viewer sensitivity accounted at once for the direct influences on visual experience as well as for the indirect, "by means of values, opinions, and preconceptions."[266] Among these various influences were *viewer activity*—driving for pleasure versus commuting in heavy traffic, for example, was thought to produce differing relationships to the landscape as mediated by the road; *viewer awareness*, including "individual preconceptions about the landscape (and the highway's appropriateness in it)"; *local values*, in which "citizen participation procedures" and engagement with community organizations could reveal a landscape's significance to local stakeholders that would "otherwise appear unexceptional"; and *cultural significance*, indicating more broadly shared historic values.[267] Offering an example of how viewer sensitivity might variably predispose certain groups to different judgments on the landscape, and at once echoing the case of Cross Lake, Jones & Jones suggested that "highways located in recreational areas are often exposed to a very sensitive group of viewers with strong preconceptions about the visual appropriateness of roads in these settings."[268] Accounting in these various ways for the variable values, activities, and preconceptions of specific groups, the

---

264 Ibid., 5–9.

265 Jones & Jones et al., *Visual Impact Study: Statement of Findings, Alternative Closed Cycle Cooling Systems, Indian Point Nuclear Generating Plant* (Seattle: Jones & Jones, 1975).

266 Jones & Jones, *Visual Impact Assessment for Highway Projects*, 9.

267 Blair, Harvard, and Jones & Jones, *Esthetics and Visual Resource Management for Highways: Seminar Notes, 1979-1980*, 34; Jones & Jones, *Visual Impact Assessment for Highway Projects*, 22.

268 Jones & Jones, *Visual Impact Assessment for Highway Projects*, 22.

notion of viewer sensitivity perhaps indirectly recalled, if not referenced, the concept of environmental dispositions that had animated contemporaneous environmental-psychological discourse in the period.

The concept of viewer sensitivity, to be sure, was not wholly unique to the Federal Highway Administration in this period. Both the Bureau of Land Management and the United States Forest Service, in different ways, addressed what they called "sensitivity," but they importantly constructed this concept differently to the Federal Highway Administration. In the case of the Bureau of Land Management, for example, sensitivity was measured on a three-point spectrum from high to low and was understood to be the result of various factors including rates of use, adjacent land uses, and the "type of users." Such factors—with the exception of user type—would have largely been incorporated into viewer exposure or landscape description, rather than sensitivity, under the Federal Highway Administration's system. The Bureau of Land Management's "type of users," alone, would have fit more squarely within the Federal Highway Administration's understanding of sensitivity. This factor, perhaps tellingly described only in the singular, required the agency's expert evaluator to produce a single rating indicating, per the agency's instructions on the Sensitivity Level Rating Sheet, that visual quality was either "a major concern for most users," "a moderate concern for most users," or "a low concern for most users."[269] That is, the Bureau of Land Management constructed sensitivity in part based on a single "type" of user in order to yield a singular rating assessed by a single expert rater. Kenneth Craik, for one, took direct issue with this mode of address, systematically studying the Bureau of Land Management's reliance on the single rater and finding low levels of reliability across judges.[270] The Federal Highway Administration's guidelines, by

[269] U.S. Bureau of Land Management, *Visual Resource Inventory*, Manual Handbook 8410-1 (Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986).

[270] Craik, "The Psychology of the Large-Scale Environment," 72; Nickolaus R. Feimer et al., "Appraising the Reliability of Visual Impact Assessment Methods," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C.

comparison, devoted a great deal more attention to accounting for and explaining difference across *types* of viewers (fig. 2.28).

Offering an example, Jones & Jones' guidelines walk readers through a hypothetical scoping questionnaire for an unidentified "urban freeway" project which, in many ways, sounds strikingly similar to the case of the bypass over Cross Lake. Describing a "freeway spur that would provide access to the downtown core of a medium-sized western coastal city, as well as a bypass route for traffic bound to the north and east of the core," the imagined project included a controversial "2.3 mile east-west connection across the waterway" immediately to the east of the city center. The questionnaire prompts the putative visual impact manager to assess the project's impacts to visual quality, with particular attention to the effects on viewer sensitivity across different groups. Considering first the view from the road, the example suggests the new bypass might improve the visibility of the downtown core and therefore have positive impacts on first impressions of the city's visual quality: "Businessmen and most city officials," in particular, "anticipate [the] project improving visibility of downtown and contributing to revitalization." The view of the road, by comparison, would suffer from highly adverse visual impacts especially for residents and recreational boaters. Nevertheless, answers to the questionnaire suggest the project could "improve overall visual quality significantly."[271] In this way, the Federal Highway Administration's visual impact assessment guidelines developed by Jones & Jones resolutely affirmed a positive capacity for roads. Citing Kevin Lynch's *Image of the City*, the guidelines aver that "researchers have also shown that the view from the road is the basis for much of what we know about our everyday environment and for our mental image of the city"; "sometimes," they continue later, "a highway project can make a significant

Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 286–95.

[271] Jones & Jones, *Visual Impact Assessment for Highway Projects*, 26–29.

contribution to the renewal of a city center by increasing the traveler's awareness of the center and improving the visual quality of the entry to it."[272]

It was in this broader regulatory context that the case against the Cross Lake bridge moved forward, and that Berkeley's Environmental Simulation Laboratory would partner with Jones & Jones to play a key role in mediating that debate. After the initial injunction suit against the highway was dismissed in 1967, critics of the project regrouped to form the Louisiana Environmental Society in 1971.[273] Filing suit later that year, the group alleged that the Louisiana State Highway Department had failed to definitively prove that there was "no feasible and prudent alternative" to the bridge cutting through the area's recreational facilities, and thus it was not in compliance with the 4(f) stipulations outlined in the recently passed Department of Transportation Act.[274] The suit also alleged that National Environmental Policy Act-mandated environmental impact reporting for the project had been "so vague, general, indefinite and conclusory as to virtually preclude reasonable and intelligent comment thereon by other agencies, thereby depriving the public of their expertise."[275] The impact statement, the Society argued, hadn't sufficiently produced an interdisciplinary account of "presently unquantified" environmental attributes in keeping with these provisions.

On these grounds, a temporary restraining order against the highway project was issued, and the case moved back and forth between the U.S. District Court and the U.S. Court of Appeals over the next five years. Meanwhile, construction proceeded in fits and starts, with the state agency managing to build out the highway all the way up to the lake's eastern shore—through and alongside the city's predominantly Black neighborhoods—making it appear to some to be all but a fait

---

272 Ibid., 2, 22.

273 "Group Forms to Halt Cross Lake Bridge," *The Times*, July 9, 1971, 20.

274 Louisiana Environmental Soc., Inc. v. Coleman 524 F. 2d 930 (5th Cir. 1975).

275 Louisiana Environmental Soc., Inc. v. Brinegar 407 F. Supp. 1309 (W.D. La. 1976).

accompli.[276] The Louisiana Department of Transportation and Development, as it had been restructured and renamed by the mid-70s, meanwhile weighed whether to take the case to the Supreme Court or to try to meet the court-ordered requirement to supplement the project's environmental impact reporting with further research and evidence production.[277] In 1978, the state agency submitted an updated 4(f) analysis which assuredly claimed the proposed routing "intrudes the least into visual experiences of the public and provides increased visual qualities to the greatest number of people."[278] Challenging the evidentiary support for that claim, along with others, U.S. District Judge Nauman Scott halted construction on the project one last time in 1981. Scott ruled that 4(f) considerations around recreational uses had by that point been largely addressed—with the conspicuous exception of visual impacts to the area: "the visual intrusion of either route," he ruled, represented "the only substantial harm that merits consideration."[279] The Federal Highway Administration and the state agency appealed this decision, but they at once undertook a series of significantly more in-depth visual impact studies to provide conclusive assessments of visual impacts in the chance that Scott's ruling was upheld.[280]

Tasked with demonstrating definitively that visual impacts had been sufficiently considered in determining the project's routing, the Louisiana Department of Transportation and Development contracted with a cadre of environmental consultants, landscape architects, and analysts to develop quantified visual impact projections for the project, spending roughly $250,000 in state and federal funds on the court-ordered studies.[281] The Department directed the engineering firm overseeing the

---

276 "Land Purchases for Highway Halted by Judge," *Daily World*, October 13, 1971, 7.

277 "U.S. Highways Officials' View of I-220 Span Asked," *The Times*, October 19, 1976, 4.

278 Louisiana Environmental Soc., Inc. v. Brinegar, 513 F. Supp. 179 (W.D. La. 1981), 186.

279 Louisiana Environmental Soc., Inc. v. Brinegar, 513 F. Supp. 179 (W.D. La. 1981), 189.

280 Jones & Jones, *I-220: Cross Lake Visual Impact Assessment*, 1983, 3.

281 Doyle, "Cross Lake Bridge Film Draws 200," 14; Hirsch, "Any Bridge at All Is an Intrusion," 29.

project's design, Howard, Needles, Tammen and Bergendoff, to develop these visual impact assessments; the firm, in turn, subcontracted with Jones & Jones, who had demonstrated especial expertise on the matter of visual impacts and infrastructure development over the previous decade and had already developed a close working relationship with the Federal Highway Administration in the same years. The firm likewise retained the services of Berkeley's Environmental Simulation Laboratory, charged with developing immersive simulations for the project as well as psychometric techniques for measuring subjects' responses to these simulated scenes, purportedly at the somewhat reluctant acquiescence of the Louisiana Department of Transportation and Development which evidently feared such simulations might not support their desired outcome.[282]

Called upon to produce these visualizations for the controversial Cross Lake project, the Environmental Simulation Laboratory undertook a robust effort to study the area and produce a highly detailed, though fragmentary, model. Led by Peter Bosselmann, an urban designer who had managed the Environmental Simulation Laboratory since 1976 and took over as its director after Donald Appleyard's untimely passing in 1982, the Berkeley team studied the topographic maps, aerial photographs, and engineering drawings they'd received from the State of Louisiana and from Howard, Needles, Tammen, and Bergendoff, which Bosselmann supplemented with his own motion and still photography of the area.[283] Extrapolating information from these various forms of representation, the team fabricated a detailed model at a scale of one inch to thirty feet representing only the portions considered necessary to furnish a set of representative "key views" for each of the alternatives (fig. 2.29). Totaling 16 in number, these key views purportedly captured the full scope of

[282] William G. E. Blair, "Visual Impact Assessment in Urban Environments," in *Foundations for Visual Project Analysis*, ed. Richard C. Smardon, James F. Palmer, and John P. Felleman (New York: John Wiley & Sons, 1986), 240; Bosselmann, *Dynamic Simulation of Urban Environments*, 16; Jones & Jones, *I-220: Cross Lake Visual Impact Assessment*, 3–4.

[283] Bosselmann reports that he learned of the work at Berkeley from Carl-Axel Acking of the Lund Institute in 1973. Bosselmann, "The Berkeley Environmental Simulation Laboratory: A 12 Year Anniversary," 152.

the "viewshed" by representing prospects from the viewpoints Jones & Jones identified as "actually likely to be visited or used by significant numbers of people," among other criteria. Together, these views were determined to be "approximately balanced" with regard to their distance to the highway segments in question.[284] "Insert panels" allowed sections of the model to be swapped in and out, affording flexibility to easily represent 'before' views and the various alternatives. The model was encircled by a cycloramic photographic background of clouds and sky and was placed under bright, overhead lighting to suggest daylight. Deploying the modelscope, the Berkeley team imaged the model in its multiple arrangements, yielding photographic stills variously representing a driver's view across the bridge alternatives, a boater's view underneath, and a pedestrian's view from the shore. The resulting images were stitched together by stop-frame animation to yield moving films.[285]

These model simulations on film were interpolated into a study whose method explicitly followed the guidelines Jones & Jones had developed for the Federal Highway Administration in the immediately preceding years. Jones & Jones consulted with Kenneth Craik and subcontracted with local planning firm Urban Analysts, Inc., to develop population sampling techniques and recruitment strategies for the study.[286] Together they identified nine key constituent groups—seven representing local residents arranged by neighborhood and two groups of non-residents engaged in "passive recreation" in the area, including drivers deemed "likely to cross the lake on I-220… whose travel could be enhanced by the visual experience of this crossing" and lake users engaged in activities like sailing, boating, fishing, wildlife observation, or strolling. A recruitment goal of at least 20 representatives for each group was set, which admittedly "approache[d] the lower limit for a statistically reliable sample." Urban Analysts sought to recruit participants randomly: sourcing

---

[284] Jones & Jones, *I-220: Cross Lake Visual Impact Assessment*, 17, 20.

[285] Ibid., 24–25.

[286] J. Thomas Atkins and William G. E. Blair, "Visual Impact of Highway Alternatives," *Garten Und Landschaft*, no. 8 (1983): 635.

contact information from things like telephone directories, tax assessor's records, local companies' employee directories, and membership lists for the local yacht club, a computer program randomly generated constituent samples who were then repeatedly contacted by telephone and by mail to solicit their participation. Two additional groups supplemented the initial nine: uninvited, walk-in participants formed a tenth, and a "professional panel" of experts based in Seattle with experience in visual assessment served as the eleventh—as a control group. In total, about 240 individuals participated in the visual impact tests, with the groupings of users standing in, at least in part, as proxies for shared values and shared potential impact: the participants organized by neighborhood of residence, for example, were thought to share similar levels of viewer exposure as a result of their distance to the bridge, constituting a direct influence on visual impact, while participants grouped by forms of activity were thought to necessarily demonstrate differing degrees of viewer sensitivity and "emotional involvement," indirectly conditioning their response. The impact assessment, to be sure, urged "caution" regarding this sampling method, however: group responses were not weighted relative to their share of the total population in the study area, and thus responses from residents in less populated neighborhoods were overvalued where responses from residents in more heavily populated neighborhoods were given less weight.[287] No attempt to account for racial difference, let alone equity, it seems was made. With questionnaire packets in hand, the test participants were thus prompted:

> Thank you for coming to this presentation. We are studying how I-220 could change the appearance of the Cross Lake area. We asked you here today to help us learn how the public would respond to these changes…
>
> We want you to help us identify and compare the visual effects of these three options. To do this, we will show you a number of film scenes made from scale models of the Cross Lake area. Some of them illustrate existing views. Others show what a particular view would look

[287] Jones & Jones, *I-220: Cross Lake Visual Impact Assessment*, 29–34, 39.

> like in the future if one or another of the options is built. We will ask you several questions about each of these scenes and ask you to mark your answers in this packet.[288]

Instructed in this way, the sample viewed the Berkeley simulations in 15-second intervals and rated scenes for natural beauty and personal preference on 5-point Likert scales. Subjects were also presented with before-and-after views and asked to quantify the degree of change and visual intrusion in each (figs. 2.30 and 2.31). The simulated driver's-eye views in particular required the development of new forms of questioning: "Because these were new views and could not be compared to existing conditions, the format of the questions had to be changed to deal with the potential beneficial impacts of increased scenic appreciation and the personal importance of these views."[289] Viewers rated their overall preferences for each of three bridge alternatives—conspicuously, however, the no-build option was excluded from consideration. Reflexively, the simulations themselves were called into question, too: subjects were asked whether each simulated scene had "increased or decreased [their] appreciation of the Cross Lake area" and to rate the "fairness" of the presentation as a whole (figs. 2.32 and 2.33).[290] In total, subjects answered approximately 200 questions each during the course of the one-and-a-half-hour procedure, following the response formats that had been designed in close consultation with Kenneth Craik to facilitate the production of quantified data to allow statistical analyses performed by computer.

The results of the closed-door impact tests purported to demonstrate that while each alternative was rated roughly equivalently for the *average* viewer, one alternative—the state's preferred route, with the longest bridge span—would affect about a tenth of the total viewers that the others did, owing to the fact that it was farthest from the majority of neighborhoods along the

288 Ibid., A2-1.

289 Ibid., 35.

290 Ibid., A2-1–A2-26.

lake sampled in the study.[291] Conspicuously, two groups expressed disagreement with this seeming consensus: recreational users of Cross Lake as well as viewers in one residential neighborhood located closest to the state's preferred route registered much higher negative visual impacts to the routing. That is, if recreational users demonstrated a greater degree of "viewer sensitivity" to the state's preferred route, the lower aggregate "viewer exposure" to that route, as constructed by the design of the sample, rendered it the least harmful of the possible options. Jones & Jones acknowledged that this strategy yielding a "single index of response" covered over such differences across the groups, and thus had to be understood, to some extent, as "deceptive." But, they averred, "the need for a simple summary of the response results is also recognized."[292]

This period was one in which the discipline of psychology was increasingly called into question for the sociopolitical effects of applied statistical and psychometric techniques more broadly—perhaps exemplified in some ways in the construction of the response data for the Cross Lake study. Personality psychologists had, for some time, been aware of this concern, as perhaps a self-conscious reaction against a longer history of psychometric and statistical techniques being interpolated into manipulative and discriminatory practices. The American Psychological Association had acknowledged this legacy some years earlier, in 1974, upon its issuance of updated standards for psychological tests, which made revisions to the earlier 1966 edition in part necessitated by "an awakened concern about problems like invasion of privacy or discrimination against members of groups such as minorities or women." The Association carefully deemed these to be "more a result of the ways in which tests have been used than of characteristics of tests

[291] Blair, "Visual Impact Assessment in Urban Environments," 241; Jones & Jones, *I-220: Cross Lake Visual Impact Assessment*, 7.

[292] Jones & Jones, *I-220: Cross Lake Visual Impact Assessment*, 39.

themselves" and laid out explicit standards for how these tests should be deployed.[293] The capacity for instruction sets to condition test takers' responses, too, formed a key part of this concern: in his study on the Connecticut River Valley, Ervin Zube, for one, cited the problem of "good subject syndrome" in which participants are predisposed to provide answers that appease the experimenters.[294] Perhaps to wit, the Cross Lake study prompted the sample with the question, "Did the simulation increase your appreciation of the area…?," to which the professional panel indicated a slight increase in appreciation, while local residents and users registered a slight decrease, with the state's preferred route causing less of a decrease than the other options. In regard to items querying the perceived fairness of the simulations, the study results affirmed that participants had "judged the presentations to be fair, not biased in either a favorable or unfavorable direction."[295]

The conclusions of the Cross Lake visual impact study also suffered, in different ways, on closer examination: though the report carefully affirmed in text that all three alternatives "would cause significant adverse visual resource effects and that these effects would be on the same general order of magnitude for all options," close analysis of the data visualization in fact reveals that the state's preferred route was estimated to have by far the most significant negative effect on natural beauty—the key concern laid out in section 4(f) of the Department of Transportation Act (fig. 2.34).[296] Obfuscating these effects as being of "the same general order of magnitude," the report carefully accommodates, yet perhaps evades, the alternatives analysis mandated by the Act. Buried elsewhere in the final reporting for the tests is the admission that although one route might be

---

293 American Psychological Association, American Educational Research Association, and National Council on Measurement in Education, *Standards for Educational & Psychological Tests* (Washington, D.C., 1974), 1–2.

294 Zube, Pitt, and Anderson, "Perception and Measurement of Scenic Resources in the Southern Connecticut River Valley," 25.

295 Jones & Jones, *I-220: Cross Lake Visual Impact Assessment*, 46–47.

296 Ibid., 51.

deemed preferable over the others, the "sample generally rated the existing scenes higher in natural beauty than scenes containing any of the three options."[297]

The results were never entered into updated impact statements nor court records. While the visual impact studies were in fact still underway, the Louisiana Department of Transportation and Development successfully appealed Scott's ruling in the 5th Circuit U.S. Court of Appeals. In 1983, the Court upheld the earlier 4(f) determination, rendering the plaintiffs' case moot and allowing the project to proceed without further study.[298] Construction on the 1.6-mile bridge over Cross Lake began in January 1984 and was completed by April 1989, 25 years after it was first proposed, at a cost of $31,000,000.[299] But despite this outcome, the Cross Lake trials reaching the Federal Court of Appeals remain important legal precedents in 4(f) and environmental impact determinations for federal highway projects, having been repeatedly cited as precedents for what constitutes the minimization of harm, the sufficient demonstration of imprudence or infeasibility in alternatives analyses, and "use" as such, with the visual affirmed as a "constructive use."[300]

Berkeley's Environmental Simulation Laboratory briefly sat in this way at the center of consequential transformations in the juridical and regulatory apparatuses charged with reconciling newly refigured, mutually constitutive notions of natural beauty, visual impact, and viewer sensitivity with the state demand for large-scale infrastructure development. If in few distinct ways the Lab represented an attempt to broaden architecture's purchase on the public—whether through

[297] Jones & Jones, 40.

[298] Jim Montgomery, "The Bridge Joke," *The Times*, January 30, 1983, 25; Jones & Jones, *I-220: Cross Lake Visual Impact Assessment*, 7.

[299] "Firm Works into Night on Bridge," *The Times*, October 11, 1984, 1; "Span Across Cross 25 Years in the Making," *The Times*, April 9, 1989, 2.

[300] See James B. McDaniel, ed., *Environmental Law and Transportation*, Selected Studies in Transportation Law, Volume 3 (Washington, D.C.: Transportation Research Board of the National Academies, 2010), 2–30, 2–31, 2–37.

communication, experimentation, arbitration, or, often, some combination of the three—it should be said, although perhaps plainly apparent, that both its ambitions and its specific techniques were received with significant skepticism, if not controversy, among contemporaries in the architectural discipline. As psychologists, state agents, activists, and planners turned to the Lab's simulations toward divergent ends, and while it was successful in securing great sums of external research funding, the Simulation Lab faced significant distrust among architects almost immediately contemporaneous to its development—not least of which came from within the College of Environmental Design itself. Some saw the Lab as too positivistic and, at once, too enmeshed in the workings of governance, and among Berkeley faculty and students, the Lab contended with recurrent critiques over its demands on resources and on space within the building.[301] Already by 1977, just two years after receiving its last grant from the National Science Foundation, Appleyard expressed an imminent threat of closure due to a lack of funding.[302] By the following year, Appleyard admitted in a note to Bosselmann, "Student use is really down."[303] Appleyard found ample cause to defend the work of the Lab, however: in a note to colleagues around 1978 or 1979, he suggested, "The Environmental Simulation Laboratory, which I should remind you, brought in $1,350,000 into the College (and out again) a few years ago, has evolved into a lower key, student-oriented facility, which has actually been very creative."[304] Addressing these issues in a draft letter to Provost George

[301] Landscape Architecture Faculty Committee Meeting Minutes, November 28, 1979, BANC MSS 83/165 c, Carton 11, Folder 9, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

[302] Correspondence from Donald Appleyard to Joseph Esherick, Michael Laurie, Allan Jacobs, and Richard Bender, September 19, 1977, BANC MSS 83/165 c, Carton 11, Folder 8, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

[303] Correspondence from Donald Appleyard to Peter Bosselmann, November 15, 1978, BANC MSS 83/165 c, Carton 2, Folder 1, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

[304] Correspondence from Donald Appleyard to Allan Jacobs and Bob Tetlow, ca. 1978–1979, BANC MSS 83/165 c, Carton 9, Folder 14, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

Maslach requesting an annual budgetary allocation from the University, planning professor Melvin Webber's feedback was frank: "If this thing is so great, why is it broke?"[305]

The Lab's architectural and environmental-personological outputs were already irretrievably entangled in a system of lawyers, bureaucrats, statisticians, consultants, and planners that ostensibly rendered its immediate findings in the specific instance of the Cross Lake bridge moot. But it is in fact perhaps precisely in this manner that evidence of its instrumentalization in the service of the production of a regulatory regime designed to accommodate, however asymmetrically, both demands for citizen participation and the state's will to infrastructure development becomes apparent. On one hand, subjects were enthusiastic to participate in these studies, identifying what they thought to be an opportunity to shape their local environments, but they were nevertheless interpolated into a particular condition—a particular set of cognitive frameworks, one might argue—by way of the specific, strategic chaining together of techniques and media forms. The time-based simulations afforded immersive entertainment value, while the personological-psychological testing strategies labored to construct the expert authority of these simulations as veracious technical images. Subjects in the Cross Lake tests, for one, were variously conditioned to accede to a particular, peculiar redefinition of beauty around the notion of viewer sensitivity, the latter of which had the result, at least to some extent, of beginning to desensitize the sample to accepted presuppositions around "natural beauty" and to re-sensitize them to find positive value elsewhere—even on a highway bridge. Such exercises satisfied the political demand for the appearance of governmental engagement across diverse populations—for the performance of consensus.

By some point, if not initially, the Berkeley researchers became well aware of the risks of this interpolation into governance. In his twenty-year retrospective essay on the Simulation Lab, Peter

---

305 Draft Correspondence from Donald Appleyard and Kenneth Craik to George Maslach, Melvin Webber, and William Garrison, May 18, 1978, BANC MSS 83/165 c, Carton 11, Folder 12, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

Bosselmann acknowledged that the Lab's simulations had in certain cases been used because "the state wanted to influence public opinion."[306] Such use of the Environmental Simulation Laboratory would come to be considered objectionable by the project directors, as evidenced by the relatively late addition of a series of new principles to the Lab's mission statement:

> There is only one way to avoid such conflicts… An organization or individual interested in commissioning the Lab services must understand that the ultimate client of simulations is not the user who in fact pays for this service. Rather, the simulations are prepared for the benefit of the decisionmaking body… The client is the concerned public. If simulations are to remain credible as an aid in the decisionmaking process, then it is critical for simulators to consider the decisionmakers as the ultimate client of the work. Because this notion is of utmost importance, we have made it the first principle of our mission statement at Berkeley:
>
> 'The primary goal of the Berkeley Simulation Laboratory is to provide the most accurate and comprehensible simulations possible to assist those who are evaluating plans at all stages in the planning process…'[307]

And later:

> Again, this notion of impartiality is so important that we have made it the third principle of our mission statement at Berkeley:
>
> 'In all cases it should be understood that the sole purpose of the simulation laboratory is to provide information. Under no circumstances will the staff of the laboratory become involved in the process of negotiation, arbitration, or decisionmaking.'[308]

A desire to repress this tendency notwithstanding, the Environmental Simulation Laboratory's capacity to collapse the projective into the predictive and the persuasive rendered it a potent means to work out the newly charged social, aesthetic, and environmental concerns around the matter of infrastructure development, and highways in particular, in the United States after about 1970. The deliberate technological and technical choices that constituted the Lab's methodology had the effect of refiguring both the legal mechanisms and the psychological discourses attending the relationship between environments and individuals. For a time, this twin redefinition of

---

[306] Bosselmann, *Dynamic Simulation of Urban Environments*, 14.

[307] Ibid., 15.

[308] Ibid., 18.

environment and of human subjects was understood to be requisite in fabricating a new politics of consensus, however fragile.

Chapter 3 *Signal Detection, Behavioral Economics, and Digital Perspective*

The significant postwar expansion of strip mining across the United States, and in the southwest in particular, catalyzed fundamental transformations in the visual management of landscapes. In Utah alone, the annual production of coal had risen from 9.2 million tons to 12.3 million tons in the two years between 1977 and 1979, with projections by the Department of Energy suggesting that coal production in the state could reach 43 million tons by 1990, an ambition at least in part informed by national energy policy following the 1973 oil embargo.[1] These resource interests placed newfound pressures on matters of air quality, which in the period turned increasingly onto the particular problem of visual perception. If the first chapter of this dissertation had largely concerned hand-painted photographic composite imagery, the emergence of cognitivist theories of mind, and nuclear power generation, and if the second chapter had addressed moving image-based model simulation, techniques in personality psychology, and the federal highway program, this chapter, in turn, centers coal extraction in the southwestern United States, where the twin issues of visibility and visual intrusion became subject to particular contestation as a result of a number of pieces of newly passed federal legislation and resulting regulatory directives. These developments required the specific turn across disparate actors—landscape architects, atmospheric scientists, economists, forest managers, and computer programmers, especially—to new strategies of visualization, which increasingly took the form of digitally generated perspectival imagery (figs. 3.1–3.3). The application of these visualizations in projecting and adjudicating matters of visual impact, in turn, necessitated specific, though variable recourse to concepts in psychophysics, updated by way of methods developed for the theory of signal detection, which were variously interpolated into

[1] U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4* (Washington, D.C.: U.S. Department of the Interior, 1980), II-29.

behavioral-economic frameworks toward federal bureaucratic, cost-benefit-analytic ends. Emergent across these efforts, this chapter will show, were novel visual ecologies embedded in increasingly computational models of governance, in which the administrative state's burgeoning capacity to manage geographic and contextual specificity within a generic, impersonal system addressed broader challenges to late twentieth-century federalism in the United States.

In 1976, Utah International, Inc., a construction and mining company which in the same year had been acquired by General Electric for $2.17 billion, first put forward what would become a highly contentious proposal to the U.S. Geological Survey to develop strip mining on some 27,000 acres of federally owned land it held leases and agreements to in the hills around Alton, Utah, in the state's southern extent.[2] In partnership with Nevada Electric Investment Company, Utah International, Inc., estimated that in total approximately 290 million tons of coal were available for surface mining on these lands, from which about 11 million tons could be extracted per annum for twenty to twenty-five years, thus roughly doubling the state's annual output.[3] Though primarily sited on lands overseen by the Bureau of Land Management, the project drew especial controversy owing to its immediate proximity to lands governed by the National Park Service and United States Forest Service. Most pressingly was the matter of Bryce Canyon National Park, first established as a national monument by presidential proclamation in 1923, at whose southern extremity sits Yovimpa Point, one of the park's thirteen major scenic outlooks, approximately five miles from the eastern

---

[2] For a corporate history of Utah International, Inc., see Sterling D. Sessions and Gene A. Sessions, *A History of Utah International: From Construction to Mining* (Salt Lake City: University of Utah Press, 2005).

[3] United States Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, iii-1; II-27; Michael Hatfield, A. J. LeRoy Balzer, and Roger E. Nelson, "Computer-Aided Visual Assessment in Mine Planning and Design," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 323; Joanne Omang, "Bryce Canyon Coal Mining Compromised," *Washington Post*, December 17, 1980; "The View From Yovimpa Point," *The New York Times*, October 8, 1981, sec. Opinion.

limit of the proposed mines.[4] Among the key concerns raised as a result of this proximal condition were the thousands of acres of mined lands that would lie directly and conspicuously within immediate views from Yovimpa Point—what would be identified in the period as "visual intrusions" on the landscape—as well as the more insidious, pervasive "visibility" effects caused by diminished air quality associated with blasting, excavation, equipment movement, and twenty-four-hour flood lighting, thought to pose impacts across the national park and the region more broadly.[5]

The project for coal extraction was to serve a broader, $4-billion proposal for the Allen-Warner Valley Energy System, planned by parent company to Nevada Electric Investment Company, the Nevada Power Company, in conjunction with Southern California Edison, Pacific Gas and Electric Company, and the city of St. George, Utah. Coal mined in the Alton hills was to be trucked to a processing facility where it would be crushed and mixed with water to form a slurry, which was then to be transported by way of pipelines to two coal-fired, steam-electric power generation plants, the 500-megawatt Warner Valley Powerplant in Warner Valley, Utah, and the 2,000-megawatt Harry Allen Powerplant in Dry Lake, Nevada, with 84 percent of the generated power to be directed to users in Southern California by way of a newly installed, high-voltage electrical transmission system. Various water needs for slurry production and for power plant cooling required additional infrastructure including reservoirs, pumping stations, and pipelines, with water for processing and transport to be drawn entirely from the Navajo Sandstone Formation.[6] Explicitly positioned, according to the California Public Utilities Commission, as "a

---

[4] U.S. Bureau of Land Management, ed., *Draft Environmental Impact Statement on the Allen-Warner Valley Energy System* (Cedar City, Utah: U.S. Department of the Interior, 1980), 3-24; National Park Service, *Results of National Park Service Visitor Survey Conducted At Bryce Canyon National Park Summer 1980* (Washington, D.C.: U.S. Department of the Interior, 1980), 4, Nina Dougherty papers, 1949-2010, Accn 2002, Box 73, Folder 5. Special Collections, J. Willard Marriott Library, The University of Utah.

[5] "Bill May End Mining Threats To Bryce," *National Parks* 64, no. 5/6 (May/June 1990): 12.

[6] U.S. Bureau of Land Management, ed., *Draft Environmental Impact Statement on the Allen-Warner Valley Energy System* (Cedar City, Utah: U.S. Department of the Interior, 1980), S-1; United States Geological Survey, *Development of Coal*

matter of national importance," the project was estimated to have had the capacity to generate energy equal to that of approximately 25 million barrels of oil per year.[7]

Both projects garnered significant criticism for their projected social, ecological, hydrological, and public health-related effects, but for opponents of the Alton strip mine it was the matter of the visual that posed the most pressing concern. As the draft environmental impact statement for the Allen-Warner Valley energy system affirmed, "southwestern Utah historically has some of the most pristine air quality in the nation," for which reason "the visual resource at Bryce Canyon National Park is considered one of the most important aspects of visitor enjoyment."[8] Responding to impacts projected to result from these coal projects, the National Park Service asserted, "Undoubtedly the silence and solitude, so profound at Bryce, would be adversely affected."[9] Exceptionalism, it seems, was at risk.

Addressing such concerns early on in 1975, Utah International disseminated documentation in preparation of the Allen-Warner Valley energy system environmental impact statement which acknowledged that elements of the coal project would be visible from Yovimpa Point in Bryce Canyon, but asserted that from this overlook mining would appear only as "a thin, almost continuous strip of land" with no "easily distinguishable" details—"not, in total, a distinctive landmark in the overall panorama." To mitigate these assumedly minor impacts, Utah International submitted that "a special interpretative exhibit" could be installed at the overlook "which describes

---

Resources in Southern Utah: Regional Analysis, vol. 1 (Washington, D.C.: U.S. Department of the Interior, 1979), I-13; Omang, "Bryce Canyon Coal Mining Compromised."

7 U.S. Bureau of Land Management, *Draft Environmental Impact Statement on the Allen-Warner Valley Energy System*, S-8; 1-2.

8 Ibid., 3-24.

9 National Park Service, *Statement for Management: Bryce Canyon National Park* (Washington, D.C.: U.S. Department of the Interior, 1983), SMF-7. See also U.S. Bureau of Land Management, *Final Environmental Impact Statement: Proposed Kaiparowits Project* (Washington, D.C.: U.S. Department of the Interior, 1976); Environmental Research & Technology, Inc., *Kaiparowits Coal Development and Transportation Study* (Fort Collins, Colorado: Environmental Research & Technology, 1980); United States Geological Survey, *Development of Coal Resources in Southern Utah: Regional Analysis*; United States Geological Survey, *Development of Coal Resources in Southern Utah: Site Specific Analysis*, vol. 2 (Washington, D.C.: U.S. Department of the Interior, 1979).

the mining operation, its role in the overall Allen-Warner Valley Energy System, its basis in terms of Project Independence, and the reclamation plans and activities in the project area, including a description of any and all future uses that will be of direct public benefit as a result"—in order "to educate the park visitor to the history and significance of the man-made activities or events which he is seeing in the natural setting."[10] Elsewhere, a project consultant averred that land reclamation proceeding "a rate equal to the rate of surface disturbance" should result in "no long-term adverse visual impacts."[11] If such claims were understood, to some extent at least, to suffice early in the project's development, these assurances would not last long, owing to disputation led primarily by federal agencies, activist groups, and environmental planners, made possible by a number of major legislative and regulatory transformations in place by the end of the decade.

In November 1979, the Environmental Defense Fund, Friends of the Earth, the Sierra Club, and seven Alton-area residents filed a joint Unsuitability Petition arguing that more than 500 square miles of lands in and adjacent to Bryce Canyon National Park and Dixie National Forest, including those then under lease to Utah International, should be designated unsuitable for surface mining (fig. 3.4).[12] Amid claims regarding the infeasibility of land reclamation and negative impacts to water resources and agricultural productivity in the area was the allegation that coal mining in the Alton hills "would seriously damage Bryce Canyon National Park," causing "irreparable harm":

> … surface coal mining operations in the affected area, which abuts Bryce Canyon, would scar the Park's scenic vistas, significantly reduce visibility and other air quality related values, threaten the fragile and unique geologic formations for which Bryce Canyon is famous, and damage the Park's ecological system. These adverse effects would significantly diminish the

---

[10] Bechtel Power Corporation, Stearns-Roger, Inc., Utah International, Inc., Southern Pacific Pipe Lines, Inc., *Allen-Warner Valley Energy System: Environmental Assessment*, vol. 5: Alton Coal Field (United States, 1975), 2.12-3; 4.12-2.

[11] Hatfield, Balzer, and Nelson, "Computer-Aided Visual Assessment in Mine Planning and Design," 324, 326.

[12] U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*; U.S. Office of Technology Assessment, *An Assessment of Development and Production Potential of Federal Coal Leases* (Washington, D.C.: United States Congress, 1981), 263.

> educational, aesthetic and recreational experience of the thousands of persons who visit the Park each year.[13]

Though the petition cited impacts to "the visitor experience" stemming from increased noise levels and odors, as well as vibrations caused by blasting, here visual matters took primacy. The mining operation, the petitioners maintained, would produce visual effects on two importantly distinct registers. The physical appearance of infrastructural elements, extraction activities, and insufficiently reclaimed lands as features in the viewshed from Yovimpa Point were thought to constitute visual intrusions which could "permanently scar the Park's panoramas." At once was the more pervasive matter of visibility: increased atmospheric particulate concentrations were considered likely to adversely affect visual range and clarity throughout the park, thus causing harm to scenic values even in areas where the mines might not be immediately seen.[14]

The joint petition was the very first to be filed and accepted under provisions laid out in the recently passed Surface Mining Control and Reclamation Act of 1977, which had aimed to address environmental impacts stemming from the expansion of surface coal mining across the United States in the period. In addition to standardizing permitting practices, setting environmental performance standards, and laying out provisions for land reclamation, among other things, critically to the case here, the Act detailed procedures for restricting surface mining on certain lands. Disallowed under all circumstances under Section 522 of the Act was surface mining in National Park Service lands and federal Wilderness Areas; in U.S. Forest Service lands, unless it could be demonstrated that there were "no significant recreational, timber, economic, or other values which may be incompatible with such surface mining operations"; and, as would be brought to bear in the

---

[13] Environmental Defense Fund, Friends of the Earth, Sierra Club, Sylvan Johnson, Leon Lippincott, Caroline Lippincott, Jet Mackelprang, Cynthia Myers, Susan Hittson, and Larry Little, "Petition in the Matter of Designating Certain Federal Lands in Kane and Garfield Counties, Utah, Abutting Bryce Canyon National Park and Dixie National Forest as Unsuitable for Surface Coal Mining Operations before the Office of Surface Mining Reclamation and Enforcement," 1979, 14.

[14] Ibid., 14–15.

case of the Alton proposal, in areas "which will adversely affect any publicly owned park… unless approved jointly by the regulatory authority and the Federal, State, or local agency with jurisdiction over the park." Under this stipulation, the National Park Service was therefore afforded some degree, however ambiguous, of regulatory oversight over the challenge to mining in the region. Additionally, Section 522 laid out procedures by which citizens could file petitions of unsuitability along criteria including "incompatib[ility]" with existing land use plans, infeasibility of land reclamation, and impacts to "fragile or historic lands" that might cause "significant damage to important historic, cultural, scientific, and esthetic values and natural systems"—the latter of which figured prominently in the Alton Unsuitability Petition.[15]

Of particular concern here was the matter of jurisdiction. The lands subject to the broader unsuitability filing were in large part federally owned and directly overseen by either the Bureau of Land Management or the U.S. Forest Service, although not insignificant portions were either state-owned or private; under the Surface Mining Control and Reclamation Act, a newly established Office of Surface Mining retained new regulatory oversight for surface coal mining proposals, and the National Park Service was afforded some say in these matters by virtue of the adjacency of lands under its jurisdiction to the contested areas, with the Secretary of the Interior retaining ultimate authority in designations of unsuitability.[16] Assessing key concerns laid out in the unsuitability petition, namely, impacts to visibility and visual intrusion, was complicated by this state of affairs—what was identified in the period as a condition of "intervisibility" across these variously managed lands—coupled with the non-stationary nature of pollutant emissions and atmospheric dynamics.

---

[15] Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. § 1201 et seq.; Environmental Defense Fund, Friends of the Earth, Sierra Club, Sylvan Johnson, Leon Lippincott, Caroline Lippincott, Jet Mackelprang, Cynthia Myers, Susan Hittson, and Larry Little, "Petition in the Matter of Designating Certain Federal Lands in Kane and Garfield Counties, Utah, Abutting Bryce Canyon National Park and Dixie National Forest as Unsuitable for Surface Coal Mining Operations before the Office of Surface Mining Reclamation and Enforcement," 3.

[16] U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*.

That is, visibility and visual intrusion, by their very nature, resisted geographic limits to agency jurisdiction. The case, in this way, required the cooperation of—and frequently resulted in conflict among—the Bureau of Land Management, the National Park Service, and the Office of Surface Mining, all within Department of Interior, as well with the U.S. Forest Service, within the Department of Agriculture, and the Environmental Protection Agency, an independent agency which had been formed following the enactment of the National Environmental Policy Act in 1970.

Somewhat unsurprisingly, the various agencies adopted opposing positions in the matter: the National Park Service and the Environmental Protection Agency each opposed strip mining in the area, with the former having already voiced support, in accordance with agency policy, for the allegations made in the initial petition and submitted as Exhibit 3 in the petition documentation, and the latter arguing in a letter to an Office of Surface Mining administrator that "visibility reduction and visual intrusion" caused by surface mining would represent "unacceptable impacts" to Bryce Canyon National Park, suggesting that "to turn one of our most majestic national parks into a balcony for observing a strip mining operation flies in the face of those values for which our parks stand."[17] The Bureau of Land Management, the State of Utah, and the majority of local jurisdictions and residents, on the other hand, strongly favored coal mining in the region. In a draft management plan, the Bureau of Land Management affirmed that coal resources could be developed in the area on a multiple-use basis, at once affording various protections for air quality, recreational values, and archeological resources, in accordance with the Federal Land Policy and Management Act of 1976.[18]

[17] Environmental Defense Fund, Friends of the Earth, Sierra Club, Sylvan Johnson, Leon Lippincott, Caroline Lippincott, Jet Mackelprang, Cynthia Myers, Susan Hittson, and Larry Little, "Petition in the Matter of Designating Certain Federal Lands in Kane and Garfield Counties, Utah, Abutting Bryce Canyon National Park and Dixie National Forest as Unsuitable for Surface Coal Mining Operations before the Office of Surface Mining Reclamation and Enforcement," exhibit 3; Correspondence from Gene A. Lucero, Deputy Regional Administrator of EPA Region VIII, to Donald Crane, Regional Director Office of Surface Mining, undated, in *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4*.

[18] U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, I-6; II-11.

As briefly introduced in chapter one, the Federal Land Policy and Management Act was the Bureau's organic act and directed the agency to employ comprehensive land-use planning across its lands according to principles of "multiple use and sustained yield," thus balancing the demand for resource extraction—recognizing "the Nation's need for domestic sources of minerals, food, timber, and fiber from the public lands"—against "scenic" and "atmospheric" values, among others.[19] Accordingly, the Bureau of Land Management's Visual Resource Management procedure, also introduced in chapter one, identified the area in question as primarily comprising Class IV lands—that is, lands of lowest relative scenic value, a classification under which greatest degrees of development were to be allowed—with, in turn, only three percent of the petition area deemed Class II, affording the highest level of protection under the Bureau's purview.[20] The Bureau's analysis acknowledged that surface mining would cause short-term exceedances of impact limits for all management classes, though it assured reviewers that in the long term successful reclamation would render these areas compliant with class criteria.[21] Responding to the unsuitability petition, an associate director of the Bureau of Land Management was sure to clarify in a letter to the Office of Surface Mining that the draft unsuitability evaluation "would lead the reader to believe that once these classes are established they cannot be violated. This is not the case, as the VRM classifications are inventory information to be weighed by the decision maker in solving resource conflicts."[22]

---

[19] Federal Land Policy and Management Act, 43 U.S.C. § 1701 (1976).

[20] Bechtel Power Corporation, Stearns-Roger, Inc., Utah International, Inc., Southern Pacific Pipe Lines, Inc., *Allen-Warner Valley Energy System: Environmental Assessment*, vol. 1: System Overview (United States, 1975), 5.1-3; Bechtel Power Corporation, Stearns-Roger, Inc., Utah International, Inc., Southern Pacific Pipe Lines, Inc., *Allen-Warner Valley Energy System: Environmental Assessment*, 1975, 5: Alton Coal Field: 2.12-1.

[21] United States Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, III-8.

[22] Correspondence from Ed Hastey, Associate Director of Bureau of Land Management, to Paul Bodenberger, Office of Surface Mining, October 13, 1980, in *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4*.

During the very same months of debate over the unsuitability petition, the Bureau issued its draft environmental impact statement for the broader Allen-Warner Valley energy system in June of 1980, and its final statement in November of that year. The agency's findings did not support claims to do with the alleged infeasibility of land reclamation in the Alton hills, impacts to Bryce Canyon's geologic formations, and potential damages to local water resources, among other factors.[23] The statement did however find that mining in the eastern portions of the coal field would constitute "a major visual intrusion on the landscape" from Yovimpa Point and could reduce visibility there by five to twenty-five percent, and that the blasting and noise associated with mining would be "perceivable and probably distracting to visitors throughout the park at all times of the year" and thus cause adverse impacts on "recreation and aesthetic values."[24] Such reservations notwithstanding, the Bureau endorsed a partial build out of the broader proposal, with a preferred alternative including the Harry Allen powerplant and associated transmission lines and excluding the Warner Valley powerplant, its associated coal slurry pipeline, and other project elements. The agency deferred action on the controversial Alton mine proposal, awaiting determinations by the Utah State Engineer and the Secretary of the Interior.[25] Elsewhere, the Bureau directly weighed in on the unsuitability petition: in a statement presented at a hearing on the issue, a Bureau of Land Management official recapitulated, "the essence of our summary is that coal can be mined in the major portion of the petition area without undue damage to the resources in the area."[26]

---

[23] U.S. Office of Technology Assessment, *An Assessment of Development and Production Potential of Federal Coal Leases*, 263.

[24] U.S. Bureau of Land Management, *Final Environmental Impact Statement on the Allen-Warner Valley Energy System* (Cedar City, Utah: U.S. Department of the Interior, 1980), S-9.

[25] U.S. Bureau of Land Management, S-22.

[26] United States Bureau of Land Management, "BLM Statement Presented at the OSM Alton Coal Unsuitability Hearing in Kanab," September 29, 1980, in *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4*.

Local and state officials took strident positions against the unsuitability petition. Scott M. Matheson, then governor of the State of Utah, had in the immediate years previous adopted a policy encouraging the development of coal resources especially in the state's southern reaches, with the aim of dispersing impacts away from central Utah which had seen the majority of coal mining in the state.[27] "The state's position," the governor wrote in a letter to the Office of Surface Mining, "is that the Secretary should designate none of the leased lands unsuitable."[28] Local jurisdictions and residents, in turn, assumed increasingly hostile positions, largely commenting in favor of surface mining in written statements and at hearings which garnered hundreds of participants, variously citing impacts to employment, economic growth, and rights to self-determination and local control. A petition endorsed by hundreds of residents of Garfield County, representing "mayors, city and town council members, merchants, representatives of local organizations, ranchers, farmers, government workers, teachers, housewives, and private citizens from every walk of life who live, work, and own property in Garfield County," suggested, among other things:

> We live here and work here; our ancestors recognized the inherent value and beauty of the area long before environmentalists donned their first pair of fancy hiking boots and expensive backpacks. We care about our lands; we understand our area. We are better able determine what is best for our area than people who don't live here and don't understand the vicissitudes of earning a living and raising a family here…
>
> We favor economic growth but we have had to watch every opportunity die unborn because government regulations, interference, and encroaching restrictions have strangled each attempt.
>
> We object to the ever-growing and expanding domination by the federal government in its administration of the federal lands within our boundaries as it has moved relentlessly closer to total control.

---

[27] United States Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, II-13.

[28] Correspondence from Scott M. Matheson, Governor of the State of Utah, to Paul Bodenberger, Office of Surface Mining, October 14, 1980, in *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4*.

> We object to the continual use of our tax money on endless environmental studies and efforts to increase the power of the already too powerful government agencies which are serving only to further diminish our freedoms.[29]

In a written response to the matter, two aggrieved local politicians wrote, "We state, first of all, that we who live in Garfield County are an endangered species, and that, as such, we are deserving of at least the same consideration and concern as the woundfin minnow of the Virgin River." Identifying themselves and other area residents as the "people whose ancestors settled the land," they argued:

> There is a very real bond that exists between them and their land; they have worked it, they have loved it, they have cared for it. They are puzzled, indeed, insulted that others could think they would willingly allow it to be destroyed by misuse. Didn't they appreciate its beauty enough to part with the most beautiful portions so that others could enjoy it. They owned Bryce Canyon; they owned Capitol Reef; they owned Canyonlands and every other beautiful place so appreciated by the tourists who outnumber them often as much as 500 to one. But enough is enough. They gave freely at first, but the federal government continued to take and to take and would take even more. What it does not openly take it would control nevertheless.[30]

Entwined in this political history were, in this way, strong, mutually reinforcing currents of anti-federalism, anti-elitism, pro-laissez faire capitalism, grievance politics, and an unrepentant, settler-colonial fantasy.

The concerns of Indigenous groups were little accounted for in the bulk of these studies. "Cultural resource surveys," to be sure, were carried out in the petition area, but these were largely confined to archaeological analysis for sites representing Fremont, Anasazi, Paiute, and Navajo cultures.[31] One notable exception, a study conducted by the consulting firm Cultural Systems Research, Inc., under contract to Southern California Edison Company, in 1978 and 1979 for the

---

[29] Petition, Garfield County, 1980, in *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4*.

[30] Kathryn J. Thomas and Laurie Holley, "A Response to the Southern Utah Petition Evaluation Document and Draft 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4," October 11, 1980, in *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4*.

[31] United States Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, II-14; Forrest Richard Hauck, *Cultural Resources Evaluation of South-Central Utah, 1977-1978*, Cultural Resource Series No. 4 (Salt Lake City: U.S. Department of the Interior, Bureau of Land Management, Utah, 1979).

Allen-Warner Valley energy system did attempt to offer some account for various Indigenous perspectives. Conducting ethnographic and historical studies with Indigenous groups the firm identified as either historically or currently associated with lands likely to be affected by the transmission system—the Mojave, Chemehuevi, Paiute, Serrano, Kawaiisu, and Kitanemuk peoples, primarily—Cultural Systems Research developed short- and long-term projections for the cultural, religious, archaeological, aesthetic, recreational, and economic effects the high-voltage electrical transmission system was thought likely to exert.[32] Delineating a theoretical approach informed by cultural ecology, ecological anthropology, and general systems theory, with a grounding in physics, cybernetics, information theory, and game theory, the firm's anthropologists variously deployed open-ended interviews, structured surveys, and contingent economic analysis to identify potential impacts.[33] Their findings ranged widely: anonymous responses among those surveyed from Mojave groups, for example, suggested some support for electricity generation if it resulted in lower energy costs; some opposition to the transmission lines for visual, aesthetic, and auditory effects; and a fair degree of resignation, with one respondent stating, "No matter what we say, they'll do it anyway."[34] Compiling these findings, the primary outcome for this work was a rating, on scales from one to ten, of the "cultural sensitivity" for particular sites along the proposed transmission lines, in order to facilitate siting.[35]

---

[32] Lowell John Bean and Sylvia Brakke Vane, "Allen-Warner Valley Energy System: Western Transmission System: Ethnographic and Historical Resources," Report to Southern California Edison Company (Menlo Park, CA: Cultural Systems Research, Inc., December 15, 1979), 1-1–1-3, 7-5, Richard Stoffle Collection, University of Arizona Libraries, Special Collections.

[33] Ibid., 2-1, 2-10.

[34] Ibid., 6-2–6-3.

[35] Ibid., 7-9–7-14. With regard to an analogous case of energy development in the Navajo Nation, anthropologist Dana E. Powell has argued that this relationship between the U.S. government and Indigenous nations represented a form of colonialism not reducible to settler colonialism, but rather a form predicated on lease-holding and resource extraction. Dana E. Powell, *Landscapes of Power: Politics of Energy in the Navajo Nation* (Durham, NC: Duke University Press, 2018).

Coincident throughout this specific history, then, were mutually constitutive conflicts between federal and local control, environmental rights and individual autonomy, and legacies of the ongoing colonial project. The particularity of the geographic and political context perhaps bears underscoring: at the time of the filing of the unsuitability petition, the federal government owned and managed a significant majority of lands within the state of Utah, with the Bureau of Land Management alone charged with overseeing approximately 43.5 percent of the state's territory. The bevy of environmental statutes enacted during the same period, including the Surface Mining Control and Reclamation Act, was forced to contend with constitutional limits to federal power, forging a cooperative federalism approach in which the federal government laid out regulatory frameworks which states were then expected to carry out. This too was the period which witnessed the emergence of the Sagebrush Rebellion, a political movement primarily in the western states which agitated for greater state control over federally managed lands largely in response to increased grazing fees and proposed limits on herd size, which Ronald Reagan later capitalized on in his first presidential campaign.[36] Brought to the surface here, then, were renewed, yet ongoing conflicts between federal, state, local, and individual power—a key problem pervading political arrangements in the U.S., which was to be managed in this case by a burgeoning administrative apparatus.

It was in this fraught political context that, as this chapter will show, a flurry of new analytical techniques, both analog but increasingly digital, converged around the controversial proposal for coal strip mining on the Alton hills in southern Utah. Mustered to mediate the newly pressing matters of visibility, visual intrusion, and the burgeoning regulatory apparatuses around them, the development of new, computer-generated forms of visualization linking perspectival rendering to data mapping afforded various federal agencies, activist groups, energy conglomerates,

---

[36] For more on this history, see James R. Skillen, *This Land Is My Land: Rebellion in the West* (New York, NY: Oxford University Press, 2020).

and environmental consultancy firms with potent media for evidence generation, contestation, and refusal. The interpolation of these visualization methods alongside analog techniques into recently developed, comprehensive land-use planning programs and visual management frameworks, both largely indebted to the research sponsored by the U.S. Forest Service, promised to render visual effects available to newly expanded regulatory oversight and federal bureaucratic management. Subjecting the twin matters of visibility and visual intrusion to regulation in this way at once required the deliberate chaining together of techniques from psychophysics, which made possible the translation of atmospheric variables to optical and psychological effects; the theory of signal detection, charged with accounting and correcting for individual biases thought to condition sensation; and contingent market valuation, which promised to ascribe economic value to the aesthetic matter at hand, a practice identified in part with what would later be termed behavioral economics. Suffused through this effort, in this way, was a double problem of relating atmospheric variables to perceptual effects and rendering perceptual effects available to economic analysis, with cost-benefit analytic frameworks increasingly positioned in the period to allow the aesthetic, the social, the material, and the economic to be accounted for on purportedly equal footing. At the center of these currents, hybrid forms of analog and computer-generated visualization were uniquely primed to mediate and arbitrate newly identified environmental impacts to the visual—a capacity predicated on, reflected in, and furthered by a federalist administrative model of governance.

I. "Visual Vulnerability," "Visual Absorption," and the U.S. Forest Service

Matters of visuality had entered into systems of legality in the years immediately preceding the controversy over the Alton coal mines. Although the unsuitability petition most directly bore on provisions laid out in the 1977 Surface Mining Control and Reclamation Act, it was another significant piece of legislation passed the same year, the Clean Air Act Amendments of 1977, that had identified visibility and visual intrusion as specific, legally bounded notions whose insistent ambiguities would trigger legal and practical uncertainty as exemplified by the Alton case. A longer history of the federal role in managing air quality in the United States would begin with the Air Pollution Control Act of 1955, followed by the numerous subsequent pieces of legislation including the Clean Air Act of 1963 and Air Quality Act of 1967. Perhaps most significant, however, in this string of legislative acts, the Clean Air Act of 1970 had, among other things, directed the establishment of comprehensive regulations to limit emissions and substantially expanded federal enforcement authority. One of a number of new regulatory mechanisms stemming from the 1970 Act, the National Ambient Air Quality Standards set nationwide limits for atmospheric concentrations for a number of pollutants including particulate matter, sulfur oxides, and nitrogen dioxide, among others.[37] Critics argued however that these nationally determined, uniform standards made little sense given the legislation's stated aims: if the same metrics were to govern both urban cores and national parks alike, the standards would likely become either practically unattainable for cities or permissive of great degrees of deterioration in already-pristine areas. Recognizing the need for a geographically differentiated approach with area-specific baselines "as a matter of equity," Congress took up these matters beginning in 1976 and developed a new classification system codified in the Clean Air Act Amendments of 1977.[38] This framework for what it identified as the Prevention of Significant Deterioration in areas which had already attained the National Ambient Air Quality Standards designated location-specific air quality classes allowing for specified maximum increases in pollutant concentrations at different levels of protection, ranging from Class I, allowing

[37] Richard K. Lattanzio, *Clean Air Act: A Summary of the Act and Its Major Requirements* (Washington, D.C.: Congressional Research Service, 2022); Julie R. Domike and Alec C. Zacaroli, eds., *The Clean Air Act Handbook*, 4th ed. (Chicago: American Bar Association, 2016).

[38] U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *Protecting Visibility: An EPA Report to Congress* (Washington, D.C.: U.S. Environmental Protection Agency, 1979), n.p.

little degradation in air quality and comprising the majority of national parks and wilderness areas, to Class III, allowing the largest incremental increase in emissions and, correspondingly, greatest degrees of development. The legislation stipulated new review and permitting requirements for proposed emissions sources affecting these areas, requiring demonstration that projected emissions would not be in violation of class increments.[39]

Section 169A of the 1977 Amendments to the Clean Air Act went further in strengthening federal oversight over visual air quality. Identifying a new "visibility protection" program, the section "declares as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory class I Federal areas which impairment results from manmade air pollution." The section directed the Environmental Protection Agency to develop and promulgate new techniques for accounting for visibility including "methods for identifying, characterizing, determining, quantifying, and measuring visibility impairment"; "modeling techniques" to identify "the extent to which manmade air pollution may reasonably be anticipated to cause or contribute to such impairment"; and "methods for preventing and remedying such manmade air pollution and resulting visibility impairment."[40] Additionally, Section 165 of the Amendments identified federal officials overseeing parks and wilderness lands as having "an affirmative responsibility to protect the air quality related values (including visibility)" of lands under their purview, affording them some authority to review proposed projects.[41] In these ways, the Amendments of 1977 significantly restructured the federal role in regulating air quality, with new, geographically specific standards for visibility protection necessarily taking into account scenic and recreational values and with an affirmative role extended to Federal Land Managers in assessing

[39] Clean Air Act Amendments of 1977, 42 U.S.C. § 7470 et seq.

[40] Clean Air Act Amendments of 1977, 42 U.S.C. § 7491.

[41] Clean Air Act Amendments of 1977, 42 U.S.C. § 7506; United States Environmental Protection Agency, Office of Air Quality Planning and Standards, *Protecting Visibility: An EPA Report to Congress*.

impacts.[42] The desideratum of how exactly federal agencies would develop the visibility assessment methods stipulated in the legislation remained however a key challenge.

With twin charges laid out under authorities granted by the Clean Air Act Amendments of 1977 and the earlier National Park Service Organic Act of 1916, the National Park Service understood its mandate to include the protection and enhancement of air quality-related values in its parks, specifying such values to entail "visibility and those scenic, cultural, biological, and recreation resources of an area that are affected by air quality."[43] Under these terms, the National Park Service sought to contend with the matter of surface coal mining adjacent to Bryce Canyon. Although the national park was identified as a mandatory Class I area under the new regulatory framework, the remainder of the petition area was designated Class II, indicating that moderate air quality degradation could be accommodated.[44] The key concern to be worked out here, then, was the matter of adjacency. In a 1979 report made to Congress, the Environmental Protection Agency acknowledged the ambiguity of this particular circumstance: "The location of visibility impairment is extremely important in terms of visibility protection because the national goal states that visibility in class I areas is to be restored and protected. It is uncertain whether this definition includes impairment caused by pollution outside of a class I area." The report suggested however that it was "reasonable and consistent" with common interpretation of the term "visibility" to include "the view of unobstructed objects located inside and outside of the area." To illustrate this very problematic was a photograph depicting Navajo Mountain from Bryce Canyon (fig. 3.5). "The

[42] Opposition to many of these provisions was led by Utah Senator Jake Garn who argued the resulting regulations would infringe on states' rights to self-determination and the national need for coal infrastructure, but his filibuster in fact gave legislators time to strengthen the visibility protection provisions. Ronald L. Rudolph, "Visibility Protection: A Historical Perspective with Suggestions for Policy Implementation," in *Proceedings of the Workshop in Visibility Values, Fort Collins, Colorado, January 28-February 1, 1979* (U.S. Department of Agriculture, Forest Service, 1979), 28.

[43] 43 Federal Register 15016. National Park Service, *Air Quality in the National Parks: A Summary of Findings from the National Park Service Air Quality Research and Monitoring Program* (U.S. Department of the Interior, National Park Service, Air Quality Division, 1988), 1-1.

[44] U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, II-3.

mountain, not in a class I area," the report explains, "is usually visible from Bryce Canyon. In EPA's view, important views extending outside the boundaries of class I areas are part of the visibility value of the area, and are included in the national goal."[45]

If the Clean Air Act Amendments of 1977 had triggered jurisdictional uncertainties regarding views across differently managed lands, analogous ambiguities attended the development of the Surface Mining Control and Reclamation Act. Early versions of that legislation included provisions for buffer zones which would have protected areas adjacent to national parks from surface mining development, but defining the extent of these zones proved controversial, and such provisions were excluded from the final legislation.[46] Later regulations promulgated by the Office of Surface Mining in response to the Clean Air Act Amendments did however include provisions for the protection of "fragile lands"—defined as comprising not only exceptional areas but also "buffer zones adjacent to the boundaries of areas where surface coal mining operations are prohibited," a provision which was cited in the Alton unsuitability petition.[47] Section 169A of the Clean Air Act Amendments however had specifically disallowed "the use of any automatic or uniform buffer zone or zones" in setting parameters for visibility regulations in Class I areas, and thus the matter continued to generate significant uncertainty.[48]

In December 1980, just before a ruling in the unsuitability case was to be issued and about a month before Reagan was to take office, the Environmental Protection Agency promulgated its

[45] U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *Protecting Visibility: An EPA Report to Congress*, 32.

[46] U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, I-4.

[47] 30 CFR §762.5. Environmental Defense Fund, Friends of the Earth, Sierra Club, Sylvan Johnson, Leon Lippincott, Caroline Lippincott, Jet Mackelprang, Cynthia Myers, Susan Hittson, and Larry Little, "Petition in the Matter of Designating Certain Federal Lands in Kane and Garfield Counties, Utah, Abutting Bryce Canyon National Park and Dixie National Forest as Unsuitable for Surface Coal Mining Operations before the Office of Surface Mining Reclamation and Enforcement," 13.

[48] Clean Air Act Amendments of 1977, 42 U.S.C. § 7491.

initial set of regulations addressing the visibility protection provisions outlined in Sections 169A and 165 of the Clean Air Act Amendments. Promising a "phased approach," the Agency put forth regulations pertaining to the relatively straightforward matters of single-source emissions and their effects on National Park and Wilderness lands, while deferring regulations pertaining to the trickier question of multiple-source regional haze and urban plumes, citing the need for better-refined regional atmospheric models for emissions and their effects on visibility.[49] Among the issues addressed in these 1980 regulations was this very matter of adjacency. The EPA put forward a concept for what it identified as "integral vistas" in national parks, or views deemed "integral to the visitor experience and to the purposes for which the area was established."[50] Specifying an integral vista as one in which "a view perceived from within the mandatory Class I Federal area" looks toward a "landmark or panorama located outside the boundary," the provision required Federal Land Managers to identify such views according to criteria including "whether the integral vista was important to the visitor's visual experience," and it directed states and other land managers to give special consideration to these vistas in environmental impact determinations.[51] Legal justification for the extended reach of visibility protections beyond Class I areas was made solely under the aegis of the visibility protection program outlined in Section 169A of the Clean Air Act Amendments, with the EPA arguing that visibility is a "perceptual value" and that "the perception occurs in an area"

---

[49] The latter regulations wouldn't be issued for more than a decade and a half. 45 FR 80084; U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook* (Research Triangle Park, NC: U.S. Environmental Protection Agency, 1981), 1-2; U.S. Environmental Protection Agency, *Developing Long-Term Strategies for Regional Haze: Findings and Recommendations of the Visibility Task Force* (Research Triangle Park, NC: U.S. Environmental Protection Agency, 1984); U.S. Environmental Protection Agency, Office of Policy Analysis, *Methods Development for Environmental Control Benefits Assessment*, vol. VIII: The Benefits of Preserving Visibility in the National Parklands of the Southwest (Washington, D.C.: U.S. Environmental Protection Agency, 1985), 10; Vickie Patton and Bruce Polkowsky, "The EPA's Regional Haze Proposal: Protecting Visibility in National Parks and Wilderness Areas," *Tulane Environmental Law Journal* 11, no. 2 (1998): 300, 308.

[50] National Park Service, "Identification of Integral Vistas Associated With Federal Class I Areas; Guideline Availability and Preliminary List," *Federal Register* 46, no. 10 (January 15, 1981): 3647.

[51] 40 CFR § 51.301, 51.304; United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook*, 1-2.

which is nevertheless affected by impairments whether within or without.[52] Such designation would have afforded no additional protection and was rather understood to be "informational"—states would retain decision-making powers to determine what protections, if any, to extend to such views.[53] In accordance with the proposed regulations, in early 1981 the National Park Service identified 173 views from 136 observation points in 43 of its parks, ranging from 5-degree to 360-degree viewing angles, to be included in the initial Integral Vista program. The view from Yovimpa Point south to the Alton coal fields, perhaps unsurprisingly, was one such proposed vista.[54]

The Integral Vista program, however, was never enacted. Subject to significant litigation and faced with stiff opposition from industry lobbyists, state officials, and other federal managers, the program, its critics argued, would render significant portions of western states unavailable to development.[55] In federal legislative proceedings, commenters argued the program would amount to a "federal land grab" and a "de facto restriction of energy and economic development."[56] No action was taken on the proposed regulations until late 1985, when Secretary of the Interior under Ronald Reagan, Donald Hodel, dismissed the proposal, arguing that the "designation of 'integral vistas' would not be good for the parks." Hodel posited that "formal publication of a list is unnecessary and would only create an atmosphere of confrontation and serve as the basis for expensive litigation,

---

52 The application of Section 165 to areas outside Class I lands was struck down in Alabama Power Company v. Costle. See Jerome Ostrov, "Visibility Protection Under the Clean Air Act: Preserving Scenic and Parkland Areas in the Southwest," *Ecology Law Quarterly* 10, no. 3 (1982): 440–41; 445.

53 "Interior Able To Protect Fully National Parks Without Integral Vista Concept, Hodel Says," Department of the Interior News Release, October 25, 1985.

54 "Interior Able To Protect Fully National Parks Without Integral Vista Concept, Hodel Says"; Philip Shabecoff, "Plan For Vista Outside National Parks Is Rejected," *The New York Times*, October 27, 1985, sec. 1, 29.

55 Cass Peterson, "National Parks Not Always A Breath Of Fresh Air," *Washington Post*, July 8, 1987; Ostrov, "Visibility Protection Under the Clean Air Act," 400.

56 National Park Service, "Identification of Integral Vistas Associated With Federal Class I Areas; Guideline Availability and Preliminary List," 3650.

uncertainty and delay," which "would impair our ability to protect the parks." The Secretary was sure to clarify, however: "This does not mean that we do not wish to protect vistas."[57]

Under the various provisions laid out by the Clean Air Act Amendments of 1977, the Environmental Protection Agency, Utah International, and the Sierra Club Legal Defense Fund each produced competing air quality analyses for the proposed Alton strip mines. Although technically not subject to provisions for the Prevention of Significant Deterioration due to a court decision which determined, among other things, that the program only pertained to single-source emissions and not the type of multiple-source "fugitive emissions" that might characterize strip mine operations, the standards were nevertheless deployed as "familiar and useful yardsticks."[58] These studies made use of Utah International-provided meteorological data and a number of different atmospheric and emissions diffusion modeling techniques to project resulting particulate concentrations. The EPA studies concluded that although *annual* average particulate concentrations stemming from mine operations would not exceed Class I or Class II standards, maximum allowable 24-hour increments would be exceeded for Yovimpa Point at least once or twice a year and for numerous Class II areas with more frequency. Utah International, by comparison, retained the environmental planning firm, Environmental Research and Technology, of Westlake Village, California, to conduct their studies, which, among other things, accounted for increased rates of deposition, or the process by which emissions are removed from the atmosphere. Environmental Research and Technology's analyses indicated particulate concentrations would remain well below the Prevention of Significant Deterioration increments. Countering Utah International's study, the Sierra Club produced an alternate analysis which demonstrated much greater exceedances of pollutant limits; the Office of Surface however quickly dismissed the Sierra Club-sponsored study

[57] "Interior Able To Protect Fully National Parks Without Integral Vista Concept, Hodel Says."

[58] U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, III-3.

for having made what it argued to be a number of incorrect assumptions, corrections for which would reduce estimates to levels closer to Class I increments.[59]

If one primary mode of address accounted for visibility by way of material calculation along these lines, the corollary matter of atmospheric perception remained. As acknowledged in an Office of Surface Mining response to the unsuitability petition, "visibility involves the human perception of the physical environment," and stemming from this fact, "an evaluation of the effects of air pollution on visibility must include a consideration of the process of human visual perception and quantification of the impacts of air pollution on the optical characteristics of the atmosphere."[60] Similarly, National Park Service policy specifically mandated visibility protection "at human levels of perception."[61] This matter of impacts to perception was subject to numerous contemporaneous—and often conflicting—studies by the Bureau of Land Management, the Environmental Protection Agency, the National Park Service, the Office of Surface Mining, and Utah International.[62] Just as had been the case with the controversially proposed Greene County Nuclear Power Plant and the highway bridge over Cross Lake, the problem presented here was how exactly to relate physical and environmental variables, on one hand, to matters of human perception, on the other, and how, then, to base perceptual projections on changes to these environmental variables. Contra recourse to cognitivist theories of mind and personological frameworks mobilized in the former cases, however, the issue of air quality and visibility initially required broad-based recourse to techniques developed in psychophysics, with a physically biased, atomistic mode of address largely centering methods that had been developed in particular for the U.S. Forest Service.

---

[59] Ibid., III-3–III-5.

[60] Ibid., II-3.

[61] U.S. Bureau of Land Management, *Draft Environmental Impact Statement on the Allen-Warner Valley Energy System*, 3-6.

[62] Ibid., 17.

If chapters one and two of this dissertation had dealt with the *specific* problem of reconciling particular infrastructure types against various demands for scenic beauty, aesthetics, and recreation, this chapter concerns the two federal agencies with an altogether different orientation, agencies that were and are concerned the *general* problem of how to consider the aesthetic as but one resource to managed against numerous others—namely, the Bureau of Land Management and the Forest Service. Charged with oversight for vast swathes of federally owned lands especially in the western United States, both agencies had developed exhaustive visual impact methodologies considered largely foundational across other federal agency practices. Although the case bore most immediately on the Bureau of Land Management by virtue of its oversight on the lands in question, the practices which converged around this case were founded in large part upon techniques developed by and for the Forest Service in response to specific pressures. Though both agencies could, at least in part, trace their origins to legislative reforms made to the Homestead Acts beginning in the late nineteenth century, strictly construed, the Forest Service predated the Bureau of Land Management by some four decades, with precursors including the Division of Forestry and later the Bureau of Forestry a few decades prior. The result of a series of legislative maneuvers including the Forest Reserve Act of 1891, the Organic Act of 1897, and the Transfer Act of 1905, the setting aside of lands in the public domain as federal forest reserves had been authorized, with provisions for leasing these lands out for use and resource development. Leasing afforded a novel mechanism by which federal lands could be disposed of to private interests, offering what was understood as a corrective to the earlier Homestead Acts—the Timber Culture Act of 1873, in particular, which had granted tracts to homesteaders if they were to plant trees on a percentage of their land. Seeking to curtail the rampant speculation, fraud, and monopolization of lands then taking place under this guise, the national forest system overseen by the U.S. Forest Service offered new mechanisms for retaining lands under federal control while rendering them available for private development—timber production, especially.[63] These federal leasing frameworks developed by multiple agencies served, in many ways, as key instruments inextricable from longer and ongoing histories of the settler colonial project in this country.

By the early 1960s, dictates around the use of these federal lands changed in tenor, if not in effect. If the Organic Act of 1897 had, among other things, charged the national forests with "furnish[ing] a continuous supply of timber for the use and necessities of the citizens of the United States," by the sixties, a number of controversial, highly publicized examples of clearcutting in national forests, largely serving the rapid growth of single-family housing in the country, garnered significant criticism for adverse impacts to recreational and scenic values, leading to Congressional hearings and litigation in federal court by the first half of 1970s, with important decisions rendered against the Forest Service.[64] In the same years, a number of significant pieces of legislation sought to redirect the agency's priorities, including the Multiple-Use Sustained-Yield Act of 1960, the Forest and Rangeland Renewable Resources Planning Act of 1974, and the National Forest Management Act of 1976.[65] In the case of the 1960 Multiple-Use Sustained-Yield Act—which the Forest Service initially opposed or was neutral on—Congress clarified that national forests "shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes," thus placing timber development on relatively equal footing with various other resources.[66] Under this directive of "multiple use," these various resources were to be developed and managed "in the combination that will best meet the needs of the American people" and "making the most judicious use of the land," in a manner ensuring "harmonious and coordinated management of the various resources,

63 Gerald W. Williams, *The USDA Forest Service—The First Century* (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 2005); U.S. Office of Technology Assessment, *An Assessment of Development and Production Potential of Federal Coal Leases*, 227.

64 Organic Act of 1897, 16 U.S.C. § 473 et seq.; Williams, *The USDA Forest Service—The First Century*, 105–6.

65 Williams, *The USDA Forest Service—The First Century*, 55, 102, 116, 127.

66 Ibid., 105.

each with the other… with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output."[67] If the Multiple-Use Sustained-Yield Act had in 1960 substantively redefined agency priorities, two pieces of legislation in the mid-1970s laid out procedural transformations designed to make possible this reprioritization. The Forest and Rangeland Renewable Resources Planning Act of 1974 directed the Forest Service to produce various forms of regular reporting including resource inventories, long-term management plans, supply-demand analyses, and cost-benefit studies. Among other directives, an annual report to Congress detailing Forest Service progress toward meeting multiple-use objectives containing "appropriate measurements of pertinent costs and benefits" with careful assessments of "the balance between economic factors and environmental quality factors" was to "include, but not be limited to, environmental quality factors such as esthetics, public access, wildlife habitat, recreational and wilderness use, and economic factors such as the excess of cost savings over the value of foregone benefits and the rate of return on renewable resources."[68] Significantly amending the Forest and Rangeland Renewable Resources Planning Act two years later, the National Forest Management Act of 1976 substantially expanded and clarified these reporting requirements, in an action described in the *Journal of Forestry* and reproduced in the *Federal Register* as "mak[ing] the land management plan the basic institution, the cornerstone for management of the National Forest System."[69] The 1976 Act required significant public participation and the use of interdisciplinary teams in the development of land and resource management plans, and it compelled the development of new regulatory guidelines, including methods for identifying the "suitability" of specific lands for resource development and management, provisions for the dissemination of

[67] Multiple-Use Sustained-Yield Act of 1960, 16 U.S.C. § 528 et seq.

[68] Forest and Rangeland Renewable Resources Planning Act of 1974, 16 U.S.C. § 1601 et seq.

[69] "National Forest System Land and Resource Management Planning: Proposed Rules," in *Federal Register*, vol. 44, no. 88, May 4, 1979, Appendix I.

resource data "including pertinent maps, graphic material, and explanatory aids," and procedures for projecting aesthetic impacts stemming from timber harvests, including clearcutting.[70]

Under the aegis of these pieces of legislation and the contemporaneous Federal Land Policy and Management Act of 1976, then, both the Forest Service and the Bureau of Land Management were charged in different ways with developing long-range, multiple-use planning procedures whose objective was to balance extractive resource development against recreational and aesthetic values, a matter to be determined by way of recourse, at least in part, to economic frameworks. These dictates directed an incremental turn away from single-resource, functional planning practices and instead toward what were understood to be interdisciplinary, integrated forms of planning. As a result of these directives, the Forest Service sought out new forms of expertise, not only hiring biologists, hydrologists, geologists, and soil scientists in significant numbers, but so too sociologists, economists, archeologists, public relations specialists, and, importantly here, landscape architects.[71]

To contend with these new regulations required the development of increasingly computerized techniques to manage multiple-use planning mandates. In the late 1970s, in direct response to the planning directives laid out in National Forest Management Act, the Forest Service began developing a linear programming system named FORPLAN—short for "Forest Planning"—which allowed forest managers to compile comprehensive data about forests and develop data models to perform various projective functions including estimating yields as a result of various inputs and constraints, forecasting productivity over time, tracking land allocations and treatments for subareas, projecting management costs, and simulating the effects of management decisions. An

---

[70] National Forest Management Act of 1976, 16 U.S.C. § 1600 et seq. For more on the development and carrying out of provisions laid out in the National Forest Management Act, see John F. Hall and Richard S. Wasserstrom, "The National Forest Management Act of 1976: Out of the Courts and Back to the Forests," *Environmental Law* 8, no. 2 (1978): 523–38; Jack Tuholske, "A Question of Balance: The National Forest Management Act and Draft Forest Plans in the Northern Region," *Public Land and Resources Law Review* 6 (1985).

[71] Williams, *The USDA Forest Service—The First Century*, 122–24, 128.

outgrowth of earlier linear planning systems developed by the Forest Service for resource planning, timber management scheduling, budgeting, and forecasting, FORPLAN offered an integrated system which rendered comprehensive forest planning available to certain forms of computational and economic analysis in the study of management alternatives and "the tradeoffs that result from the imposition of management restrictions that are required by law, policy, etc."[72] By 1979, FORPLAN's use was mandated across all national forests as "the required primary analysis tool" for forest planning, affording "interdisciplinary" teams a method to bring disparate concerns together and ensuring a degree of consistency in planning methods across various forests.[73] Coupled with this effort was the establishment of a Service-wide computer system electronically linking all of the agency's offices across the country and providing a standard suite of softwares.[74] As was pointed out by critics, however, the computer-based integrated planning method had a number of key limitations, not least of which was its inability to sufficiently account for as-yet unquantified—or unquantifiable—values, including those related to aesthetics, scenic beauty, recreation, and visibility. This shortcoming wasn't restricted to FORPLAN alone; this very inability remained a key aporia among the Service's techniques and methodologies, attracting a great deal of research attention already beginning in the late 1960s.

Much Forest Service-sponsored research in the years after the Multiple-Use Sustained-Yield Act demonstrated an aggressive interest in quantifying the visual in specific ways. The Forest Service, to be sure, had long sponsored experimental investigation, with the earliest Forest Experiment Station established in 1908 in Coconino National Forest, Arizona, soon followed by the establishment of dozens of research stations and experimental forests across the country. Seven

---

72 Brian Kent et al., "Natural Resource Land Management Planning Using Large-Scale Linear Programs: The USDA Forest Service Experience with FORPLAN," *Operations Research* 39, no. 1 (February 1991): 18.

73 Ibid., 13.

74 Williams, *The USDA Forest Service—The First Century*, 131.

years later, in 1915, the Service organized a Branch of Research which was given equal priority to the agency's administrative functions within its organizational structure. Early research sponsored by the Service largely concerned dendrology, timber management, and lumber production techniques, with later interests turning to range research, fire research, forest genetics, and forest economics. After the Second World War, the Forest Service directed significantly increased outlays to these applied research programs, with new interests emerging especially in the area of recreation research.[75] It was in this same period that the Forest Service began hiring landscape architects in increasing numbers, not only to serve as forest managers but, importantly here, as dedicated, in-house researchers at its experiment stations.[76] A key area of investigation for this increasingly interdisciplinary group attended the effort to quantify the visual, positioned to address the planning dictates laid out in the various legislative directives. The Service's foundational work in this area, with a particular interest in relating discrete landscape elements to evaluative judgments, garnered broad-based influence across governmental agencies, consultancy firms, and academic researchers in the period.[77]

Among the figures whose work was foundational to the development of this particular project of quantification was Luna Leopold, a hydrogeologist with a background in civil engineering, physics, meteorology, and geology, who served as the Chief Hydrologist for the U.S. Geological Survey before taking an appointment in the Department of Landscape Architecture at the University of California, Berkeley. Son of the naturalist Aldo Leopold, Luna Leopold laid out what are often credited as among the earliest methods for enumerating visual values made possible by measurement of landscape elements. In work sponsored by the U.S. Geological Survey, Leopold suggested it

---

[75] Ibid., 29–41.

[76] Ibid., 94.

[77] Carl H. Petrich, "Science and the Inherently Subjective: The Evolution of Aesthetic Assessment Since NEPA," in *Environmental Analysis: The NEPA Experience*, ed. Stephen G. Hildebrand and J. B. Cannon (Boca Raton, FL: Lewis Publishers, 1993).

might be "difficult to evaluate the factors contributing to aesthetic or nonmonetary aspects of a landscape," but "in contrast, aspects which lend themselves to cost-benefit comparisons are now treated in a routine way," the result of which is a circumstance where "non-monetary values are described either in emotion-loaded words or else are mentioned and thence forgotten."[78] Leopold situated this rhetorical asymmetry in its immediate legal context:

> There are an increasing number of bills before Congress that in one way or another affect the landscape or the environment. Each of these requires seemingly endless numbers of congressional hearings, which are recorded upon endless reams of paper.
>
> And if, for some reason, you happen to read the voluminous testimony surrounding one of these environment-affecting proposals, you will generally find a marked contrast between the volume and kind of information presented by those who are pressing for technical development—building a dam, constructing a highway, installing a nuclear power plant—and the testimony of those who either oppose the development or wish to alter it in some way. The developer usually employs numerical arguments, which tend to show that there is an economic benefit to be obtained by constructing something—whatever that something may be. The argument is usually expressed in terms of a 'cost-benefit ratio.' It is typically argued, for instance, that the construction cost of a given project will be repaid over a period of time and will yield a profit or a benefit in excess of the development costs by a ratio of, let us say, 1.2 to 1. The argument is further supported with great numbers of charts, graphs, tables, and additional figures.
>
> In marked contrast, those who favor protection of the environment against development are fewer in number, their statements are based on emotion or personal feelings, and they usually lack numerical information, quantitative data, and detailed computations. Perhaps this is the reason why this latter group seems to be continually fighting rear-guard actions—losing battle after battle.[79]

To allay this disparity, Leopold proposed "a method that would quantify the esthetic features of the environment" which "would tend to provide a more prominent consideration of nonmonetary values to society." Leopold argued that such methods were requisite to the rhetorical dictates of the day, despite admitted reservations: "While to some of us this may be a little like using a computer to

---

[78] Luna B. Leopold, *Quantitative Comparison of Some Aesthetic Factors Among Rivers* (Washington, D.C.: U.S. Geological Survey, 1969), 1.

[79] Luna B. Leopold, "Landscape Esthetics: How to Quantify the Scenics of a River Valley," *Natural History*, October 1969, 37.

describe Shakespeare, it seems that society still has the right to have all aspects of any proposed development presented in a way that is as objective as possible."[80]

Leopold developed and demonstrated his method for quantification of the visual by way of a hypothetical exercise in siting a hydropower dam in the area around Hells Canyon of the Snake River in Idaho—an area which, in reality, had garnered significant debate over plans for dam development in the decade and a half prior to his study. In August 1968, Leopold toured the region and identified twelve possible sites, recording for each observations, measurements, and estimations for an exhaustive checklist of 46 factors thought to determine relative scenic uniqueness—a measure, for him, of "scarcity" and, therefore, "significance to society."[81] Leopold's 46 factors were variously descriptive of discrete aspects of the landscape and could be classified into one of three types: physical features, such as river water velocity or the ratio of valley height to width; biological features, including the amount and type of algae present in the waterway; and human-interest factors, such as the occurrences of litter per hundred feet of river.[82] Whether subject to direct measurement or rough estimation, each factor was converted to a five-degree scale, and the scales could be measured against one another and interrelated to produce relative quantified values for various metrics. In the case of the hypothetical example, Leopold suggested the "scale of valley character" represented "a measure of the viewer's esthetic impression of the landscape at each site" and could be determined by interrelating scores for the ratio of valley height to width, the quantity of scenic vistas, and the degree of urbanization.[83] Each score was then to be measured for its uniqueness: if all twelve sites demonstrated the same ratio of valley height to width, then none was

80 Luna B. Leopold, "Landscape Esthetics," *Ekistics* 29, no. 173 (1970): 271.

81 Luna B. Leopold and Maura O'Brien Marchand, "On the Quantitative Inventory of the Riverscape," *Water Resources Research* 4, no. 4 (1968): 714; Leopold, *Quantitative Comparison of Some Aesthetic Factors Among Rivers*, 3, 5.

82 Leopold, *Quantitative Comparison of Some Aesthetic Factors Among Rivers*, 2.

83 Leopold, "Landscape Esthetics: How to Quantify the Scenics of a River Valley," 42–44.

unique and each received a low "uniqueness ratio"; if only one site exhibited a particular quantity of scenic vistas, by comparison, it scored a high uniqueness ratio. Uniqueness ratios for each of the 46 factors were to be added together to produce a "total uniqueness ratio" for each of the sites, allowing them to be compared numerically against one another.[84] The results of Leopold's analysis in Hells Canyon determined two sites, one on Snake River and the other on Salmon River, to be "highly unusual" owing to factors including their "narrow valley floors, high adjacent mountains, availability of distant vistas, and little or no urbanization," thus rendering them poor candidates for dam siting (fig. 3.6).[85] Leopold was sure to underscore that uniqueness scores were "objective measures" demonstrably including no degree of "personal preference," but he cautioned that the method afforded equal weight to all factors, suggesting it the responsibility of observers to identify which factors were most pertinent on a case-by-case basis.[86]

If Leopold had laid out an unweighted method for quantifying scenic value, recreation researcher Elwood Shafer built upon this work to develop a weighted, atomistic scheme for visual quantification. Employed at the Forest Service's Northeastern Forest Experiment Station in Syracuse, New York, Shafer developed a strategy for quantifying what he identified as "scenic beauty" to better guide Forest Service management decisions—claiming, per the title of his 1970 report to the federal agency, "It Seems Possible to Quantify Scenic Beauty in Photographs."[87] Shafer's aims were in many ways decidedly anti-Gestaltic and anti-cognitivist, instead positing a direct physicalism between discrete visual elements in the landscape and evaluations of preference. Writing in 1969, Shafer suggested:

[84] Leopold, *Quantitative Comparison of Some Aesthetic Factors Among Rivers*, 5–6.

[85] Leopold, "Landscape Esthetics," 276.

[86] Leopold, "Landscape Esthetics: How to Quantify the Scenics of a River Valley," 40, 41.

[87] Elwood L. Shafer and James Mietz, *It Seems Possible to Quantify Scenic Beauty in Photographs*, Forest Service Research Paper, NE-162 (Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, 1970).

> The most important question a planner may wish to answer is not 'how do people feel about an environment?,' but rather, 'how is the total variation of that environment distributed among its various elements?' By knowing how an environment's total variation is partitioned among its component parts, a planner may be able more adequately to define and manage an environment for maximum perception opportunities.[88]

In a series of studies for the Forest Service beginning in the late 1960s, Shafer developed his "landscape-preference model" which posited that physical measures taken from landscape photographs could be directly predictive of subjects' preference ratings for those sites.[89] Shafer's method saw the research team overlay clear plastic, quarter-inch grids atop eight-by-ten-inch, black-and-white photographs of a range of landscape types across the United States. The use of grids facilitated the recording of area and perimeter measurements for what Shafer identified as eight "landscape zones," or broad categories of scenic elements that might comprise a natural landscape. One such zone specified areas of sky and clouds; three zones entailed vegetation in the foreground, middle-ground, and background, respectively; another three represented non-vegetative features such as rocks, soil, or snow in the foreground, middle-ground, and background, respectively; and a final zone indicated the presence of water (fig. 3.7).[90] Together, the physical extent of these eight zones constituted, for Shafer, "predictor variables" for preference.[91]

In a series of trials, Shafer and his research team produced measurements for these various factors for a series of photographs of selectively cut forest stands in the Adirondacks in New York, meanwhile tasking recreationists in those areas with ordering the same photographs by preference. Seeking to correlate subjects' preference ratings to the various "independent" measures, both types of data were recorded on punch cards and fed into an IBM computer, where statistical analyses were

---

[88] Elwood L. Shafer, "Perception of Natural Environments," *Environment and Behavior* 1 (1969): 76.

[89] Shafer and Mietz, *It Seems Possible to Quantify Scenic Beauty in Photographs*, 1.

[90] Elwood L. Shafer, John F. Hamilton, and Elizabeth A. Schmidt, "Natural Landscape Preferences: A Predictive Model," *Ekistics* 29, no. 173 (1970): 278–83.

[91] Elwood L. Shafer and Robert O. Brush, "How to Measure Preferences for Photographs of Natural Landscapes," *Landscape Planning* 4 (January 1, 1977): 239.

able to identify a direct relationship between the physical measures and preference ratings, rendered in the form of a weighted equation with relative values for each of the factors (fig. 3.8).[92] This formula, in turn, was thought to offer a model by which preference ratings for other scenes could then be predicted: in a study of recreationists in Utah, predicted preference scores calculated by way of physical measurement of photographs were shown to correlate with actual preference ratings.[93] Among the conclusions suggested by the formula—some of which were admittedly unintuitive and resisted "straight-forward interpretation"—was the identification of factors such as *perimeter of immediate vegetation* having a positive effect on aesthetic appeal, whereas *perimeter of intermediate vegetation multiplied by area of distant nonvegetation* was demonstrated to have had a negative effect.[94]

Regardless, the result purported "a quantitative index of how much one landscape is generally preferred over another," thus thought to furnish planners with a "factual basis" for making comparative evaluations and management decisions.[95] Shafer demonstrated how his method might inform management strategies in a number of hypothetical scenarios. In the case of a "farmland scene" in Iowa featuring low, rolling hills and rows of trees set amid a patchwork of agricultural and grazing lands, the addition of a lake, Shafer suggested, occupying 108 grid squares within the scene would effect "a dramatic positive shift of 23% in scenic quality," compelling "the management recommendation: Establish the proposed lake in the valley."[96] In the case of a "wildland scene" in Washington state featuring a lake, an alpine meadow, a coniferous forest, and a snow-capped peak, Shafer maintained that the formula indicated that the addition of openings, by virtue of timber

---

92 Shafer and Mietz, *It Seems Possible to Quantify Scenic Beauty in Photographs*, 2.

93 Ibid.

94 Shafer, Hamilton, and Schmidt, "Natural Landscape Preferences: A Predictive Model," 281; Shafer and Brush, "How to Measure Preferences for Photographs of Natural Landscapes," 253.

95 Shafer and Mietz, *It Seems Possible to Quantify Scenic Beauty in Photographs*, 11, 12.

96 Shafer and Brush, "How to Measure Preferences for Photographs of Natural Landscapes," 241.

harvesting, in the distant vegetation would slightly improve scenic quality by 4%—a landscape alteration considered "particularly relevant to forest management practices."[97] Shafer also suggested the method might be further applied to the study of manually produced photomontages to project visual impacts for proposed projects.[98]

Shafer acknowledged that his preference modeling method failed to provide "an economic value for aesthetic quality"—suggesting "this may never be possible."[99] But his method had already presumed the recreationist to be a particular type of consumer: citing Shafer's work, Leopold described the predictive preference method as a "consumer-demand analysis of what people seek in landscape."[100] Shafer pointedly suggested that "future research is needed to determine the relationship, if any, between preference value and the real-estate value of a given landscape."[101]

If both Leopold and Shafer had, to varying degrees, suggested the pressures of—and limits to—interpolating the aesthetic into economic frameworks, another key figure in this history, R. Burton Litton, who was briefly introduced in chapter one, developed a series of techniques for managing the visual which afforded incremental accommodation of economic matters. Credited in Forest Service publications as a "pioneer" in visual impact management for having "developed many of the concepts and vocabulary still used today," Litton first joined the faculty at UC Berkeley as a professor of landscape architecture in 1948, before gaining concurrent employment with the Forest Service as a researcher at the Pacific Southwest Forest and Range Experiment Station in Berkeley

---

97 Ibid., 247–49.

98 Shafer, Hamilton, and Schmidt, "Natural Landscape Preferences: A Predictive Model," 283.

99 Shafer and Mietz, *It Seems Possible to Quantify Scenic Beauty in Photographs*, 12.

100 Leopold and O'Brien Marchand, "On the Quantitative Inventory of the Riverscape," 716.

101 Shafer and Mietz, *It Seems Possible to Quantify Scenic Beauty in Photographs*, 12.

after about 1964.[102] Around this time, Litton began laying out a framework for the Forest Service for the descriptive classification of its lands along criteria which were decidedly anti-Gestaltic, atomistic, and physicalist in emphasis. In his foundational 1968 publication *Forest Landscape Description and Inventories – A Basis for Landplanning and Design*, Litton cited a wide range of concepts from art criticism, Gestalt theory, and quantitative aesthetics to identify a number of compositional types, based on a landscape's relatively stable formal properties, as well as variable factors affecting an observer's specific, changeable engagement with these compositions, which together offered the possibility of objective, structured description for views. Key among these variable factors were distance in plan and observer position in section, both of which were subject to three-step evaluation—foreground, middleground, and background; and inferior, normal, and superior, respectively—accompanied by extensive forms of diagramming (figs. 3.9 and 3.10).[103]

These various ambitions toward the description, classification, and aesthetic quantification of landscapes championed by Leopold, Shafer, Litton, and others unsurprisingly garnered a great deal of contemporaneous criticism across a wide swath of practitioners and theorists in the period. Not least of these were aestheticians such as Allen Carlson in Department of Philosophy at the University of Alberta. In a strident review article, Carlson took Leopold, Shafer, and Litton to task, suggesting they each had, to varying degrees, committed a number of category errors in their efforts to quantify landscape aesthetics. The philosopher objected to the use of photographs as surrogates for landscapes, which he argued privileged particular kinds of formal analysis at the expense of the

---

[102] The dates for Litton's start with the Forest Service range from about 1964 to 1969, according to various sources from the period. U.S. Department of Agriculture, Forest Service, *Landscape Aesthetics: A Handbook For Scenery Management*, Agriculture Handbook 701 (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1995), G-4, 4.

[103] R. Burton Litton, *Forest Landscape Description and Inventories - A Basis for Land Planning and Design*, Res. Paper PSW-RP-049 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1968); See also R. Burton Litton and Robert H. Twiss, "The Forest Landscape: Some Elements of Visual Analysis," in *Proceedings of the Society of American Foresters Meeting: Resources, Foresters, and Policies for Progress* (Washington, D.C.: Society of American Foresters, 1967); R. Burton Litton and Kenneth H. Craik, "Aesthetic Dimensions of the Landscape" (Berkeley, CA: Department of Landscape Architecture, University of California, 1969).

images' content; he insisted on the distinction between environments and what he called "traditional art objects," the latter enframed and affording critical distance; and he distinguished between aesthetic criticism, which he understood as a domain of particular expertise requiring trained sensibility and subtlety, and public preference, which he suggested could only reveal as scenically beautiful landscapes "with the most obvious and superficial appeal"—that is, "the lowest common denominator of public preference for the natural environment."[104] Carlson reserved the brunt of his criticism for Shafer, arguing the researcher's work constituted "formalism of a rather extreme kind."[105] Objecting in particular to the elevation to policy of what he understood as specious methods for quantifying scenic beauty, citing the U.S. Forest Service in particular, Carlson explained:

> Imagine that due to a shortage of funds, space, or whatever, a society has to make certain basic decisions about its art collection. It has to decide which of the art objects in its collection are to be preserved for public display and which are to be allowed to fall into private hands and/or to be gradually destroyed by neglect or poor treatment. It is either taken for granted in or decided by this society, reasonably enough, that at least a part of the basis for making such decisions should be the aesthetic quality of the works… Now further suppose that, in order to determine the aesthetic quality dimension relevant to such decisions, the following procedure is adopted: The society's planners randomly select about 250 adults whom they happen to find in some randomly selected galleries, have these 250 adults express their preferences for about 100 art works, and on the basis of these preferences rank these art works. Then the planners construct a model (perhaps by means of measuring certain formal aspects of the art works) which can mirror this ranking. Lastly, this model is applied to the society's art collection in order to compare and evaluate the aesthetic quality of the works about which decisions must be made…
>
> Much of the above makes a fairly obvious point: at least in regard to art, we as a society do not take aesthetic quality to be meaningfully correlated with public preference… That this is true of the fine arts is, I take it, beyond dispute… Given this state of affairs, the question which arises is: 'Why should this not also be true of the aesthetic quality of the natural environment?'[106]

---

104 Allen A. Carlson, "On the Possibility of Quantifying Scenic Beauty," *Landscape Planning* 4 (January 1, 1977): 145–48, 159.

105 Ibid., 142.

106 Ibid., 149–50.

This period, as pointed out by numerous historians and critics, was one which witnessed the broad-based erosion of particular notions of expertise and taste, and of distinctions between art objects and environments—currents which Carlson seemed determined to resist. Leopold, and to a lesser extent Litton, came out marginally better in Carlson's handling, with the philosopher suggesting that both are "simply doing what I would call environmental criticism"—with, to be sure, "varying degrees of competence"—where qualitative assessments are merely assigned quantitative measures, ex post facto.[107] Responding to this critique, Shafer dismissed Carlson's claims that his method merely confirmed "what we already know." Instead, Shafer suggested, this was precisely the point:

> The scientist who 'understands' a phenomenon is almost always in a position to predict… If the scientist knows how to change the results by altering the attendant circumstances, then he is well along the way to accomplishing control; and the control of natural phenomena, to bring them more effectively to the services of man, is obviously one of the major aims of science.[108]

Despite such criticisms, these various analytic frameworks centering a concept of the visual based upon discrete, physical determinants—and their apparently attendant ambitions toward control—were foundational to U.S. Forest Service standard practice in the early development of what it identified as its Visual Management System, first promulgated Service-wide by 1974 and which would remain in place until 1995.[109] Stemming directly from the various clearcutting controversies and pieces of legislation that followed in their wake, efforts to develop visual management strategies had been first led by the Forest Service's regional offices; an effort to standardize these management strategies across the Forest Service commenced in earnest by 1969, with one regional scheme based on Litton's framework in particular elected to be adapted Service-

[107] Ibid., 155.

[108] Shafer and Brush, "How to Measure Preferences for Photographs of Natural Landscapes," 252–53.

[109] U.S. Department of Agriculture, Forest Service, *Landscape Aesthetics: A Handbook For Scenery Management.*

wide.[110] In keeping with multiple-use mandates, the resulting guidelines specified the "visual landscape" to be "a basic resource," which was to be "treated as an essential part of and receive equal consideration with the other basic resources of the land."[111] Elsewhere the Forest service identified landscape management as an "art and science" comprising "the planning and design of the visual aspects of multiple-use land management."[112]

The Forest Service's comprehensive Visual Management System, whose goal, to be sure, was "to inventory and interpret the visual resource" on the vast majority of Forest Service lands "at a detailed, intensive level," required the division of national forests into discrete management units subject to various forms of inventorying and classification.[113] Units were evaluated for criteria including a measure of variety, or uniqueness, from Class A, "distinctive," to Class C, "minimal"; sensitivity, identifying the "level of user concern for the visual environment," from Level 1, the highest, to Level 3, the lowest; and others, which would importantly be added later, to be detailed in a moment.[114] In many senses, the identification of variety classes recalled Luna Leopold's commitments, with the Forest Service suggesting that areas "with the most variety or diversity have the greatest potential for high scenic value."[115] The concept of sensitivity levels, in turn, more closely

---

110 Warren R. Bacon, "The Visual Management System of the Forest Service, USDA," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 660; U.S. Department of Agriculture, Forest Service, *Landscape Aesthetics: A Handbook For Scenery Management*, Agriculture Handbook 701 (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1995), G-4–G-6.

111 Forest Service Manual 2380, Landscape Management. Quoted in U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 1: The Visual Management System*, Agriculture Handbook 462 (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1974), 1.

112 U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 1*, Agriculture Handbook 434 (Washington, D.C.: U.S. Department of Agriculture, 1973), 4.

113 U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 1: The Visual Management System*, 9.

114 Ibid., 12, 18.

115 Ibid., 12.

recalled that of the Bureau of Land Management, with the identification of a single rating for an area taking different users into account only in aggregate and in large part based on an analysis of the distance from which development activities would be seen, rather than the Federal Highway Administration's expanded notion of user sensitivity, as was discussed in chapter two. Together, variety class and sensitivity level determinations were charted in a decision matrix yielding what were termed Visual Quality Objectives for each management unit, which, in turn, could be mapped (fig. 3.11).[116] These Visual Quality Objectives afforded "measurable standards" for scenic management, each identifying a "different degree of acceptable alteration of the natural landscape… measured in terms of visual contrast," ranging from preservation to retention, partial retention, modification, or maximum modification, in the long term, and rehabilitation or enhancement in the short-term.[117] The conceptual framework for these degree-of-allowable-change standards was likewise credited to Litton, who had also proffered "deterioration" and "destruction" as two further possible goals, which the Forest Service elected to omit.[118] In this way, the Visual Management System offered a framework to accommodate development against newly strengthened scenic and visual objectives.

If the Forest Service's construction of Visual Quality Objectives, based on assessments of the diversity of natural features and the estimated level of public concern for scenic quality, was to serve initially as the primary basis for land-use planning directives, some key concerns that would be brought to bear as a result of the particularity of the Forest Service's remit redirected this focus elsewhere. Already between a 1972 draft edition and the Forest Service's published guidelines in 1974 was the conspicuous addition of a number of key "premises," suggesting the already growing

---

116 Ibid., 43.

117 Ibid., 28.

118 R. Burton Litton, "Descriptive Approaches to Landscape Analysis," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 85.

importance of a number of issues which would continue to gain significance in the years following. Among these late additions were the postulation that "Viewing Distance is Critical," suggesting visual impacts to be negatively correlated to distance from which impacts were seen; "Viewing Angle is Critical," purporting visual impact to be positively correlated to the angle of a viewer's line of sight with regard to the slope upon which impacts are to take place; and "The Capacity of Each Landscape to Absorb Alteration Without Losing its Visual Character is Critical," suggesting landscape units each had a unique capacity to accept modifications without transforming their "inherent" character, owing to physical determinants including screening by vegetation and topography, textural variety, and vegetative growth patterns.[119] Pertinent to some of these late additions to the published guidelines was the additional acknowledgment of a number of "variable factors" which were thought to affect the perception of form, line, color, and texture—namely light, atmospheric conditions, and observer position, among others—which had likewise been sourced from Litton's framework, but remained little addressed in the initially promulgated methods.[120] Together these issues sketched out matters which seemingly required—and in fact received—further agency attention: the need to better account for relationships between observers and development activities as a function of viewing angle and distance, for a landscape's physically determined ability to absorb development, and for the variable effects of light and atmospheric conditions.

Following the promulgation of the Forest Service's visual management system was the incremental alteration and addition of a number of newly identified, key concepts designed to address these shortcomings, in the years just after the passing of the National Forest Management Act. By about 1977, the analysis of distance zones had been separated out from sensitivity level

[119] U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 1: The Visual Management System*, 4; cf. Warren R. Bacon and Paul F. Hansen, *Handbook on the Visual Management System* (Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, 1972).

[120] U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 1*, 49.

determinations and had come to constitute its own dedicated step in the identification of Visual Quality Objective classes, where, for example, treatments meeting Visual Quality Objectives in the middle ground were thought to achieve quality objectives one degree higher if sited in the background.[121] More significantly however was a newly clarified concept, Visual Absorption Capability, which after 1977 offered a key framework to be deployed alongside and on par with Visual Quality Objectives, making its first formal appearance as a specific directive in a Forest Service Manual in 1977.[122] Referred to elsewhere as "visual vulnerability," Visual Absorption Capability was a physically determined measure of how much development a landscape could accommodate—or absorb—without significantly affecting its visual character or integrity. That is, Visual Absorption Capability indicated "the potential difficulty, and thus the potential cost," of achieving scenic quality targets for an area.[123] Based on the landscape's physical factors alone, rather than factors identified as perceptual, the concept assumed a direct physicalism wherein variables such as distance, slope, and aspect relative to observers; soil color; topographic, hydrologic, and vegetative complexity; and tree height and type, among others, were shown to direct the economic feasibility of accommodating development while meeting Visual Quality Objectives.[124]

---

121 U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 5: Timber*, Agriculture Handbook 559 (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1977), 41; Bacon, "The Visual Management System of the Forest Service, USDA."

122 Amendment No. 76 to U.S. Department of Agriculture, Forest Service, *Forest Service Manual 2380: Recreation Management* (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1977); Lee Anderson, Jerry Mosier, and Geoffrey Chandler, "Visual Absorption Capability," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 165.

123 Bacon, "The Visual Management System of the Forest Service, USDA," 664.

124 U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 5: Timber*, 87; U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 7: Ski Areas*, Agriculture Handbook 617 (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1984), 17; Anderson, Mosier, and Chandler, "Visual Absorption Capability," 164.

Visual Quality Objectives and Visual Absorption Capability were two, mutually reinforcing modes of analysis designed to be utilized alongside one another toward cost-effective ends: if Visual Quality Objectives identified normative standards for what, ideally, *should* be achieved as a result of management decisions for a landscape unit, Visual Absorption Capability by comparison offered predictive measures for costs and difficulties associated with how these goals in fact *could* be achieved. A Forest Service primer from the period was sure to clarify that the two concepts did not always have a straightforward correlation, explaining that highly restrictive visual quality targets might not necessarily be the most difficult to attain, illustrating this possibility with "some visually tolerant landscapes, usually those of considerable variety," which were considered able to absorb a fair degree of development while remaining compliant with high Visual Quality Objectives.[125] Final determinations as to the suitability of lands for development were to be assessed by a decision matrix relating Visual Quality Objectives to Visual Absorption Capabilities, together yielding a score for Visual Management Class, directing allowable degrees of development (fig. 3.12).[126] The system thus offered a method for identifying how forest managers might maximize resource utilization, even in highly restrictive landscapes, while maintaining compliance with management objectives.

The concept of visual absorption had been in development as early as 1968, with two landscape architects, Peter Jacobs and Douglas Way, under the guidance of Carl Steinitz at Harvard's Graduate School of Design, having issued an analytical technique in a research publication in the same years that Litton developed his early framework for descriptive inventories foundational to the Forest Service's Visual Management System. Jacobs and Way suggested that a landscape's ability to "visually absorb" development was "a function of" a number of factors, most notably visual transparency and complexity. Highly transparent landscapes with little complexity, they maintained,

125 Bacon, "The Visual Management System of the Forest Service, USDA," 664.

126 Anderson, Mosier, and Chandler, "Visual Absorption Capability," 170.

were most susceptible to development impacts, whereas visually complex, opaque landscapes were considered most capable of absorbing development pressures.[127] Importantly determinative of visual transparency were silvicultural factors such as vegetative density as well as physiographic conditions such as topography, with the notion of "topographic closure," a measure of "the extent of the visual field accessible from a specific topographic situation" constructed as a function of proximity, elevation, and angle of view, key among these (figs. 3.13 and 3.14).[128] Jacobs and Way's notion of visual absorption lent itself well to the impulse to quantification, with the pair developing an arithmetic function based on their scoring of landscape photographs submitted to stepwise regression analysis yielding an equation estimating absorption to be a function of visual complexity, vegetative density, and topographic closure:

Absorption = 1.46 + 0.40 Visual Complexity + 0.14 Vegetation Density + 0.27 Topographic Closure[129]

The researchers offered that this framework would be useful in determining siting for various kinds of development, directing impacts in specific contexts toward varying ends. On one hand, they suggested, in cases where there might be a desire or need to mitigate visual impacts, say for example the case of Sea Ranch, development could be accommodated by way of siting in a more highly absorptive area or by the addition of plantings and grading to increase absorption capability measures. Conversely, other types of developments—shopping centers, they proffered—might seek to produce "strong visual impact" and would be better served by siting in low absorptive contexts. The concept was aimed at informing broader-based management practices, as well, with relative capacities for visual absorption to be measured and mapped against quality objectives in order to

---

[127] Peter Jacobs and Douglas Way, *Visual Analysis of Landscape Development* (Cambridge, MA: Harvard University, Graduate School of Design, Department of Landscape Architecture, 1968), 1–2.

[128] Ibid., A-2, A-3.

[129] Ibid., 10.

determine the "visual carrying capacity" for units within a region, with development then distributed throughout the region accordingly.[130] The mapping strategy required recourse to new forms of digital visualization, with a then-new computer-based mapping program, SYMAP, developed by Laboratory for Computer Graphics and Spatial Analysis at Harvard, designed to map spatial data with standard computer symbols deployed in combinations to suggest a range of black-and-white tones corresponding with value ranges for absorptive capacities (fig. 3.15).[131]

In the years following, R. Burton Litton developed a closely related concept he termed visual vulnerability, directly building on the work of Jacobs and Way, effectively bringing many of these ideas into impact management frameworks for the Forest Service. If Litton's work in the mid-to-late 1960s had yielded descriptive and evaluative inventories directing normative management objectives, his work on visual vulnerability, by comparison, was decidedly predictive in orientation. Formulated as the inverse of absorption capability while effectively measuring the same, visual vulnerability identified a landscape's "inherent resistance or susceptibility to degrading visual impacts," affording "prediction" of impacts and "provision for their amelioration."[132] Like Jacobs and Way, Litton argued that physical and visual characteristics of landscapes alone determined this vulnerability—without much by way of recourse to psychological or societal factors—positing instead a direct relationship between compatible levels of change and landscape elements whose presence "forewarns" the forest manager that scenic quality may be affected by development in predictable ways.[133] Litton interpolated this matter of vulnerability into his descriptive scheme for landscape

---

130 Ibid., 22, 39.

131 Ibid., 33, 43. For a historical overview of this and similar software, see Catherine F. McMahon, "Predictive Machines: Data, Computer Maps, and Simulation," in *A Second Modernism: MIT, Architecture, and the "Techno-Social" Moment*, ed. Arindam Dutta (Cambridge, MA: MIT Press, 2013).

132 R. Burton Litton, *Visual Vulnerability of the Landscape: Control of Visual Quality* (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1984), 4.

133 Ibid., 4.

compositional types, assigning for each different degrees of vulnerability determined in dialogue with other factors including soil color, texture, and sun exposure.[134] For Litton, the concept of vulnerability afforded new ways to contend with the Forest Service's managerial ambitions, stating: "My thesis is this: before you consider the impact of any alterations, first look at the landscape as a resource in its own right and analyze its visual vulnerabilities."[135]

The concepts of visual absorption and vulnerability were charged in this way with addressing a number of key challenges then facing the Forest Service, particularly those to do viewshed planning and long-distance views across difficult topographies. Litton centered the matter of topography in his construction of the notion of visual vulnerability, explaining at a Forest Service recreation workshop in 1973 that flatter sites at lower elevations had higher potential for screening by way of greater perspectival foreshortening and intervening vegetation and topography, and were thus least vulnerable. Steeper, exposed sites, by comparison, were more difficult to screen and often required grading, thus increasing scales of impact. This led Litton to the "crude axiom" that "the steeper the slope, the greater the potential for visual vulnerability."[136] As one paper on the topic noted in 1979, slope was the "most universally accepted" factor in estimating visual absorption.[137]

Positing in this way a predictable relationship between topography and certain forms of visibility, and therefore, by extension, vulnerability, the matter was lavished with increasingly sophisticated, multivariate analysis by the 1980s. In a 1984 report for the Forest Service, Litton explained that the first step for estimations of visual absorption capability required analysis of

---

134 R. Burton Litton, "Visual Vulnerability of Forest Landscapes," in *Outdoor Recreation Research: Applying the Results. Papers from a Workshop Held by the USDA Forest Service at Marquette, Michigan, June 19-21, 1973*, USDA Forest Service General Technical Report NC-9 (St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station, 1974), 87.

135 Ibid., 91.

136 Ibid., 89–90.

137 Anderson, Mosier, and Chandler, "Visual Absorption Capability," 166.

landform attributes including "characteristics of profiles or silhouettes, different categories of surface slopes, degrees of steepness, surface visibilities related to steepness and angles of view, and effects based upon different terrain locations and edges."[138] Litton's increasingly parametric construction of vulnerability took significant account of viewers' position in the landscape. To wit, a key factor in Visual Absorption Capability assessment, the concept of "visual magnitude," accounted for an observer's position with regard to landscape alterations in terms of proximity, elevational difference, and the landscape's slope with regard to the observer. This notion of visual magnitude, illustrated in a computer-generated perspectival render in a Forest Service management guide for timber harvesting, suggested, for example, that distant landscape units might register lower levels of absorption capability on account of higher degrees of tilt with regard to observers (fig. 3.16).[139] Topography in this way remained a key issue in visibility determinations, requiring new forms of visualization and analysis.

Subject to certain forms of quantification, the concept of Visual Absorption Capability served the production of management directives. In the case of a 10-year Timber Management Plan produced in 1977 for Klamath National Forest, for example, in-house landscape architects carried out comprehensive Visual Absorption Capability analyses, alongside Visual Quality Objective analyses, for the entirety of the forest. The forest managers had developed a formula for calculating Visual Absorption Capability:

> Visual Absorption Capability = Slope + Vegetative Pattern and Screening + Site Recoverability + Soil Color Contrast

For each subunit of the forest, each of these factors contributing to Visual Absorption Capability was evaluated based on field investigations on different scales, thus offering a simple weighting

---

[138] Litton, *Visual Vulnerability of the Landscape: Control of Visual Quality*, 4.

[139] U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 5: Timber*, 59.

method: the unit's slope was measured on a scale of 0 to 9; vegetative screening on a scale of 0 to 6; and site recoverability and soil color contrast on scales from 0 to 3 and 0 to 4, respectively. Weighting the matter of slope most heavily in this way, the ratings were simply summed to yield an aggregate score for Visual Absorption Capability, with values ranging from 0 to 22, which were then stratified into four categories from "very low" to "high." The resulting Visual Absorption Capability scores were mapped against Visual Quality Objectives for the forest, yielding a Visual Management Class map which was to guide management practices for the next decade.[140]

In many ways a response to provisions laid out in the National Forest Management Act of 1976, Visual Absorption Capability offered a management technique to assess the ease of development across different landscape units—and, importantly, was positioned to satisfy a political drive toward cost effectiveness. If, for example, the National Forest Management Act had specified the development of planning guidelines to ensure that timber-cutting methods, including clearcutting, were only to be used on lands where an "interdisciplinary review" had determined that harvests could be executed "in a manner consistent with the protection of… recreation and esthetic resources," Visual Absorption Capability could be estimated and mapped, one Forest Service handbook suggested, to identify units, for example, with "the same relative ability to absorb clearcut logging." Elsewhere the handbook explained that the concept was crucial in "viewshed planning" for determining management costs and trade-offs.[141] A later handbook emphasized the concept's usefulness in determining the "most efficient" siting of landscape impacts "so that a project will be accomplished easily, at low cost, and with minimal reduction in scenic quality."[142] Accounting for this state of affairs, landscape architects employed at Forest Service suggested that "consumptive

140 Anderson, Mosier, and Chandler, "Visual Absorption Capability," 168–70.

141 U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 5: Timber*, 59, 87.

142 U.S. Department of Agriculture, Forest Service, *Landscape Aesthetics: A Handbook For Scenery Management*, C-1.

demands of society threaten the balance between conservation of scenic values and the efficient use of our natural resources… As environmental designers, our challenge is to facilitate development which is in harmony with the visual resource."[143] Positioned in this way as a framework to begin to account for the visual with respect to the economic toward cost-effective ends, Visual Absorption Capability was not only predictive, but also loosely prescriptive in its charge to identify how—and where—to make development possible. The concept signified an early, federal bureaucratic ambition to embed economic considerations into visual management procedures—an ambition which would only expand in scope, methodological approach, and medium in the years following.

II. A Digital Turn

If, in the immediate prehistory to the controversy over mining in the Alton coal fields, public contention over the visual environment had given rise to new legislative and regulatory pressures which compelled the U.S. Forest Service and other federal agencies to develop a number of new management concepts and planning frameworks for reconciling visual impacts and resource demands, in the same years these agencies became heavily involved in developing, sponsoring, distributing, and making accessible new, computer-generated visualization techniques as strategies for mediating matters of visuality. The programs charged with producing these novel visualizations, many of which would be brought to bear in adjudication of the Alton unsuitability case, could be broadly schematized into three types: programs to generate maps of seen areas from topographic data, including VIEWIT and SIGHTLINE; programs to produce perspectival views from topographic data, including PREVIEW and Perspective Plot; and programs to manipulate digitized photographs, including MOSAIC and the LASL visibility system.[144] The particular turn to the digital

[143] Anderson, Mosier, and Chandler, "Visual Absorption Capability," 164.

[144] These early computer-based visualization programs have received surprisingly scant historiographic attention in histories of architecture. One notable exception is presented in a recent article by architectural historian Moa Carlsson,

evidenced here was by no means totalizing, to be sure: the development of these novel techniques for computer-generated image production required the persistence and mutual coproduction of techniques which were, at once, insistently analog and digital. So too did these representational forms bridge multiple types of work—the painterly and the analytical, the digital and the computational—which happened to be facilitated by the computer.

The burgeoning reliance on computer techniques in federal bureaucratic practice in this period corresponded in particular ways with and was in large part made possible by the increasing use of centralized mainframe computers and the subsequent proliferation of desktop computing in the years following, affording what was understood as greater degrees of interactivity and feedback into planning processes. At once, the public availability of digitized U.S. Geological Survey topographic data, distributed by the National Cartographic Information Center, served as a necessary precondition for the development of these programs. Originally a "by-product" of the Defense Mapping Agency Topographic Center's effort to scan its 1:250,000-scale physical maps to support the production of physical, raised-relief maps, with a computer program guiding the carving of the plaster molds, digitizing topographic information had been made possible by a Digital Graphics Recorder developed by the topographic center in the early 1960s to record terrain elevations as a grid from contour lines on physical maps. "Almost immediately," the Center

---

whose interest in discussing a select number of these programs largely comprises generating readings of their implications on notions of truth value, labor-saving, and the viewing subject. Moa Carlsson, "Computing Views, Remodeling Environments," *Social Studies of Science* 52, no. 2 (April 2022): 227–52. Other histories of the early incursion of the digital into architectural practice have tended to focus, however crucially, on architecture's longer-standing disciplinary commitments prefiguring and constituting this turn, the technical development of these softwares, and their implications for practice. Matthew Allen, "Prehistory of the Digital: Architecture Becomes Programming, 1935-1990" (Ph.D., Cambridge, MA, Harvard University, 2019); Matthew Allen, "Architecture Becomes Programming: Invisible Technicians, Printouts, and Situated Theories in the 1960s," in *The Figure of Knowledge: Conditioning Architectural Theory, 196X-199X*, ed. Sebastiaan Loosen, Rajesh Heynickx, and Hilde Heynen (Leuven: Leuven University Press, 2020). By comparison, the methodological approach sketched out here is most immediately informed by the work of Felicity Scott in her *Outlaw Territories*, where, among other things, the historian accounts for the ways in which visualization practices were developed and deployed as techniques for "global environmental governance." Felicity D. Scott, *Outlaw Territories: Environments of Insecurity/Architecture of Counterinsurgency* (Princeton, NJ: Princeton University Press, 2016).

recognized the "enormous potential for storing, manipulating, and selectively displaying (either graphically or numerically) a vast number of terrain elevations" with applications in resource extraction and disaster management—explaining that "their usefulness to researchers is limited only by the amount and quality of creative study invested in them."[145]

Gary Elsner, a key figure in developing some of the visualization programs for the Forest Service, identified what was broadly understood to be at stake in this turn to the digital. At a 1977 meeting of the Society of American Foresters, Elsner explained his commitments were to "three complex but interrelated topics: <u>Forest landscape</u>—which is ephemeral, varied, harmonious, and often beautiful; <u>timber harvesting</u>—which is economically critical but may be esthetically damaging; and <u>computer technology</u>—which is fast, accurate, objective but inherently inhuman and insensitive technique for analysis and graphic portrayal." Thus interpolating questions of consumptive demand, normative goals for scenic quality, and techniques for visualization, Elsner suggested that "The right relation of these things is a clear challenge for forest managers: … how to use computer techniques to insure that our timber is harvested with the proper balance of economic and esthetic values?"[146] Elsner acknowledged the perceived incompatibility of these ambitions:

> But in trying to balance economic and esthetic considerations in the harvest of timber, are we really confusing two incongruous and incomparable things? Or are computer techniques for analyzing landscape modifications just fancy and expensive ways of supporting a choice that is inevitable anyway? I think the answer to both questions is 'No.' Timber and beauty are two things that the forest offers us. It is only reasonable, not only for us but for the public, to ask how much of the one we are willing to sacrifice for how much of the other. And the computer, with its accuracy and its objectivity, can give us the information on which to base our reasonable answer—an answer that will permit us an economically productive timber harvest from an esthetically undamaged landscape.[147]

---

145 National Cartographic Information Center, *Digital Terrain Tapes* (U.S. Department of the Interior, Geological Survey, 1977), 1–2.

146 Emphasis in the original. Gary H. Elsner, "New Techniques for Coordinating Timber Harvesting and Esthetic Values," in *Forests for People: A Challenge in World Affairs: Proceedings of the Society of American Foresters 1977 National Convention* (Washington, D.C.: Society of American Foresters, 1977), 46.

147 Ibid., 50.

In the trade-off between scenic beauty and economic productivity, it seems, digital visualization was to serve as a medium for a particular kind of adjudication.

As head of the recreation research unit at the Forest Service's Pacific Southwest Forest and Range Experiment Station in Berkeley, California, Gary Elsner, in collaboration with programmer Michael Travis, brought his academic training in agricultural economics to bear as a proponent in the development of a mainframe computer program, VIEWIT, which came to be heavily used across Forest Service practices and importantly formed the basis for later software packages serving visual management needs.[148] During the yearslong development and promulgation of the Service's visual management system, forest managers had begun the labor-intensive process of inventorying and mapping their lands along various new criteria by way of field observations, the manual construction of hundreds of terrain profiles, and hand-drawing boundaries on topographic maps. In the very same years, a computer program to automate this process, at least in part, had been in development. With digitized topographic data either provided by the U.S. Geological Survey or scanned by digitizer, VIEWIT allowed foresters to compute and map the maximum area visible from any selected vantage point as a function of intervening topography, rendering this as a binary field of ones and zeroes (fig. 3.17). Deemed "an economically feasible procedure" allowing seen areas to be calculated "quickly and efficiently by a computer," the FORTRAN subprogram was developed following an initial review of U.S. military aviation algorithms developed for calculating sightlines and low-altitude flight paths.[149] Initially, VIEWIT's binary seen-area maps were manually overlaid onto variety class maps to yield maps for Visual Quality Objectives. Later updates to the

---

148 Michael R. Travis et al., *VIEWIT: Computation of Seen Areas, Slope, and Aspect for Land-Use Planning*, General Technical Report PSW-GTR-11 (Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, 1975).

149 Elliot L. Amidon and Gary H. Elsner, *Delineating Landscape View Areas... A Computer Approach*, Research Note PSW-RN-180 (Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, 1968), 1.

VIEWIT software afforded greater capacities: with the newly introduced ability to render in gray scale and to include other numerical indications, map data could be weighted to account for distance, sensitivity, and multiple vantage points and could render slope maps, slope *relative to observer* maps, aspect maps, aspect *relative to observer* maps, elevation maps, profiles, and acreage tables, among other visualizations and data outputs (fig. 3.18).[150] These visualizations not only served visual planning dictates: slope maps produced by VIEWIT, for example, could be deployed to direct the efficient planning of logging schemes.[151] The updated VIEWIT allowed for these maps to be selectively overlaid atop one another, illustrated in an example in an early report on the software in which distance maps, aspect relative to the observer, and times-seen maps were merged to yield a map of the "relative visual magnitude," or the "visual perception sensitivity," of the study area—work that "would possibly take months" without the benefit of the program.[152]

By the mid 1970s, VIEWIT was integrated into a number of other software packages, including the Visual Management Support System, which promised to fully computerize the Forest Service's visual management practices. The Visual Management Support System package provided increasingly robust capabilities for overlaying multiple maps atop one another and merging their data. Initially designed to merge VIEWIT's sightline analyses and distance maps with variety class maps to automate mapping for Visual Quality Objectives, the software was extended to produce Visual Absorption Capability maps, which could in turn be merged with maps of Visual Quality Objectives to yield Visual Management Class maps. The computerized production of these various

---

150 Lee Anderson, Jerry Mosier, and Geoffrey Chandler, "Visual Management Support System," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 190–91.

151 Mark Angelo, "The Use of Computers in the Visual Analysis of Landscape Alterations," *The Forestry Chronicle* 56, no. 2 (April 1980): 73.

152 Travis et al., *VIEWIT: Computation of Seen Areas, Slope, and Aspect for Land-Use Planning*, 1–2.

evaluative maps relied on the decision matrix laid out in the Forest Service's Visual Management System, here at least partially automated by way of digital handling.[153] Affording "rapid manipulation of large amounts of data," the program could also incorporate information concerning demographics, soils, vegetation, and other spatial data "to prepare virtually any overlaid output map that may be desired."[154] The proliferation of new regulatory dictates, it seems, required a coincident proliferation of data and data visualization, whose manageability, in turn, rested on these novel computer-based analytical techniques.

R. Burton Litton, for one, championed the application of VIEWIT in his proposal to the U.S. Forest Service for another scheme for visual impact prediction and monitoring, alongside that of his notion of visual vulnerability. In the early-to-mid-1970s, the researcher proposed a network of what he called "Landscape Control Points," a series of permanent observation sites affording forest managers a "continuous view" of any given area in order to better predict levels of visual vulnerability and impacts stemming from development proposals. Litton's scheme required the regular production of multiple forms of representation taken from each of these observation points, with VIEWIT maps to be deployed alongside panoramic photographs and perspectival field sketches, each annotated with analytic graphic overlays, to offer baselines from which impact studies could be developed.[155] For Litton, the study of project alternatives by way of these multiple representational devices "allows different disciplines to assess impacts," maintaining that the use of the system "should lead to solutions which combine multidisciplinary objectives within visual end-products."[156] His proposal for a network of Landscape Control Points was never enacted.

---

153 Anderson, Mosier, and Chandler, "Visual Management Support System," 191.

154 Ibid., 189, 195.

155 R. Burton Litton, *Landscape Control Points: A Procedure for Predicting and Monitoring Visual Impacts*, USDA Forest Service Research Paper PSW 91 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1973), 1–2, 4, 13, 21.

156 Litton, 21.

Still, made accessible by way of remote terminals to the Department of Agriculture's Fort Collins Computer Center, and with copies on magnetic tape available on request, the VIEWIT system was put to use in numerous cases across the Forest Service's purview, both in the development of broad-based, land-use management plans and in the evaluation of specific project proposals, the latter of which included examples of schemes for mining, logging, roads, bridges, firebreaks, and recreational developments.[157] A proposal for a scenic tramway in Black Hills National Forest, South Dakota, for example, required analysis of both views *from* the tramway—to be encouraged—and views *onto* the tramway—to be mitigated; toward both ends VIEWIT offered a "flexible" approach for weighing project alternatives.[158] Perhaps most notably, VIEWIT was put to use in the effort to mediate Walt Disney Enterprises' controversially proposed ski resort in the Mineral King valley in the Sierra Nevadas on lands within Sequoia National Forest. Put forward in the mid-1960s, the proposed Mineral King ski resort had been subject to precedent-setting litigation by the Sierra Club.[159] Christine Johnson, a landscape architect in the Forest Service's California Region who later worked for the Federal Highway Administration, employed VIEWIT to map seen areas, weighted by distance and angle of view relative to the observer, for six alternative schemes for the Mineral King development, as well as slope maps, aspect maps, and composite slope-aspect maps.[160] The VIEWIT maps were measured against Variety Class Maps and maps accounting for

157 Travis et al., *VIEWIT: Computation of Seen Areas, Slope, and Aspect for Land-Use Planning*, 1.

158 Gary H. Elsner, *Computing Visible Areas from Proposed Recreation Developments... A Case Study*, Research Note PSW-RN-246 (Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, 1971).

159 This matter bore largely on the question of standing in litigation. In legal discourse, this case spurred debate as to whether trees, mountains, and other natural objects should have legal standing in their own right. Sierra Club v. Morton, 405 U.S. 727 (1972); Christopher D. Stone, "Should Trees Have Standing? -- Toward Legal Rights for Natural Objects," *Southern California Law Review* 45 (1972): 450–501; John W. Hiscock, "Protecting National Park System Buffer Zones: Existing, Proposed, and Suggested Authority," *Journal of Energy Law and Policy* 7, no. 1 (1986): 41; Williams, *The USDA Forest Service—The First Century*, 111.

160 Travis et al., *VIEWIT: Computation of Seen Areas, Slope, and Aspect for Land-Use Planning*; Christine G. Johnson, *Mineral King Visual Analysis* (San Francisco, CA: U.S. Department of Agriculture, Forest Service, 1974), 4, 12, 45.

"the Ability to Absorb Visual Modification" (that is, Visual Absorption Capability), yielding digital composite maps purporting to predict visual impacts, with lighter tones indicating areas amenable to development and darker tones indicating those for which development would require a greater degree of "careful planning and execution to minimize visual impact" (fig. 3.19).[161] Just as was the case with the scenic tramway proposal for Black Hills National Forest, here the VIEWIT digital mapping technique not only afforded a method for mitigating visual impacts but, so too, offered the possibility of better recreation planning: VIEWIT-generated, composite slope-aspect maps provided indications of areas deemed variously suited to "beginner, intermediate and expert skiing."[162] The software was widely impactful beyond the Forest Service, as well, with VIEWIT finding significant use by landscape architects at the Bureau of Land Management, with one example of its application in the development of a management plan for an area along the Upper Missouri River.[163]

To contend with burgeoning federal bureaucratic visual management practices, other forms of visualization were increasingly recruited in the adjudication of controversial proposals and the development of comprehensive land-use planning. Complementing VIEWIT and the Visual Management Support System's capacities to produce digital composite maps, other U.S. Forest Service-sponsored computer programs developed in the same period crucially facilitated the conversion of mapped proposals into perspectival renderings. Among the earliest of these softwares was PREVIEW, a mainframe computer program developed for the Forest Service's Northeastern Forest Experiment Station in Upper Darby, Pennsylvania, which generated perspectival views from selected viewpoints on digitized maps. Issued by 1976, PREVIEW was capable of illustrating in

161 Johnson, *Mineral King Visual Analysis*, 28.

162 Ibid., 45.

163 Dwight K. Araki, "VIEWIT Uses on the Wild and Scenic Upper Missouri River," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 618–26.

perspective topographic landforms through the use of distorted grids, as well as landscape elements including trees, rocks, water, roads, clearings, and other features through an iconographic symbol language. PREVIEW could also project landscape changes over time, rendering the visual effects of phased timber harvesting, variable rates regrowth, and other subsequent landscape alterations (fig. 3.20).[164] Although developed primarily for the visual management of logging impacts, PREVIEW found wide-ranging applications for other development types: in one instance, the software was deployed to visualize and test alternate designs for a 1977 proposed expansion to a ski resort in Banff National Park in Canada.[165]

PREVIEW was one among a number of similar programs developed and championed by forest researchers employed at the Forest Service for the production of digital perspectival renders. Another such program, Perspective Plot, was developed by the Forest Service's Logging Systems Group in Portland, Oregon, and issued by 1978 to manage the "esthetics of clearcut[s]."[166] Devised by forest managers in response to the clearcutting controversies of the 1960s and 1970s, ad hoc strategies for clearcutting—including shaping cuts so as to appear natural in origin or screening them entirely from view by way of topographic or vegetative cover, practices which were both explicitly stipulated in the National Forest Management Act of 1976—were thought to adequately accommodate scenic quality concerns. Seeking however a method to visualize and test the

---

164 Erik Myklestad and J. Alan Wagar, *PREVIEW: Computer Assistance for Visual Management of Forested Landscapes*, USDA Forest Service Research Paper NE-555 (Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, 1976).

165 Mark Angelo, "The Use of Computer Graphics in the Visual Analysis of the Proposed Sunshine Ski Area Expansion," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 439–46.

166 Roger H. Twito, *Plotting Landscape Perspectives of Clearcut Units*, General Technical Report PNW-GTR-071 (Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, 1978), n.p.; Devon B. Nickerson, *Perspective Plot: An Interactive Analytical Technique for the Visual Modelling of Land Management Activities* (Portland, OR: U.S. Department of Agriculture, Forest Service, Division of Timber Management, 1980).

effectiveness of these clearcutting strategies, researchers and programmers in the Forest Service devised a semi-automated desktop computer technique employing digitized topographic data whereby proposed cuts could be manually drawn on contour maps, traced by digitizer to convert them to planar and elevation coordinates, and, with the additional input of data for tree height and shape, could yield "accurate perspective illustrations" of landforms from selected viewpoints, with proposed timber harvests conspicuously outlined (figs. 3.21 and 3.22).[167] The program promised forest managers the possibility of "judicious design": visualizations could be evaluated against visual management guidelines, and if needed, designs could be easily modified to better suit these objectives. The program's literature, to be sure, encouraged forest managers to weigh these schemes against the costs of logging and to produce alternative plans in order to project the cost-effectiveness of meeting visual objectives against the demand for resources.[168] The program was considered particularly useful in Visual Absorption Capability assessments, with the effects of terrain attributes such as slope, aspect, and elevation relative to the observer made plainly visible through the software, and, in turn, able to be rendered on shaded maps.[169] Although designed for the management of timber harvesting, the use of Perspective Plot extended to numerous other development types, including the modelling of utility corridors, ski runs, roads, dams, hotels, water towers, and surface mines (figs. 3.23 and 3.24).[170] Among the software's acknowledged limitations, however, was its inability to account for atmospheric effects affecting visibility, which would be addressed in other newly devised visualization programs in the period.[171]

---

[167] Twito, *Plotting Landscape Perspectives of Clearcut Units*, 1; Nickerson, *Perspective Plot: An Interactive Analytical Technique for the Visual Modelling of Land Management Activities*, 1.

[168] Twito, *Plotting Landscape Perspectives of Clearcut Units*, n.p., 5.

[169] Nickerson, *Perspective Plot: An Interactive Analytical Technique for the Visual Modelling of Land Management Activities*, 111, 115.

[170] Nickerson, *Perspective Plot: An Interactive Analytical Technique for the Visual Modelling of Land Management Activities*; U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 7: Ski Areas*, 24.

[171] Twito, *Plotting Landscape Perspectives of Clearcut Units*, 5.

The various programs developed by and for the Forest Service were largely designed to be used in conjunction toward comprehensive planning ends: in the case of a Visual Absorption Capability analysis for Kootenai National Forest, VIEWIT and Perspective Plot were deployed together to facilitate analysis at telescoping scales. VIEWIT allowed the development of visual magnitude analysis at a "broad scale," with resulting Visual Absorption Capability determinations plotted in perspective for key viewpoints by virtue of Perspective Plot, thus affording greater analytic capacity "at the project level."[172] Wayne Iverson, a landscape architect employed with the Forest Service who had been involved with the national effort to develop the agency's initial visual management system, likewise developed further uses for VIEWIT and Perspective Plot in conjunction. Iverson, who had initially requested the development of the VIEWIT subprogram for generating visual magnitude analyses, recruited Devon Nickerson, programmer for Perspective Plot, to develop a program allowing the translation of perspectival views simulating visual magnitude into grey-scale plan formats accounting for what he called "relative visibility."[173] Iverson suggested the method could afford refinements to the Forest Service's visual management system, recommending, for example, the establishment of numerical thresholds for allowable development measured in terms of visual magnitude for each of the various visual quality objectives. The landscape architect suggested these would offer greater "flexibility" to forest managers in providing for "controlled development," as well as "objectivity… that could withstand the test of appeals and litigation."[174]

---

[172] Wayne Tlusty, "The Use of VIEWIT and Perspective Plot to Assist in Determining the Landscape's Visual Absorption Capability," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 207.

[173] Wayne D. Iverson, "And That's About the Size of It: Visual Magnitude as a Measurement of the Physical Landscape," *Landscape Journal* 4, no. 1 (Spring 1985): 14, 16.

[174] Ibid., 17, 21.

In the years following, these programs were increasingly incorporated into broader desktop software packages to serve integrated planning needs. Other programs developed by the Forest Service to predict the visual consequences of timber harvests included SIGHTLINE and SCOPE, designed to be used in conjunction with Perspective Plot as part of an integrated package championed by the Forest Service's Logging Systems Group. Similar to VIEWIT, SIGHTLINE generated seen-area overlays from digitized topographic data; SCOPE, an admittedly "imaginative acronym" for Vi*s*ual Management *C*omputer M*o*del for *P*artially Cut Timb*e*r Stands, simulated the visual effects of partial cut logging schemes, rendered atop perspectival views generated by Perspective Plot (fig. 3.25).[175] The package thus better served the need to render of a variety of timber-harvesting strategies, including, but no longer limited to, clearcuts. A report on the software package recommended that views taken could be from two nearby viewpoints to allow the production of immersive stereoscopic image pairs.[176]

A later desktop software package, PLANS—an acronym for Preliminary Logging Analysis System—developed by one of the proponents of Perspective Plot, intended to integrate the capacity for generating visualizations with various forms of material, physical, and economic analysis for logging engineers and transportation planners. The "computer-aided design system" allowed comparative analysis of timber harvesting alternatives "on an economic basis."[177] PLANS comprised eight subprograms including SLOPE, which, like VIEWIT, allowed for mapped overlays accounting for aspect, slope, and elevation, and VISUAL, which produced perspectival views employing a

---

[175] Nickerson, *Perspective Plot: An Interactive Analytical Technique for the Visual Modelling of Land Management Activities*, 43; Devon B. Nickerson, "SIGHTLINE, PERSPECTIVE PLOT, SCOPE: Three Desktop Computer Programs for Forest Landscape Design," *Journal of Forestry* 77, no. 1 (January 1, 1979): 14–17.

[176] Nickerson, "SIGHTLINE, PERSPECTIVE PLOT, SCOPE: Three Desktop Computer Programs for Forest Landscape Design," 14.

[177] Roger H. Twito et al., *Preliminary Logging Analysis System (PLANS): Overview*, General Technical Report PNW-GTR-199 (Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 1987), 17.

computational technique adapted from Perspective Plot.[178] In addition to these techniques for visualization were programs for estimating equipment and infrastructure needs as a result of terrain and related constraints, including a program for simulating road networks and their attendant grading requirements, namely ROUTES; programs for designing cable logging systems and estimating equipment requirements, including SKYMOBILE, SKYTOWER, and HIGHLEAD; and a "cable logging simulation model," SIMYAR, designed to estimate costs, outputs, and productivity as a result of various alternative harvest plans.[179]

Suggested in this particular history of digital perspectival visualization is the extension of software programs developed by federal agencies primarily for the purpose of managing timber harvests against demands on scenic quality onto matters far beyond this initial purview—as would become abundantly apparent in the case of the controversially proposed plan for coal strip mining in the Alton hills outside Bryce Canyon National Park. The Alton matter required a turn to many of these novel forms of visualization, with the various parties mobilizing multiple strategies, often at odds with one another, to represent and account for matters of visibility and visual intrusion.

The techniques deployed in the Alton case ranged significantly—from the analog to the digital and, so too, from the projective to the 'real.' At one extreme was a series of studies to test the visual effects of blasting associated with mine operations. In trials in May 1980, the Office of Surface Mining detonated blasts both on the ground and in the air in the areas considered likely to be visible from Yovimpa Point and recorded these by way of photographs. The images suggested

---

[178] Robert J. McGaughey and Roger H. Twito, *VISUAL and SLOPE: Perspective and Quantitative Representation of Digital Terrain Models*, General Technical Report PNW- GTR-214 (Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 1988), 2, 6, 14.

[179] Twito et al., *Preliminary Logging Analysis System (PLANS): Overview*, 4, 7, 11.

that the regular occurrence of blasting and associated dust plumes would be expected to be "readily visible to any viewer."[180]

Charged with direct oversight for the lands atop which the mine was to sit, the Bureau of Land Management produced an initial round of visualizations for the Alton coalfield, with views from Yovimpa Point in Bryce Canyon taking especial precedence in the matter. Seeking to analyze both matters of visual intrusion and of visibility, the Bureau contracted with the planning firm Environmental Associates of Salt Lake City, Utah, to produce in June 1980 two sets of panoramic photographs taken from Yovimpa Point, one on a high-visibility, cloudless day, and the other on a cloudy day with reduced levels of visibility. The Bureau's consultants montaged hand drawings of the various phases of the mine plan atop these photographs, the latter of which were selected to correspond with projected atmospheric impacts: both the representation of the present, without mining, and the simulation of the site ten years after reclamation were illustrated atop the high-visibility photographs, while the simulation of "peak mining" was depicted atop the reduced-visibility image (fig. 3.26).[181] In many ways, the strategy recalled the hand-painted composite images produced for the case of Greene County Nuclear Power Plant detailed in chapter one, but here there was to be found an incremental turn to the digital: the estimated accuracy of the Bureau's montage techniques required recourse to both digitally produced seen-area mapping data and line-of-sight analysis by laser, both of which had been furnished by Utah International.

In order to identify impacts to the viewshed from Yovimpa Point, Utah International had developed these digital mapping and laser survey techniques, the resulting data from which not only served the energy firm's needs but were also supplied to the Office of Surface Mining, the National Park Service, and the Bureau of Land Management, with the latter two agencies using these as bases

[180] U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, III-11.

[181] Ibid., III-8, V-I.

to generate their own composite-photographic visualizations. Utah International's viewshed mapping made use of COMARC, a computer program developed by Comarc Design Systems, which, like VIEWIT, allowed the production of seen-area maps from digitized topographic data, with provisions for the input of alterations on the landscape to be studied. In this case, planners input topographic data as well as data for various phases of the mine plans, which COMARC analysis was able to manipulate to generate a series of maps highlighting the areas of mining activity visible from Yovimpa Point at each successive stage (fig. 3.27).[182] A sixteen-point laser field survey, in turn, correlated COMARC-mapped data for seen-areas onto perspectival photographs.[183]

The resulting images were subject to various forms of expert judgment: in a Bureau of Land Management statement presented at hearings on the unsuitability case, it was noted that the "professional judgement" of a principal landscape architect at Environmental Associates demonstrated that "to most people who would view this activity from Yovimpa Point, it would appear to be no more than a natural opening and not readily perceivable," owing to distance and angle of sight. "Mining activities viewed from that distance and angle would not draw the viewer's attention," the Bureau averred.[184] Drawing conclusions in this way from the set of images, the analysis seemed to confirm the Bureau's support for the mining plan, with exceptions only for areas at the eastern end of the petition area within view of Yovimpa Point—amounting to about 5% of the total mineable area. The Office of Surface Mining, in response to these conclusions, contested the validity of the imaging strategy, pointing out that the montaged images represented views from only "a single observation point" and that by accounting for other points the ratio between visible

---

182 Hatfield, Balzer, and Nelson, "Computer-Aided Visual Assessment in Mine Planning and Design," 323–25.

183 Utah International, Inc., "Comments on Southern Utah Petition Evaluation Document," October 15, 1980, 21, in *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4*.

184 U.S. Bureau of Land Management, "BLM Statement Presented at the OSM Alton Coal Unsuitability Hearing in Kanab," September 29, 1980.

and non-visible areas would necessarily shift, as confirmed by OSM-directed topographic analysis.[185] The Environmental Defense Fund, too, commented on the Bureau of Land Management photosets, arguing that the images were "static" at best—a "two-dimensional, single sensory representation of what is in fact a three-dimensional, five-sensory experience"—to which the Office of Surface Mining responded, simply, "We concur."[186] Utah International likewise objected to the use of the simulations, submitting testimony suggesting that the views "exaggerated" the area visible from Yovimpa Point and arguing that the sole focus on that overlook "gives the reader an inaccurate impression that the most significant visual issue is this portion of the view from Yovimpa Point, the only overlook from which a part of the Alton coal leasehold can be seen." A "more comprehensive discussion," by comparison, would require "viewshed analysis of the <u>entire</u> Unsuitability Petition area."[187] Acknowledging some of these concerns, the Office of Surface Mining, at the behest of the Environmental Defense Fund, introduced a caveat in their Petition Evaluation report regarding the Bureau of Land Management simulations:

> … the photo sets are not completely representative of the viewable area in reality. The view appears closer and the clarity of the view appears greater when viewed first-hand than when viewed in the photographs… In terms of depth perception, the human eye compresses scenes more than does a 'normal' lens. Therefore, a surface coal mine would appear closer to Yovimpa Point when at the Point than in the photographs used here.[188]

Despite—or perhaps precisely because of—the competing aims of these various interests, at stake here were methods for the identification of what constituted key viewpoints, where viewed areas

185 OSM Comments on "BLM Statement Presented at the OSM Alton Coal Unsuitability Hearing in Kanab."

186 Environmental Defense Fund, "Comments of The Environmental Defense Fund on the Office of Surface Mining's Southern Utah Petition Evaluation Document," October 10, 1980, in *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4*.

187 Emphasis in the original. Utah International, Inc., "Comments on Southern Utah Petition Evaluation Document," October 15, 1980, 19; 20–21.

188 U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, V-1.

precisely lay, and the problem of projecting and rendering atmospheric effects, which would be attended to through recourse to other softwares and modes of visual analysis.

Utah International ushered other modes of digital representation in order to locate evidentiary support for their project. Initially, the firm sought a series of computer-generated, three-dimensional perspectives produced from the COMARC mapping analyses and laser surveys. These perspectives accounted for sequencing over time on five-year intervals, from the view as seen in the present, to a simulation of peak mining activity, to views following reclamation when lands would be "returned to the viewscape"—for what Utah International described as a "precise display of the visual impact" (fig. 3.28).[189] The method was touted for its speed, accuracy, flexibility, responsivity, comprehensiveness, and capacities for display.[190] As characterized in comments submitted for the Unsuitability Petition evaluation, however, Utah International was ultimately unhappy with the resulting perspectival views, suggesting the "accuracy of this estimation procedure decreases markedly with distance."[191]

To address these perceived shortcomings, Utah International sought competing photograph-based simulations. The company retained the services of planning firm Wirth Associates, Inc., to develop the broader visual impact assessment strategy for the Alton proposal; Wirth, in turn, subcontracted to Resource Perspectives, Inc., to produce new digital visualizations of seen areas and to prepare perspective studies for Yovimpa Point.[192] These analyses put to use yet another computer program heavily sponsored by the U.S. Forest Service, MOSAIC, which had begun development in 1970 in collaboration among the Aerospace Corporation of El Segundo, California, the Forest

---

189 Hatfield, Balzer, and Nelson, "Computer-Aided Visual Assessment in Mine Planning and Design," 326.

190 Ibid.

191 Utah International, Inc., "Comments on Southern Utah Petition Evaluation Document," October 15, 1980, 20–21.

192 Stephen R. J. Sheppard and Tim Tetherow, "Visual Assessment of Surface Mining in the Alton Coal Field," *Garten Und Landschaft*, no. 8 (1983): 625, 627; Utah International, Inc., "Comments on Southern Utah Petition Evaluation Document," October 15, 1980, 20–21.

Service's Surface Environment and Mining program, and the Forest Service's Land Use and Landscape Planning Methodology Research Project.[193] Devised initially for the visual analysis of surface mines, early schemes for the mainframe computer program sought to build on the digital-perspectival capabilities of programs like PREVIEW and Perspective Plot, furnishing these with the ability to render colors, shadows, and light intensities; the result of these initial efforts, however, was deemed subpar, and the research team instead turned to the development of a photomontage technique bridging the digital and the analog.[194] Generating computer-drawn graphic overlays for development proposals laid atop baseline photographs, MOSAIC promised what its developers identified as "maximum realism at the minimum cost."[195] The program obviated the need for extensive field surveying to assure perspectival and locational accuracy within montaged images: central features of the program provided for the precise, computational calibration of computer graphics and photographs against topographic data by way of a camera calibration and digital re-sectioning technique which required the user to select a number of reference points on both photographs and topographic maps (figs. 3.29–3.31). With data for development proposals inputted into the program, users were afforded a "substantial library of graphic options" to represent various development types, including timber cuts, fuel breaks, smokestacks, powerlines, ski lifts, hiking trails, and cabins; a dedicated subroutine of the program also calculated topographic modifications resulting from activities like surface mining. Based on these inputs, MOSAIC was able to generate graphic representations for development alternatives overlaid atop baseline photographs, at

---

193 *MOSAIC: A System for Displaying a Proposed Modification Before Its Impact on the Environment* (Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, 1977), 1.

194 A. E. Stevenson, J. A. Conley, and J. B. Carey, "A Computerized System for Portrayal of Landscape Alterations," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 151, 153.

195 Ibid., 156.

matching scales and orientation (figs. 3.32 and 3.33). If desired, the resulting images could be plotted and further retouched by hand to render color and texture.[196] Thus bridging analog photography, computer graphics, and hand-rendering, MOSAIC was characteristic, perhaps exceptionally so, of the multiple, coincident techniques required in the early development and application of computer-based perspectival rendering in matters of governance.

In the case of the Alton proposal, MOSAIC furnished Utah International with a series of digitally modified photographic montages depicting the mined areas from Yovimpa Point at successive stages of development and reclamation. These images were printed in color at large scale—thirty-by-forty inches—and were subsequently lavished with greater detail by way of hand-rendering. The resulting hybrid, analog-digital visualizations were reproduced as transparencies, installed in a "curved-plane simulation chamber," and put on display at the public unsuitability hearings. Utah International studied the resulting images against mapped Visual Absorption Capability analyses and the Bureau of Land Management's Visual Resource Management class requirements to determine projected levels of visual contrast, concluding that the project would result in highly localized, though admittedly acute visual impacts.[197]

If these various softwares largely developed by the Forest Service had primarily concerned matters of visual intrusion, the National Park Service had, by contrast, a demonstrated interest in understanding the visibility effects of increased emissions across its landscapes more broadly. In order to visualize projected impacts on visibility stemming from the related proposal for the Warner Valley powerplant, the Park Service recruited a "computer-simulated photograph technique" which

---

[196] *MOSAIC: A System for Displaying a Proposed Modification Before Its Impact on the Environment*, 2–3; Stevenson, Conley, and Carey, "A Computerized System for Portrayal of Landscape Alterations," 153, 156; Robert A. Entzminger, "MOSAIC/Photomontage: A New Concept to Help Reclamation Planning," *Coal Mining & Processing* 13, no. 6 (1976): 76.

[197] Sheppard and Tetherow, "Visual Assessment of Surface Mining in the Alton Coal Field," 627.

had been developed by researchers at the Los Alamos National Laboratory as a direct response to provisions in the Clean Air Act Amendments.[198] The LASL visibility system, as it was abbreviated, required digitized photographic slides and concurrent data for background atmospheric conditions to be input together into a computer program which correlated the atmospheric data to equivalent film densities. Fed additional information on the new emissions source to be projected, the program mathematically modeled resulting atmospheric dispersion, chemical transformation, and radiative transfer of emissions to project impacts to atmospheric brightness and color, rendered in terms of modified film densities. The newly calculated film densities formed the basis for the program to generate modified images displayed on color television monitors visualizing the mathematically modelled atmospheric effects.[199]

The National Park Service employed the LASL visibility system for two observation points in nearby Zion National Park, with baseline photographs taken in the morning on two, relatively clear days in June 1979, which were then digitally altered to simulate the atmospheric effects triggered by the presence of a coal-fired electric power station (figs. 3.34 and 3.35).[200] Commenting on the resulting images, representatives from utilities companies including the Nevada Power

---

198 U.S. Bureau of Land Management, *Draft Environmental Impact Statement on the Allen-Warner Valley Energy System*, 4-15; Michael D. Williams, Evelyn F. Treiman, and Mona J. Wecksung, "Plume Blight Visibility Modeling with A Simulated Photograph Technique," *Journal of the Air Pollution Control Association* 30, no. 2 (February 1, 1980): 131.

199 Evelyn F. Treiman et al., "Simulation of the Visual Effects of Power Plant Plumes," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 485–90; Michael D. Williams, Evelyn F. Treiman, and Mona J. Wecksung, *Plume Blight Visibility Modeling with a Simulated Photograph Technique*, Submitted to Air Pollution Control Association Conference on Visibility, Denver, CO, November 1979 (LA-UR-79-3250) (Los Alamos, NM: Los Alamos Scientific Laboratory, 1979); Williams, Treiman, and Wecksung, "Plume Blight Visibility Modeling with A Simulated Photograph Technique"; U.S. Bureau of Land Management, *Final Environmental Impact Statement on the Allen-Warner Valley Energy System*, A12-1; See also Michael D. Williams, Lo Yin Chan, and Renate Lewis, *Validation and Sensitivity of a Simulated Photograph Technique for Visibility Monitoring*, Submitted to Symposium on Plumes and Visibility: Measurements and Model Components, Grand Canyon, AZ, November 10-14, 1980 (LA-UR-80-2604) (Los Alamos, NM: Los Alamos Scientific Laboratory, 1980).

200 U.S. Bureau of Land Management, *Draft Environmental Impact Statement on the Allen-Warner Valley Energy System*, 4-15, A11-1.

Company vigorously objected to their inclusion in the environmental impact statements, suggesting that the simulation methods were specious, at best, and their results therefore "misleading."[201] A key engineer on the LASL visibility system, Michael D. Williams, by contrast, commented in support of Unsuitability Petition for the Alton coal field, suggesting reductions in visual range, detail, color, and contrast would be readily perceivable as a result of strip mining in the area.[202]

Like the National Park Service, the Environmental Protection Agency largely focused their efforts in this case on impacts to visibility. In addition to atmospheric diffusion modeling developed by the Agency in-house, visibility analyses for the Alton mine were contracted out to Systems Applications, Inc., of San Rafael, California.[203] In roughly the same years, Systems Applications had developed methods for visual impact modeling and analysis that had figured centrally in the Environmental Protection Agency's development of regulations for visibility protection. Among these contributions was a digital software package known as PLUVUE which produced computer-generated perspectival images for plume emissions sited in digital terrain and which was to be deployed for views from Yovimpa Point (figs. 3.1–3.3).[204] This simulation technique constructed mathematical models for emissions given proposed powerplant data, atmospheric and meteorological conditions, and topographic information; computed in this way, the power plant and its plume dynamics could be graphically simulated and assessed, with a "conceptual camera" able to generate "snapshots" from any observer location, whose results were considered "accurate and

---

201 Correspondence from John Arlidge, Nevada Power Company, to Morgan Jensen, Bureau of Land Management, August 22, 1980, in *Final Environmental Impact Statement on the Allen-Warner Valley Energy System*.

202 Exhibit 4 in Environmental Defense Fund, Friends of the Earth, Sierra Club, Sylvan Johnson, Leon Lippincott, Caroline Lippincott, Jet Mackelprang, Cynthia Myers, Susan Hittson, and Larry Little, "Petition in the Matter of Designating Certain Federal Lands in Kane and Garfield Counties, Utah, Abutting Bryce Canyon National Park and Dixie National Forest as Unsuitable for Surface Coal Mining Operations before the Office of Surface Mining Reclamation and Enforcement," 4.

203 David Joseph, "Summary of Air Quality and Visibility Impact Analyses for the Proposed Alton Surface Coal Mine" (Denver, CO: Environmental Protection Agency, Region VIII, Air Programs Branch, 1980), 1.

204 Ibid., 7.

visually appealing" (figs. 3.36 and 3.37).[205] Bridging computer graphics and methods of quantification, the program promised "to provide an understanding of the subjective impact of the computer predictions," with outputs including Munsell color data allowing color to be rendered atop the resulting images.[206]

Based on these various lines of investigation, Systems Applications concluded that emissions from the mining sites would be visible from Yovimpa Point under all meteorological conditions identified as commonly occurring, writing that "perceptible visual impacts" would occur "frequently" with plumes visible as white-gray clouds or layers of haze.[207] The analyses found that visual range could be reduced by as much as 25%, and that violations of Class II Prevention of Significant Deterioration increments would occur regularly.[208] Stemming from these findings, the official Environmental Protection Agency position maintained that mining in the Alton coal fields would represent "an obtrusive distraction to the scenic vista presently enjoyed from Yovimpa Point" and that the project should be held to "a very high standard of proof" given its potential impacts to the national park.[209] Still, researchers at Systems Applications, Inc., suggested there remained further psychophysical work to be done in confirming "the subjective visual impact of and human threshold

---

205 Stanley R. Hayes, "A Technique for Plume Visualization in Power Plant Siting," *Journal of the Air Pollution Control Association* 29, no. 8 (August 1979): 840–43.

206 Douglas A. Latimer et al., "The Development of Mathematical Models for the Prediction of Anthropogenic Visibility Impairment," Prepared for U.S. Environmental Protection Agency (San Rafael, CA: Systems Applications, Incorporated, 1978), 110. For more on PLUVUE, see also Clark D. Johnson et al., "User's Manual for the Plume Visibility Model (PLUVUE)," Prepared for Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency (San Rafael, CA: Systems Applications, Inc., November 1980); Douglas A. Latimer and Robert G. Ireson, "Workbook for Estimating Visibility Impairment," Prepared for Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency (San Rafael, CA: Systems Applications, Inc., November 1980).

207 Douglas A. Latimer, Stanley R. Hayes, and Clark D. Johnson, "Visual Impacts of Particulate Emissions From the Proposed Alton Coal Project," Prepared for U.S. Environmental Protection Agency, Region VIII, Air Programs Branch (San Rafael, CA: Systems Applications, Incorporated, September 23, 1980), 23–24.

208 Joseph, "Summary of Air Quality and Visibility Impact Analyses for the Proposed Alton Surface Coal Mine," 7, 11.

209 Correspondence from Gene A. Lucero, Deputy Regional Administrator of EPA Region VIII, to Donald Crane, Regional Director Office of Surface Mining, undated, in *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4*.

response to light intensity and color changes" in more clearly adjudicating these matters.[210] If novel forms of visualization, resolutely hybrid in their digital-analog character, had made possible the production of new systems of visuality, these, in turn, would require demonstrated correspondence with human perceptual processes and theories of decision-making in order to re-naturalize them into techniques available to administrative management.

III. Psychophysics, Signal Detection, and Contingent Markets

The question persistent across these various studies, regulatory frameworks, and efforts to develop techniques for visualization was how precisely to relate the material facts of atmospheric emissions to psychological matters of visual perception. If certain modes of expert judgment and public preference analysis conducted in early research at the Forest Service had sufficed, at least initially, in this effort, the continued drive toward quantification and the proliferation of atmospheric data bore coincident demands to turn increasingly to other frameworks for analysis. Mustered toward this end were a series of techniques from psychophysics, updated by way of signal detection theory, alongside behavioral-economic approaches, which together allowed the production of a purportedly objective measure of the value of visibility impacts to be interpolated in particular ways into newly charged, cost-benefit analytical frameworks.

Contending with the new national visibility goals laid out in the Clean Air Act Amendments of 1977, the Environmental Protection Agency sought to add dedicated atmospheric visibility indices to its regular reporting practices. The difficulty here was that the Agency's reporting had, to that point, exclusively concerned measurable physical variables, such as atmospheric lead concentrations, rather than the *effects* of those variables, such as lead levels in blood. Visibility, by

---

210 Latimer et al., "The Development of Mathematical Models for the Prediction of Anthropogenic Visibility Impairment," 158.

comparison, was understood explicitly as an "air quality effect" variously imbricating atmospheric dynamics, lighting, observer distance, and visual perceptual processes, and thus seemingly resisted objective reporting practices.[211] Still, a joint undertaking between the Environmental Protection Agency's Environmental Monitoring Systems Laboratory and the National Park Service oversaw the rapid expansion of visibility monitoring programs beginning in 1978.[212] Initially called VIEW—Visibility Investigative Experiment in the West—a network of thirteen sites throughout Texas, New Mexico, Arizona, Colorado, and Utah were outfitted with manually operated photographic cameras, fine particulate samplers, and multi-wavelength teleradiometers, which measured the contrast of distant objects against the sky. These forms of instrumentation generated various optical data, which were recorded against prevailing meteorological conditions. By 1982, the VIEW network had expanded to 31 sites. In the following years, an expanded program known as IMPROVE—Interagency Monitoring and Protected Visual Environments—jointly undertaken by the National Park Service and the Environmental Protection Agency, along with the Forest Service, the Fish and Wildlife Service, and the Bureau of Land Management represented a significant expansion of this activity, with approximately 20 sites equipped with transmissometers, particulate samplers, and cameras, whose use, by the late 1980s, had been fully automated.[213] The proliferation of particular kinds of visibility data was made possible, in this way, by these burgeoning forms of instrumentation, which also variously included slide densitometers or nephelometers, telephotometers, and radiometers, together charged with establishing and monitoring background

---

211 B. S. Austin et al., "Characterizing Visibility Trends: A Review of Historical Approaches and Recommendations for Future Analyses," Prepared for Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency (San Rafael, CA: Systems Applications, Inc., 1988), 5.

212 U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook*, 3-21.

213 Austin et al., "Characterizing Visibility Trends: A Review of Historical Approaches and Recommendations for Future Analyses," 22–23; National Park Service, *Air Quality in the National Parks: A Summary of Findings from the National Park Service Air Quality Research and Monitoring Program*.

levels of visibility across key sites. But the matter of how to relate these atmospheric data to processes of human visual perception remained.

Analogous tensions suffused the debates over the Alton coal field. Utah International, Inc., contracted with Environmental Research and Technology, Inc. of Westlake Village, California, to carry out air quality and visibility impact assessments for the contested areas.[214] Environmental Research and Technology's "multidisciplinary" methodology primarily comprised computational analysis modeling meteorological conditions and emissions, following the then-extant draft visibility guidelines issued by the Environmental Protection Agency.[215] Contra the analyses developed by Systems Applications under contract to the Environmental Protection Agency, Environmental Research and Technology's calculations for Utah International demonstrated that projected particulate concentrations resulting from the Alton mines would remain well below both Class I and Class II Prevention of Significant Deterioration targets.[216] In addition to these physical atmospheric measures which admittedly formed the "bulk" of their analysis, Environmental Research and Technology offered assurances that the firm had invested "considerable effort" into interpreting these measures "in terms of an observer's experience"—seeking to identify, specifically, "the potential for humanly perceptible visibility degradation."[217] In order to translate "the quantitative frame of reference to the human one," the firm looked to the growing literature of laboratory-based studies on visual perception, with particular attention to work on optics, psychophysics, and theories

---

[214] U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, III-7.

[215] Kirk D. Winges, Ronald C. Henry, and Roberta C. Lewis, "An Analysis of Air Quality and Visibility Effects of the Proposed Alton Coal Project," Prepared for Utah International (Westlake Village, CA: Environmental Research & Technology, Inc., August 1980), 2-1, 2-14, Environmental Defense Fund Archive, Box 37, Special Collections and University Archives, Stony Brook University Libraries.

[216] Joseph, "Summary of Air Quality and Visibility Impact Analyses for the Proposed Alton Surface Coal Mine," 8; Winges, Henry, and Lewis, "An Analysis of Air Quality and Visibility Effects of the Proposed Alton Coal Project," 7-1.

[217] Winges, Henry, and Lewis, "An Analysis of Air Quality and Visibility Effects of the Proposed Alton Coal Project," 2-14, 6-15.

of just-noticeable differences, which sought to identify thresholds for perceptibility—a methodological problem which would be increasingly taken up in earnest in the period in question.[218] The novelty—and uncertainty—of this methodological approach was revealed throughout the firm's reporting on the Alton studies, where it was emphasized that any relationships between atmospheric measures and human perception identified in the findings "are not based on any firm observational study," admitting "it is simply not known what degree of visual range reduction will perceptibly degrade a given vista at a given time for a given observer."[219] Still, review of the literature allowed the researchers to posit a stable measure for the just-noticeable level of atmospheric change that would constitute a "perceptible" impact; analyzing the results of their atmospheric modeling against this stable threshold yielded the conclusion that visibility degradation would be "at or near the limits of perception" only under the worst-case scenarios, expected less than 1% of the time.[220] The chain of procedures, Environmental Research and Technology maintained, would "tell us that the probability of a severe impact on visibility is small."[221] Still, the report stressed that the findings were "semi-empirical": "Although they are the result of careful study by an experienced scientist, they are not to be construed as the results of a controlled experiment. Rather, they are educated guesses and observations."[222]

The very notion of identifying thresholds for just-noticeable levels of atmospheric change constituting humanly perceptible visibility impacts was under immense pressure in this moment. In

---

[218] Ibid., 4-27.

[219] Ibid., 6-14.

[220] Winges, Henry, and Lewis, 6-15, 6-17; U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, III-7; Kirk D. Winges, "Alton Coal Project Response to the Unsuitability Petition Air Quality/Visibility Issues," Prepared for Utah International (Westlake Village, CA: Environmental Research & Technology, Inc., September 1980), Environmental Defense Fund Archive, Box 37, Special Collections and University Archives, Stony Brook University Libraries.

[221] Winges, Henry, and Lewis, "An Analysis of Air Quality and Visibility Effects of the Proposed Alton Coal Project," 6-14.

[222] Ibid., 6-15.

the same years that he'd led the visibility investigations for the Alton project, Ronald C. Henry, senior scientific advisor for Environmental Research and Technology, had published extensively on what he identified as the need to update classical psychophysical frameworks for visibility analysis. Trained in applied physics and mathematics, Henry had been employed by Bell Telephone Laboratories, Inc., prior to his work for Environmental Research and Technology, where he'd been involved in "classified work" for the SAFEGARD anti-ballistic missile system.[223] Following his work for Bell, Henry developed a specialization applying psychophysical frameworks to the study of visibility, updated by way of recourse to then-contemporary methods developed in linear system analysis and signal detection theory to distinguish a practice he referred to as "modern psychophysics."[224] If classical psychophysics had posited a direct, functional relationship between stimulus and sensation and assumed a relatively stable "sensory threshold" determining just-detectable intensities for stimuli or just-noticeable differences between stimuli, early signal detection theorists, by comparison, sought to address the problem of detecting what they called signals in the presence of noise by accounting for the instability or the variability of this threshold as such. The general theory of signal detection had been in development since the early 1950s, with mathematicians and engineers largely at the University of Michigan, Massachusetts Institute of Technology, and Harvard drawing upon earlier work in statistics and electronic communications to posit that the ability to distinguish signal from noise was based on two separate variables: not only was the receiver's "true" sensitivity or sensory capacity to discriminate determinative of their response, but so too, importantly accounted for here, was the crucial role played by non-sensory

---

223 "Affidavit of Ronald C. Henry in the Matter of Petition to Designate Federal Coal-Bearing Lands in Kane County and Garfield County, Utah, as Unsuitable for Surface Coal Mining Operations," September 1980, Environmental Defense Fund Archive, Box 90, Special Collections and University Archives, Stony Brook University Libraries.

224 Ronald C. Henry, "The Human Observer and Visibility - Modern Psychophysics Applied to Visibility Degradation," in *A Specialty Conference on View of Visibility - Regulatory and Scientific (November 26-28, Denver, CO)* (Air Pollution Control Association, 1979), 27–35.

decision criteria, including motivational, attitudinal, and cognitive processes involving biases and expectations, in directing the receiver's reactions.[225] Theorists of signal detection in the period sought to develop statistical techniques to account—or control, as necessary—for these latter criteria, plotting hit-rate probabilities against probabilities for false alarms for individual receivers. Offering an important conceptual framework for differentiating sensory processes from decision-making procedures in this way, signal detection theory was widely impactful by the period in question.[226] Though developed largely for studies of the auditory system, by the mid-1970s the framework had been extended to the study of visual stimuli, with a modern psychophysical framework for understanding the "eye-brain system" credited to work sponsored by the U.S. Office of Naval Research.[227] Casting the system of human vision as analogous to a problem of electrical engineering in this way, the theoretical framework was readily extended by psychologists to the evaluation of perceptual judgments, calculating the probability of stimulus perception isolated from decision criteria and thus useful in accounting or correcting for individual "response bias."[228]

For Ronald Henry, as well as others in the period, the Clean Air Act Amendments of 1977 had specifically triggered the methodological need to identify appropriate measures for just-noticeable differences in scenic views—that is, to identify precise thresholds constituting perceivable changes in visibility. Countering the recourse to expert judgment that in different ways had informed both the suppositional claims of landscape architects in testimonies for the Alton unsuitability

---

[225] David M. Green and John A. Swets, *Signal Detection Theory and Psychophysics* (Oxford, England: John Wiley, 1966), 1.

[226] Green and Swets, *Signal Detection Theory and Psychophysics*.

[227] Ronald C. Henry, "Psychophysics and Visibility Values," in *Proceedings of the Workshop in Visibility Values, Fort Collins, Colorado, January 28-February 1, 1979* (U.S. Department of Agriculture, Forest Service, 1979), 76; Henry, "The Human Observer and Visibility - Modern Psychophysics Applied to Visibility Degradation," 30. See Roger W. Cohen, Istvan Gorog, and Curtis R. Carlson, "Image Descriptors for Displays," Prepared for Office of Naval Research (Princeton, NJ: RCA Laboratories, 1975).

[228] Robert C. Angus and Terry C. Daniel, "Applying Theory of Signal Detection in Marketing: Product Development and Evaluation," *American Journal of Agricultural Economics* 56, no. 3 (1974): 573–77.

hearings and the psychological work of the likes of Leopold and Shafer, Henry suggested that the particular form of quantification for psychophysical processes made possible by linear system analysis and signal detection theory, effectively isolating response bias from the study of sensory stimuli, afforded the very possibility of claims to generality.[229] "By combining psychological and psychophysical methods," Henry wrote, "predictions of just-noticeable differences in scenic vistas would rest on our understanding of the visual system itself and not a series of ad hoc experiments the conclusions of which, whether right or wrong, would be debated endlessly."[230] Together, air quality modeling coupled with psychophysical analysis afforded a form of quantitative prediction which sketched out for Henry the promise of identifying emissions thresholds for new regulatory oversight—and allowance: "a modern psychophysical model of the visual system could be used to predict allowable levels of development consistent with protecting perceived visual quality."[231]

In roughly the same years, such a framework, the Scenic Beauty Estimation method, had been under development at the U.S. Forest Service.[232] Terry C. Daniel, a psychologist in the Department of Psychology at the University of Arizona had teamed with Ron Boster, Principal Economist at the U.S. Forest Service Rocky Mountain Forest and Range Experiment Station, to develop a framework which sought to offer quantitative "measures of landscape beauty independent of observer judgmental criteria" in service of the development of "a methodology for measuring

[229] Ronald C. Henry, "The Application of the Linear System Theory of Visual Acuity to Visibility Reduction by Aerosols," *Atmospheric Environment* 11, no. 8 (1977): 697–701.

[230] Emphasis in the original. Henry, "Psychophysics and Visibility Values," 78.

[231] Ibid., 74.

[232] Terry C. Daniel and Herbert Schroeder, "Scenic Beauty Estimation Model: Predicting Perceived Beauty of Forest Landscapes," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979), 514.

public esthetic preferences."[233] Distinguishing their work from the quantitative efforts of Leopold, Shafer, Litton, and others in the early development of the Forest Service's Visual Management System in the years immediately previous, Daniel and Boster noted the then-largely unaddressed issue of ordinal rating systems for judgments of scenic beauty: if asked to rate a scene for visual quality on a scale, say, of zero to nine, there was no guarantee that one subject's rating of say, six, was in any way comparable to another person's rating of, say, seven, given that each undoubtedly had their own criteria for judgment and employed the same numerical system differently. Explicitly citing as key methodological precedents the work in signal detection theory, as well as the earlier statistical scaling techniques that had formed its basis, the Scenic Beauty Estimation method addressed this inability to compare or aggregate scenic beauty ratings across individuals.[234] The method employed statistical techniques to relativize an observer's rating against others they'd made, thus affording the conversion of ordinal-scale observer ratings for scenic beauty into interval-scale indices. Controlling in this way for the criteria any given individual observer used in making a rating, quantification of scenic beauty could thus be deemed "unbiased by the observers' judgmental criteria."[235] If, to some extent, the perceived incomparability of perceptual judgments across individuals had engendered the turn to personality psychology, as was detailed in chapter two, here the analogous motivation led to the opposite solution: the Scenic Beauty Estimation method, like other psychophysical frameworks attending to the problem of visibility as informed by signal

[233] Terry C. Daniel and Ron S. Boster, *Measuring Landscape Esthetics: The Scenic Beauty Estimation Method*, Res. Pap. RM-RP-167 (Fort Collins, Colorado: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, 1976), 2, 17.

[234] Daniel and Boster, 18. In particular, they offer as precedents citations for Louis Leon Thurstone, "A Law of Comparative Judgment," *Psychological Review* 34 (1927): 273–86; Green and Swets, *Signal Detection Theory and Psychophysics*.

[235] Terry C. Daniel et al., "Quantitative Evaluation of Landscapes: An Application of Signal Detection Analysis to Forest Management Alternatives," *Man–Environmental Systems* 3, no. 5 (1973): 341.

detection theory, offered an incrementally depersonalized method which promised that "the ambiguity introduced by differences in observers' criterion values can be eliminated."[236]

The turn to signal detection theory was by no means limited to the proponents of Utah International's plan for mining in the Alton coal fields—it suffused much of the discourse around the problem of visibility in the period across various interests. Like Ronald Henry whose work for Environmental Research and Technology had been contracted to Utah International, Douglas Latimer of Systems Applications, Inc., under contract to the Environmental Protection Agency and later the National Park Service, had likewise championed the use of signal detection theory in visibility studies, and his work was cited as among the methodological precedents for Environmental Research and Technology's analysis for the Alton project. In work funded by the American Petroleum Institute, Latimer worked closely with psychologist Terry C. Daniel, key protagonist in the development of the Scenic Beauty Estimation method, to outline a psychophysical approach for relating various physical measures for pollutant concentrations to the "subjective, aesthetic human experience of scenic areas" in quantified terms, with the explicit aim of reconciling countervailing dictates of the Clean Air Act Amendments.[237] Making use of the Scenic Beauty Estimation method in what was purported to be the first experiment employing psychophysical methods for the study of visibility and scenic beauty, subjects variously rated photographs of vistas in Arizona for scenic quality and for perceived visual air quality, the resulting ratings for which were submitted to statistical techniques for multiple linear regression analysis measured against recordings and calculations for atmospheric optical parameters taken concurrently to the photographs. Seeking to test how sensitive subjects' ratings for perceived visual air quality and scenic beauty were to actual

---

236 Daniel and Boster, *Measuring Landscape Esthetics: The Scenic Beauty Estimation Method*, 17.

237 Douglas A. Latimer and Terry C. Daniel, "Preliminary Results of a Study of Human Judgment of Visual Air Quality," in *A Specialty Conference on View of Visibility - Regulatory and Scientific (November 26-28, Denver, CO)* (Air Pollution Control Association, 1979), 12.

changes in atmospheric composition, the study generated "very tentative" conclusions suggesting that people do, indeed, perceive small changes to atmospheric conditions, but that the relationship of these changes to scenic beauty was not quite as straightforward as one might expect. Impacts to "the human aesthetic experience" caused by visibility impairment, the study found, were "profoundly different" depending on the specific qualities of the viewed landscapes in question:

> In the present study, scenic beauty in the Grand Canyon was found to be significantly affected by changes in visual range, but this was not the case for Tucson area vistas. If further study confirms the tentative finding that the sensitivity of an area's scenic beauty to air quality (visibility) impacts is different in different terrain settings, it may be possible to set visibility goals on the basis of the characteristics of different areas of the country through a straightforward application of the Scenic Beauty Estimation (SBE) method. Indeed, it may be possible in the not too distant future to develop models that describe the sensitivity of an area's scenic beauty to air quality impacts using characteristics of the given area, such as its topography, geology, and vegetation.[238]

The study, in this way, afforded yet another mechanism to get at the same ambition that had informed the Prevention of Significant Deterioration provisions: that is, how to differentiate visual sensitivity as a function of a landscape's physical characteristics, and how, in turn, to identify differential, location-specific visibility goals that could accommodate development. In the years following, Systems Applications brought this methodological approach to bear in a series of follow-up studies on the issue of the Alton mine developed for the National Park Service, in which late-night field experiments conducted in Bryce Canyon National Park sought to test subjects' ability to perceive of the effects of artificial lighting in the night sky.[239]

Across these various studies, methods for the theory of signal detection were in this way identified as potentially powerful not only for developing new metrics that could account in objective terms for visibility and scenic impacts, but so too in instituting what Latimer and Daniel

---

[238] Ibid., 11, 20.

[239] Edward L. Carr et al., "Evaluation of Night Sky Model and Human Perception of Night Sky Glow" (San Rafael, CA: Systems Applications, Incorporated, 1989); Edward L. Carr et al., "Impacts of the Proposed Alton Coal Project on the Night Sky Near Bryce Canyon National Park" (San Rafael, CA: Systems Applications, Incorporated, 1989).

called "rational regulations" and "priorities for emissions control decisions."[240] The National Park Service likewise drew upon frameworks developed for the theory signal detection, by way of the Scenic Beauty Estimation method, in related efforts to variously account and correct for context and individual difference with regard to matters of visibility.[241] In these ways, the theory of signal detection was foundational to the development of practices attending to visuality in the period.

The influence of the theory of signal detection, however, was not limited to the study of environmental perception. Notable among the diverse fields of study which took particular interest in methods and frameworks developed for signal detection was semiotic theory, which saw a range of figures, including Umberto Eco, draw directly on its principles, as well as the study of visual culture which in turn had been founded, at least in part, on semiotic theory.[242] The study of consumer reactions and preferences, too, borrowed heavily on the theory of signal detection, with consumer researchers in the period turning its methods onto the study of food products, televisions, and other consumer goods, seeking to relate product variables to preferences in a non-a priori manner.[243] Terry Daniel, for one, in a characteristic study, applied the theory of signal detection to a taste-test experiment of ice cream products, investigating the rates at which consumers discerned "richness" as related to independent variables including fat level, flavor, and density of mix.[244]

240 Latimer and Daniel, "Preliminary Results of a Study of Human Judgment of Visual Air Quality," 12; See also Terry C. Daniel, "Psychological Perspectives on Air Quality and Visibility in Parks and Wilderness Areas," in *Proceedings of the Workshop in Visibility Values, Fort Collins, Colorado, January 28-February 1, 1979* (U.S. Department of Agriculture, Forest Service, 1979), 84–92.

241 See William C. Malm, Karen K. Leiker, and John V. Molenar, "Human Perception of Visual Air Quality," in *A Specialty Conference on View of Visibility - Regulatory and Scientific (November 26-28, Denver, CO)* (Air Pollution Control Association, 1979), 36–69; William C. Malm, *Introduction to Visibility* (Fort Collins, Colorado: National Park Service, Air and Water Quality Division, Air Research Branch, 1983).

242 Umberto Eco, *A Theory of Semiotics* (Bloomington, IN: Indiana University Press, 1976).

243 Daniel and Schroeder, "Scenic Beauty Estimation Model: Predicting Perceived Beauty of Forest Landscapes," 515.

244 Angus and Daniel, "Applying Theory of Signal Detection in Marketing: Product Development and Evaluation."

Not incidentally, the period was one which witnessed a broad-based effort across federal agencies to turn to techniques of economic analysis, and cost-benefit analysis in particular, with aesthetics, scenic value, and, importantly here, visibility increasingly subject to new modes of economic valuation. Historians have shown that cost-benefit analysis was already in limited use as an informal practice among federal agencies in the United States as early as the late nineteenth century, before its use was first expressly directed in federal legislation with the 1936 Flood Control Act.[245] Stemming in large part from New Deal-era commitments to publicly funded infrastructure development, particularly those concerning water resources, cost-benefit analysis was taken up by the Army Corps of Engineers and the Interior Department in a somewhat ad hoc manner, with efforts to coordinate and standardize its use emergent by the late 1940s.[246] A Federal Interagency River Basin Committee, which had its origins in informal dinner meetings beginning in 1943, organized in 1946 a dedicated Subcommittee on Benefits and Costs, composed of representatives from the Department of Agriculture, the Bureau of Reclamation, the Corps of Engineers, the Federal Power Commission, and the Department of Commerce.[247] A resulting report issued in 1950, *Proposed Practices for Economic Analysis of River Basin Projects*, laid out the earliest coordinated effort to standardize cost-benefit approaches across federal agencies, with significant discussion directed to the matter of valuing "intangibles" including scenic and recreational values.[248] In the following years, the U.S. Bureau of the Budget issued standards for cost-benefit analysis in 1952 and again in 1961; the President's Water Resources Council, an interagency group, issued yet another set of standards

---

245 Theodore M. Porter, "U.S. Army Engineers and the Rise of Cost-Benefit Analysis," in *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton, NJ: Princeton University Press, 1995), 154; E. S. Quade, "A History of Cost-Effectiveness" (Santa Monica, CA: Rand Corporation, 1971).

246 Quade, "A History of Cost-Effectiveness," 9–10. See also Roland N. McKean, *Efficiency in Government Through Systems Analysis: With Emphasis on Water Resources Development* (New York: Wiley, 1958).

247 Porter, "U.S. Army Engineers and the Rise of Cost-Benefit Analysis," 182–83.

248 Federal Inter-Agency River Basin Committee, Subcommittee on Benefits and Costs, "Proposed Practices for Economic Analysis of River Basin Projects" (Washington, D.C.: U.S. Government Printing Office, 1950).

which were adopted in 1962.[249] The growing bureaucratic interest in analytic frameworks for cost-effectiveness and cost-benefit comparison corresponded with the postwar formalization of a number of fields including operations research, management science, systems analysis, and other decision-oriented disciplines; as historian Ted Porter points out, the emergence of a discipline of welfare economics in the 1950s which would develop academic frameworks for cost-benefit analysis represented no more than a "convergence" with already-long-extant bureaucratic practice.[250] Porter argues that the intended application of these cost-benefit frameworks was not merely to assist in federal decision-making—rather, they "structured relations" within and among agencies, even if they failed, in fact, to reconcile bureaucratic practices.[251]

By the period in question, dollars promised to afford federal bureaucrats a potent, standard unit of measure for addressing environmental regulatory provisions, charged with particular notions of democratic participation, consumerism, and Western exceptionalism. Economists writing in 1958 formulated an economic-evaluative framework for river planning founded upon "the underlying belief that in democratic societies the economy and its institutions should serve the needs of its members, and that the members are themselves best qualified to determine their needs and desires."[252] One recreation researcher writing in 1963 identified the "market process" as an "information medium" revealing consumer values which "stem from the free exercise of sovereignty by the mass of consumers."[253] A later report on environmental impact evaluation practices for the

---

249 Quade, "A History of Cost-Effectiveness," 10.

250 Quade, 2; Porter, "U.S. Army Engineers and the Rise of Cost-Benefit Analysis," 187.

251 Porter, "U.S. Army Engineers and the Rise of Cost-Benefit Analysis," 175, 185.

252 John V. Krutilla and Otto Eckstein, *Multiple Purpose River Development; Studies in Applied Economic Analysis* (Baltimore, MD: Johns Hopkins Press, 1958), 18.

253 Robert K. Davis, "Recreation Planning as an Economic Problem," *Natural Resources Journal* 3, no. 2 (Spring 1963): 239, 243.

U.S. Nuclear Regulatory Commission identified dollar values as affording "the advantage of being nearly universally recognized and meaningful to people in Western society."[254]

Economic methods had in many ways been foundational, specifically, to the emergence of recreation research as a discipline beginning in the early 1950s, as was briefly detailed in chapter two.[255] A key motivation for much of this work stemmed from the multiple-use mandates which had directed some federal agencies in the period to account for recreation benefits against resource extraction and production. If U.S. Forest Service activities, for one, had already been largely driven by economic considerations, with practices like clearcutting considered economically cost-effective, if scenically disastrous, programs like the recreation research program within the Division of Forest Economics at the Forest Service sought to develop methods for placing the scenic on equal footing with the economic.[256] This broad-based turn to economic methods for the quantification of scenic values, to be sure, was not an uncontroversial proposition: key thinkers whose work in quantification formed the early foundation for much of this activity, including Luna Leopold and Terry Daniel, expressed varying degrees of reservation regarding the effort to render the aesthetic in monetary terms. Although certainly committed to projects of quantification, theirs were not strictly economic in outlook—for Leopold, the desire to monetize recreational values "misses the whole point."[257] Later research associated with the Forest Service, however, increasingly centered economic modes interpolating the aesthetic and the recreational: one paper at a 1974 Forest Service-sponsored

---

[254] J. A. Hebert, R. Shikiar, and R. W. Perry, "Valuing the Environment via Bidding Games: A Psychological Perspective," Prepared for the U.S. Nuclear Regulatory Commission (Richland, WA: Pacific Northwest Laboratory, August 1980), 5.

[255] For early, key texts representing the introduction of economic methods into recreation research, see Marion Clawson, "Methods of Measuring Demand for and Benefits of Outdoor Recreation" (Washington, D.C.: Resources for the Future, Inc., 1959); Marion Clawson and Jack L. Knetsch, *Economics of Outdoor Recreation* (Baltimore, MD: Johns Hopkins Press, 1966).

[256] Williams, *The USDA Forest Service—The First Century*.

[257] Leopold, "Landscape Esthetics: How to Quantify the Scenics of a River Valley," 37; Daniel and Boster, *Measuring Landscape Esthetics: The Scenic Beauty Estimation Method*, 3.

symposium suggested "recreation is a commodity that is basically esthetic in its attributes," likened to a film or a theatrical production.[258]

Such efforts accelerated in the period in question owing to specific regulatory pressures. To some limited extent, both the Surface Mining Control and Reclamation Act of 1977 and Section 169A of the Clean Air Act Amendments of 1977 had encouraged the use of cost-benefit analysis. Under the former, matters of suitability were to account for the economic feasibility of reclamation, and designations of unsuitability required detailed statements on "the demand for coal resources" and "the impact of such designation on the environment, the economy, and the supply of coal."[259] Under the latter, assessments of the "value of visibility" were to be weighed against "costs of compliance" in control decisions, suggesting impacts to visibility could be tolerated were it demonstrated that associated control costs were too high, among other related provisions.[260]

The legality of the federal bureaucratic turn to cost-benefit-analytical frameworks directed in these pieces of legislation and elsewhere was not a straightforward matter: other federal policies for environmental management had explicitly limited or effectively forbade the use of economic and cost-benefit analysis. The earlier Clean Air Act of 1970, for example, had clarified that the primary goal of the National Ambient Air Quality Standards was to protect public health, which a Court of Appeals decision had interpreted to signify that economic analysis of costs associated with

---

[258] E. Boyd Wennergren and Warren E. Johnston, "Economic Concepts Relevant to the Study of Outdoor Recreation," in *Outdoor Recreation: Advances in Application of Economics*, ed. Jay M. Hughes and R. Duane Lloyd, General Technical Report WO-2 (U.S. Department of Agriculture, Forest Service, 1977), 5.

[259] Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. § 1272.

[260] Clean Air Act Amendments of 1977, 42 U.S.C. § 7491; U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook*, 1-4. See also Ostrov, "Visibility Protection Under the Clean Air Act," 434, 437; U.S. Environmental Protection Agency, Office of Policy Analysis, *Methods Development for Environmental Control Benefits Assessment*, VIII: The Benefits of Preserving Visibility in the National Parklands of the Southwest: 10.

compliance could not be required—or even permitted.[261] In 1981, however, President Ronald Reagan issued an Executive Order directing the use of cost-benefit analysis across federal agencies when devising any "major" regulatory shift. The Executive Order stipulated that "regulatory action shall not be undertaken unless the potential benefits to society for the regulation outweigh the potential costs to society," and that "regulatory objectives shall be chosen to maximize the net benefits to society." Regulatory shifts qualifying as "major" included those likely to exert "significant adverse effects on competition, employment, investment, productivity, innovation, or the ability of U.S.-based enterprises to compete with foreign-based enterprises in domestic or export markets."[262] The Order did acknowledge the legislative and judicial limits on the use of cost-benefit analysis, but it nevertheless directed the preparation and promulgation of these analyses, even, it recognized, if the findings could not be legally acted upon.[263]

Already in the years following the agency's formation but especially after Reagan's Executive Order, the Environmental Protection Agency had acknowledged its increasing reliance on cost-benefit analyses in regulatory schemes. Describing cost-benefit analyses as "increasingly useful tools in helping to provide the balance required in complex regulatory decisions," the Agency had begun a research program around 1972 aimed at developing new methods for economic analysis, which grew significantly through the 1980s.[264] Despite the legal uncertainty around their use, the Environmental Protection Agency argued that cost-benefit approaches offered "a consistent framework for

---

261 U.S. General Accounting Office, "Cost-Benefit Analysis Can Be Useful in Assessing Environmental Regulations, Despite Limitations," Report to the Congress of the United States (Washington, D.C.: U.S. General Accounting Office, April 6, 1984), 15–16.

262 U.S. General Accounting Office, 3–4; U.S. Environmental Protection Agency, Office of Policy Analysis, Economic Studies Branch, *EPA's Use of Benefit-Cost Analysis: 1981-1986* (Washington, D.C.: U.S. Environmental Protection Agency, 1987), S-2.

263 U.S. General Accounting Office, "Cost-Benefit Analysis Can Be Useful in Assessing Environmental Regulations, Despite Limitations," 4.

264 U.S. Environmental Protection Agency, Office of Policy Analysis, Economic Studies Branch, *EPA's Use of Benefit-Cost Analysis: 1981-1986*, 3.

evaluating environmental initiatives," with the ability to measure the relative cost-effectiveness of various regulatory alternatives, programs, and decisions.[265]

Given these legislative and regulatory pressures, opponents to the unsuitability designation for the Alton coal field raised a number of economic concerns in response to the Office of Surface Mining's draft evaluation for the petition. A Bureau of Land Management representative, for one, had urged further analysis of the economic effects of an unsuitability designation, in accordance with provisions in the Surface Mining Control and Reclamation Act.[266] Addressing these concerns, the Office's final petition evaluation document afforded expanded focus to economic impacts. This analysis noted that region was "economically depressed," with an outsize reliance on tourism to National Parks in the area—an industry considered especially sensitive to economic fluctuation, as had been made plainly visible in the years immediately prior. The introduction of strip mining to the Alton hills, the Office of Surface Mining projected, would instead position resource extraction as the "predominant basic economic sector" in the region, with coal mining considered less sensitive to such fluctuations and therefore promising the possibility to "turn the economy from bust to boom." If the petition area were deemed unsuitable for surface mining, the analysis found, the action "would remove the most feasible and immediate means of improving the local economy."[267]

But it was the matters of visibility and visual intrusion, in particular, that challenged limits of economic analysis. Attempts to account for total costs and benefits stemming from environmental determinations necessarily required the ability to quantify the economic benefits associated with better visibility or unimpeded scenic views. These visual matters were thought likely to have direct

---

[265] U.S. Environmental Protection Agency, Office of Policy Analysis, Economic Studies Branch, 5-3.

[266] Correspondence from Ed Hastey, Associate Director of Bureau of Land Management, to Paul Bodenberger, Office of Surface Mining, October 13, 1980.

[267] U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, II-20–II-21, IV-2.

economic effects on tourism and recreation spending, but significant uncertainty attended methods for discerning the exact nature of these relationships.[268] The question posed by the political drive toward cost-effectiveness, then, was how to place value on impacts to the visual—that is, how to account for visibility impacts and visual intrusions in robustly economic terms.[269] Significant research attention at the Environmental Protection Agency was directed to this perceived need to better develop methods for placing monetary value on "benefits for which no private markets exist"—that is, for ecological and aesthetic values, both of which were considered non-market, public goods.[270]

An explicit directive in Section 169 of the Clean Air Act Amendments of 1977 prompted the Environmental Protection Agency to issue a report to Congress in 1979 detailing progress toward the development of methods for accounting for visibility in service of the newly established national visibility goals. The resulting report centered this matter of valuation, sketching out a broad conceptual framework bridging methods in economics, recreational psychology, and human perception which together promised techniques for identifying the value, critically, of "incremental" improvements or deterioration in visibility. If the Clean Air Act Amendments had stipulated that the Agency account for "significant" and "adverse" visibility impacts, the report declined to define significance and instead adopted a definition of visibility impairment which maintained that "an increment (or decrement) in visibility impairment must as a minimum be perceptible to be significant or adverse."[271] Variously citing the work of Ronald Henry of Environmental Research

---

268 U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook*, 5-17.

269 For a contemporary reflection on the inability of what legal scholar Cass R. Sunstein calls the "cost-benefit state" to capture welfare, see Cass R. Sunstein, "Some Costs & Benefits of Cost-Benefit Analysis," *Daedalus* 150, no. 3 (July 1, 2021): 208–19.

270 U.S. Environmental Protection Agency, Office of Policy Analysis, Economic Studies Branch, *EPA's Use of Benefit-Cost Analysis: 1981-1986*, 7-3.

271 U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *Protecting Visibility: An EPA Report to Congress*, 1-38.

and Technology, Douglas Latimer of Systems Applications, and Michael Williams of the Los Alamos Scientific Laboratory, the report relied on concepts in optics, psychophysics, and signal detection theory to sketch out an understanding of "human eye-brain responses" to atmospheric change in which the eye converts "image-forming radiation from the environment" into electrical impulses, which are in turn perceived by the brain in a signal-noise discrimination process of "dynamic searching for the best interpretation of the available data." At minimum, the report explained, the criterion of perceptibility required the identification of just-noticeable differences—that is, the "smallest perceptible change" produced by an "increment" in pollution concentration.[272] Still, the report underscored the remaining work to be done in clarifying the value—economic, psychological, social, and otherwise—of visibility, as among the Agency's key "research needs," and it recommended a "coordinated visibility values research program" toward these ends.[273]

Early results of these Agency efforts to further develop techniques for estimating the economic value of visibility were issued two years later in a 1981 *Visibility Benefits Assessment Guidebook*, a key section of which was written by Ronald Henry of Environmental Research and Technology and which, in turn, relied "heavily" on the work of Douglas Latimer.[274] The guidebook sought to interrelate perception, consumer behavior, and economic value in particular ways:

> … public goods such as air quality are not exchanged on a market and do not have explicit prices. This does not mean they do not have value. People change their recreation patterns, move their residences, or simply alter their moods due to the existing level of air pollution. These non-market goods affect our well-being, and consequently, they have implicit values. By analyzing how individuals react to air quality changes, the value they place on air quality may be revealed.[275]

---

272 Ibid., 2-2–2-4.

273 Ibid., 1-28.

274 U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook*, 3-5.

275 Ibid., 2-2.

Seeking to make explicit these implicit visibility values, Henry explained in the guidebook that in order "to quantitatively estimate benefits associated with increments in visibility," measures of "humanly perceptible increments" must first be known.[276] Henry acknowledged the variability of these thresholds based on observer expectations, scenic context, and content and maintained that "perception thresholds," were, in other words, "basic to the quantification of the good."[277]

The notions of just-noticeable differences and incremental thresholds sourced from discourse in psychophysics and signal detection corresponded well, if only by analogy, to established frameworks for economic analysis founded upon concepts of marginal value and marginal utility. As the guidebook explained:

> The benefits to an individual from a change in visibility aesthetics equal the change in his well-being, a value which is difficult to quantify. Economic benefit measures address the problem by attempting to put a monetary quantification on changes in well-being. The monetary measure of benefits for a change in air quality is said to equal the change in income that would yield the same change in an individual's well-being.[278]

As Alan Randall, Professor of Agricultural Economics at the University of Kentucky whose work had been cited extensively in both EPA reports and elsewhere throughout this literature, explained in remarks delivered to a 1979 workshop of economists, atmospheric scientists, psychologists, and agency administrators which had been organized jointly by the Forest Service, the National Park Service, and the Bureau of Land Management: if costs and benefits are to be assessed in meeting visibility goals, "the perspective of economic theory permits us to be more specific: the efficient level of atmospheric visibility is that level at which the incremental costs and incremental benefits of the last added unit of visibility are equal."[279] In this way, concepts developed for the theory of signal

---

[276] Ibid., 3-11.

[277] Ibid., 3-6.

[278] Ibid., 2-3.

[279] Among the participants of the workshop were Kenneth Craik, William Malm, Terry Daniel, Ronald Henry, and Douglas Latimer. Alan Randall, "The Economic Value of Atmospheric Visibility," in *Proceedings of the Workshop in*

detection found themselves in productive correspondence with key tenets of economic theory, thus facilitating the interpolation of cost-benefit analyses into broad conceptual frameworks for adjudicating matters of visibility.

The Environmental Protection Agency developed and promulgated an increasing number of specific techniques for valuing nonmarket, public goods in monetary terms after the mid-to-late 1970s. Attempts to interpolate these "goods" into economic frameworks were largely classified into one of two types: actual market approaches—including residential property value studies and the hedonic price technique, which sought to infer the implicit values of nonmarket goods influencing market values, such as the effect of air quality on property value—and contingent market approaches, including iterative bidding techniques, willingness-to-pay studies, and travel-cost methods, which directly posed hypothetical situations to survey respondents to measure how they believed they would behave in response to specified changes in visibility.[280] The latter techniques were considered especially germane to matters of visibility and visual intrusion in Class I settings.[281] In one characteristic willingness-to-pay study jointly undertaken by the Environmental Protection Agency, the National Park Service, the University of Wyoming, and the University of New Mexico, a sample of some 600 households in Denver, Los Angeles, Albuquerque, and Chicago, solicited through random, door-to-door solicitation, was queried for willingness to pay to prevent degrees of air quality deterioration, as represented in a series of photographs for three views in Grand Canyon National Park, one view in Zion, and one in Mesa Verde "selected to represent humanly perceptible

Visibility Values, Fort Collins, Colorado, January 28-February 1, 1979, ed. Douglas Fox, Ross J. Loomis, and Thomas C. Greene (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1979), 124.

280 U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook*, 4-1, 4-2, 4-29–4-31; U.S. Environmental Protection Agency, Office of Policy Analysis, Economic Studies Branch, *EPA's Use of Benefit-Cost Analysis: 1981-1986*, 7-3.

281 Actual market approaches, by comparison, were considered better suited to the study of air quality effects in urban and suburban areas, as the methods often required the use of market property values. United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook*, 5-7.

increments in air quality" (fig. 3.38).[282] Through an iterative bidding technique, participants volunteered how much more in park entrance fees or in utility bill surcharges they would be willing to pay to prevent levels of deterioration as represented in the images, with the study representing what the EPA deemed "the most detailed effort to link emissions to air quality, to photographs, and finally to economic valuations" to date.[283] The travel-cost method, by comparison, had largely been developed to study the demand for recreation, with expenditures in terms of time, difficulty, and expense in reaching a recreational site serving as surrogates for economic value: traveling longer distances to reach a destination, for example, signified greater implicit costs which could be estimated in monetary terms.[284] A 1981 report by the Environmental Protection Agency explained that the method had not been put to use "as yet" in visibility analyses—but it cited a study at Bryce Canyon then underway as constituting the first.[285]

The use of contingent market methods, in particular, admittedly rested on a number of psychological assumptions concerning the legibility of relationships among environmental variables, stated attitudes, and behavioral outcomes: not only was a somewhat direct correlation among these factors necessarily assumed, but also that degrees of behavioral change or other incremental forms of expenditure could reveal intensities of preference.[286] As economist Alan Randall explained, the

---

282 U.S. Environmental Protection Agency, Office of Policy Analysis, *Methods Development for Environmental Control Benefits Assessment*; United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook*, 6-24.

283 U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook*, 6-28. For the early development of the iterative bidding technique, see Robert K. Davis, "Recreation Planning as an Economic Problem," *Natural Resources Journal* 3, no. 2 (Spring 1963): 239–49.

284 U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook*, 4-61. For one of the earliest attempts to develop the travel-cost approach, following the advice of statistician and economist Harold Hotelling at the University of North Carolina, see Andrew H. Trice and Samuel E. Wood, "Measurement of Recreation Benefits," *Land Economics* 34, no. 3 (August 1958): 195–207.

285 U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook*, 4-64. For a primer on studies investigating the value of air quality conducted in National Parks, see National Park Service, *Air Quality in the National Parks: A Summary of Findings from the National Park Service Air Quality Research and Monitoring Program*.

286 U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, 4-2.

reliance of contingent market methods on hypothetical scenarios was likely to induce "skepticism" among economists, whereas psychologists had, by comparison, developed sophisticated analytical frameworks to educe relationships between attitudes and behavior, suggesting that psychological frameworks for the study of attitude formed a key "basis" for contingent valuation methods.[287] A report made to Nuclear Regulatory Commission on the use of the bidding technique in environmental determinations similarly positioned these valuation methods as "essentially social-psychological field studies interpreted in an economic theoretical framework."[288]

Importantly coincident to this history was a period of newfound, robust traffic between the disciplines of psychology and economics, giving rise to the fields of experimental economics and behavioral economics. Although there had been some interface between economics and psychology in the nineteenth century, to be sure, there was relatively little by comparison in the first half of the twentieth. The turn to cognitive theory and the study of attitudes in psychology, detailed in chapters one and two respectively, afforded by the late 1950s a new basis for psychological interest among a small, but growing segment of economists, constituting an area of investigation termed "behavioral economics" by the following decade and later institutionalized as a discipline in the 1980s.[289] These economists had become interested in what was termed "bounded rationality": rejecting the "rational-actor" assumption foundational to neoclassical economics, these economists instead sought to develop methods to account for discrepancies among attitudes, behavioral intentions, motivations, and actual, observed behavior in individuals, rather than dismissing them outright. The psychology of attitudes and cognitive psychology variously provided increasingly robust frameworks for these economic studies, seeking to take into account the situational determination of an individual's

---

[287] Randall, "The Economic Value of Atmospheric Visibility," 127.

[288] Hebert, Shikiar, and Perry, "Valuing the Environment via Bidding Games: A Psychological Perspective," 1–3.

[289] Esther-Mirjam Sent, "Behavioral Economics: How Psychology Made Its (Limited) Way Back Into Economics," *History of Political Economy* 36, no. 4 (2004): 739, 740, 744.

actions or decisions by way of factors including context, expectations, biases, social influences, and knowledge asymmetries.[290] One of the key forerunners in this area of theorization, economist and political scientist Herbert A. Simon, emphasized what he described in a 1959 text as the importance of accounting for "the distinction between the objective environment in which the economic actor 'really' lives and the subjective environment that he perceives and to which he responds." Behavioral prediction based on the "objective environment" alone becomes infeasible, given this distinction—"we also need to know something about his perceptual and cognitive processes."[291] For Simon, the computational metaphor was enticing: describing the environment as "generat[ing] millions of bits of new information each second," human perception, he suggested, seemed capable of admitting no more than 1,000 bits per second, which then in turn was subject to "processing" in the brain resulting in yet further simplification.[292] Simon's interest in what he called "the modern digital computer" was not only metaphorical, however; he encouraged "the use of computers to build theories of human behavior" through "the simulation of higher mental processes," which would begin, he held, to better align economics with "its sister sciences," psychology and sociology.[293]

Although it would be some years before methods for signal detection theory were integrated into behavioral-economic analysis in earnest, an analogous ambition—accounting and, in some instances, correcting for individual bias—had motivated both. The problem of submitting the visual to forms of environmental regulation, then, benefitted doubly from recourse to signal detection in

---

[290] For a foundational psychological text on the relationship between attitude and behavior which was repeatedly cited in environmental-economic discourse and in the literature on visibility valuation specifically, see Icek Ajzen and Martin Fishbein, "Attitude-Behavior Relations: A Theoretical Analysis and Review of Empirical Research," *Psychological Bulletin* 84 (1977): 888–918.

[291] Herbert A. Simon, "Theories of Decision-Making in Economics and Behavioral Science," *American Economic Review* 49, no. 3 (1959): 256.

[292] Ibid., 273.

[293] Ibid., 280. See also Herbert A. Simon, "A Behavioral Model of Rational Choice," *Quarterly Journal of Economics* 69, no. 1 (1955): 99–118.

this way: in direct psychophysical terms, the theory afforded a framework for handling optical, sensory, and perceptual processes, and, at once, it provided a conceptual structure for theories of decision-making required to render the matter available to economic analysis.

In the spring and summer of 1980, in response to the specific allegations made in the Alton unsuitability petition as well as to the general directives laid out in the Clean Air Act Amendments, the National Park Service developed and carried out an extensive series of visitor surveys at Bryce Canyon National Park in collaboration with the Department of the Interior's Office of Policy Analysis and economists from the University of Wyoming—amounting to what would be identified as the first travel-cost study developed for the study of visibility.[294] Addressing two distinct concerns, the surveys sought to identify what values were considered important to park visitors and how such values might be affected by the introduction of strip mining in the immediate vicinity. To address these concerns, the surveys specified a novel, hybrid methodology: subjective responses to photographic simulations were interpolated into travel-cost method-based contingent market analysis in order to project the effects of visual intrusion and visibility impacts to Bryce Canyon.[295]

Successfully soliciting the voluntary participation of some 2,700 visitors, including 1,200 to Yovimpa Point, survey officiants conducted three questionnaires: a travel-cost survey to determine how far visitors had travelled, or would have been willing to travel, to Bryce Canyon, therefore measuring the economic value of visits to the park; a survey identifying respondents' activities and interests while in the park; and an aesthetic-impact survey making use of photograph-based

[294] U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, V-2, V-20.

[295] National Park Service, "Results of National Park Service Visitor Survey Conducted At Bryce Canyon National Park Summer 1980," S-1.

simulations (figs. 3.39 and 3.40).[296] Administered at Yovimpa Point, the latter aesthetic-impact survey queried visitors for emotional responses, projected levels of enjoyment, and changes to their willingness to travel as a result of the introduction of strip mining in the viewshed and its projected effects on air quality. Visual intrusions on the landscape were simulated with three panoramic color photographs, which, like the Bureau of Land Management visualizations, had been produced in part from the Utah International-provided COMARC mapping data: one panoramic image represented the existing view from Yovimpa Point; another was montaged to illustrate the viewshed during active mining; and a third was modified to suggest the landscape following successful reclamation. A second set of photographs taken from Yovimpa Point over the course of the year previous was to serve as surrogates representing a range of air quality effects resulting from mining activities, from worst-possible to most pristine.[297]

The survey results seemed to support the Park Service's argument that visibility was among the key values that brought visitors to Bryce Canyon. The questionnaire found that more than 99% of the sample felt that scenic vistas were of importance, while over 98% suggested that clean, fresh air was a deciding factor; respondents suggested that they would have been willing to drive, on average, an additional 300 miles to get to Bryce Canyon. Of the visitors to Yovimpa Point, 76% of that sample explained that the view was the primary purpose for their visit, and about 50% suggested they would have driven an additional half-hour or more to reach the overlook.[298] Responding to the images simulating the appearance of the mine on the viewshed, approximately 68% of the sample felt that the value of their visit would decrease as a result of the projected

---

[296] U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, III-10; National Park Service, "Results of National Park Service Visitor Survey Conducted At Bryce Canyon National Park Summer 1980," 2.

[297] National Park Service, "Results of National Park Service Visitor Survey Conducted At Bryce Canyon National Park Summer 1980," A-1.

[298] Ibid., S-2, 11.

changes, and more than a third suggested they would have spent less time at Yovimpa Point. Sixty-three respondents answered that they would not have visited at all. These metrics only slight improved when survey participants considered simulated illustrations after reclamation of the mined lands: more than 27% of the sample responded that they would have decided to spend less time at Yovimpa Point as a result of these changes to the landscape, with about 3% suggesting that wouldn't have visited Yovimpa Point at all. Responding to the air quality images, in turn, more than 32% suggested that they would have been disappointed or very disappointed with any reduction from the present average, and over 85% answered that they would have been disappointed or very disappointed in the worst-case scenario.[299] Unprompted by any illustration, the survey also directly queried respondents for their attitudes toward strip mining in the area—about 68% were decidedly opposed, while 4% were in favor—and allowed respondents to provide open-ended commentary. One respondent pointed out something of a contradiction in the line of investigation which seemingly posed an opposition between tourism values and the need for energy development: "There is an abundance of beauty here, but we must be practical, however. Energy needs must be met, or in the long run we won't be able to drive out and see these places."[300]

The survey method—and its use of photograph-based simulations in particular—generated a significant amount of criticism among both test respondents and the various stakeholders invested in the Alton project. One survey respondent suggested that the simulations significantly underestimated the impacts of surface mining: "We personally feel there will be more damage than your photographs represent—and this would dramatically decrease our appreciation of the park."[301] The petitioners in favor of the unsuitability designation likewise argued in testimony and in written

299 Ibid., S-2–S-3, 14, 16.

300 Ibid., 18, 19.

301 Ibid., C-11.

submissions that the images understated the mine's adverse impacts.[302] Others resisted the economizing logic of the survey altogether: "The national parks, including Bryce Canyon, are a priceless resource and vital to the quality of life."[303]

Others objected to the survey procedure for opposing reasons. Utah International commissioned a social psychologist to produce what was deemed "a critical analysis of the survey process." Among other concerns, the psychologist's report suggested that the order of questions, the failure to rotate responses, the partiality of the interviewers, the lack of a systematic sampling strategy, and the use of what the energy firm considered a derogatory term, "strip mining," constituted undue influences on the survey outcome. Additionally, the report found, the national park's various programming activities around environmental education and the presence of literature in the visitor's center regarding alternative energy sources amounted to a "climate of bias" negatively influencing the survey's objectivity.[304] The analysis also pointed out that "the questionnaire was printed on both sides of the paper and in combination with a clipboard and the wind, it was difficult to manage."[305] In oral testimony at the unsuitability hearings, a representative for Utah International took the National Park Service to task for its refusal to publish the images employed for the survey, suggesting that if these were disseminated, "the panel will readily see that the photo-simulation used in that survey is grossly inaccurate and biased in a way to prejudice visitor response."[306]

---

302 U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*, III-10.

303 National Park Service, "Results of National Park Service Visitor Survey Conducted At Bryce Canyon National Park Summer 1980," C-18.

304 K. L. Berry, "Critical Analysis Of The Bryce Canyon National Park Visibility Values Survey," Prepared for Utah International, August 29, 1980, 1, 13, 14, in *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4*.

305 Ibid., 12.

306 Testimony of Roger Nelson of Utah International, Inc., October 10, 1980. In U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document*.

The veracity of these particular simulations notwithstanding, adjudicating the claims that the Alton hills should be designated as unsuitable for surface mining required a coincident turn to increasingly digital forms of visual simulation, the application of frameworks from psychophysics and signal detection theory, and new, behavioral-economic methods for valuing scenic goods, which together lent to various forms of interpretation incorporated into the Office of Surface Mining's nearly thousand-page report evaluating the unsuitability petition's claims. Issued in November 1980, the Petition Evaluation Document compiled, weighed, and summarized the various findings raised through the numerous studies, reports, pieces of evidence, and opinions which had been solicited over multiple days of public hearings and through written testimony; together, these were to inform the Secretary of the Interior's final determination on the unsuitability question to be issued the following month.[307] The Office's evaluation found that visual intrusion and visibility effects stemming from strip mining in the Alton hills would have perceptible effects across Bryce Canyon, though these would be "relatively short-term," with the exception of long-term impacts to landscape color and texture resulting from reclamation. For Yovimpa Point, the report found that "reactions would be mixed, depending on the viewer's perspective. For some, to see a strip mine in operation would be an unwelcome intrusion. For others, it may be an interesting highlight."[308]

In December 1980, Secretary of the Interior under President Carter, Cecil Andrus, issued a ruling on the unsuitability petition. In what the *Washington Post* described as a "narrow compromise," just over 9,000 acres, containing an estimated 24 million tons of coal, in the eastern portion of the petition area in closest proximity to Yovimpa Point were deemed unsuitable for surface mining.[309] Andrus's ruling dismissed the allegations that the land could not be reclaimed, as

---

307 U.S. Office of Surface Mining Reclamation and Enforcement, ii-1.

308 U.S. Office of Surface Mining Reclamation and Enforcement, III-12, iv-3.

309 Omang, "Bryce Canyon Coal Mining Compromised."

well as those concerning impacts to the regional water supply and potential damages to the geologic formations within Bryce Canyon. Citing provisions in the National Park Service Organic Act, Section 169 of the Clean Air Act Amendments, and Section 522 of the Surface Mining Control and Reclamation Act, the Secretary's decision argued, however, that visual intrusions and effects on visibility across Bryce Canyon, and at Yovimpa Point in particular, would represent "unconscionable," adverse impacts to the values for which the National Park had been established and those important to the park's visitors.[310] Andrus further explained that these findings had been specifically based on the numerous simulation-based studies, including the visitor survey, developed to adjudicate these matters, which together had substantiated for him the claim that visual impacts would be "severe."[311] The decision, however, left almost 90% of the petition area available to strip mining, including 16,700 acres of land leased to Utah International and the Nevada Electric Investment Co., containing an estimated 266 million tons of coal.[312]

In federal court, Utah International challenged the ruling on procedural grounds, arguing the case was exempt from provisions in the Surface Mining Control and Reclamation Act and ensuing regulation as the company had made substantial financial and legal commitments to developing its leasehold prior to the enactment of the legislation. The Environmental Defense Fund likewise appealed the decision, arguing it failed to sufficiently consider impacts on the national park and on the water supply.[313] Following judicial review, the ruling was upheld.[314] In the same years, Section

---

310 Cecil Andrus, "Secretary's Decision, Petition to Designate Certain Federal Lands In Southern Utah Unsuitable for Surface Coal Mining, OSM Reference 79-5-001" (Washington, D.C.: U.S. Department of the Interior, Office of the Secretary, December 16, 1980); Omang, "Bryce Canyon Coal Mining Compromised"; "Judge Rebuffs Interior Secretary on Bryce Canyon Mining Request," *New York Times*, January 19, 1982, sec. A.

311 Cecil Andrus, "Statement of Reasons, Petition to Designate Certain Federal Lands In Southern Utah Unsuitable for Surface Coal Mining, OSM Reference 79-5-001" (Washington, D.C.: U.S. Department of the Interior, Office of the Secretary, January 13, 1981), 17.

312 U.S. Office of Technology Assessment, *An Assessment of Development and Production Potential of Federal Coal Leases*, 264.

313 Ibid., 264.

314 Sara G. Smith, "Utah International, Inc. v. Watt: Adjudicative or Legislative Hearing," *Kentucky Law Journal* 72, no. 1 (1983); Patrick McGinley, "The Surface Mining Control and Reclamation Act: Ten Years of Promise and Problems for

522 of the Surface Mining Control and Reclamation Act faced significant constitutional challenges centering claims that it violated the Commerce Clause and the Fifth and Tenth Amendments of the Constitution, with litigation reaching the Supreme Court.[315]

Still, the decision remained vulnerable to broader shifts in the political terrain, already suggested in the federal bureaucratic turn to cost-benefit analysis. Andrus's successor under Reagan, James Watt, petitioned in federal court the following year to reconsider the unsuitability designation. Citing the concerns raised in litigation following Andrus's designation, Watt suggested that the petition evaluation process had been pervaded by procedural errors, a move which representatives for Utah International applauded where a representative for Friends of the Earth called "a transparent excuse to open the whole field to coal mining."[316] Among Reagan's most controversial cabinet appointees, Watt had been variously described in the contemporary press as "anti-environmentalist," "a religious fundamentalist," and "an ideological choice" given the fact that upon his appointment he had pending litigation against the department he was primed to lead. In his short tenure as Interior Secretary, Watt oversaw the opening of vast swathes of federal lands to resource development, including a fivefold increase in federal lands leased to coal companies; the gutting of the Interior Department of much of its staff; the closing down of regional offices of the Office of Surface Mining; and the general loosening of regulations through indirect maneuvers rather than outright legislative change, which together triggered a series of Congressional investigations in which the Alton matter was raised repeatedly.[317] During the same years, the Department of Agriculture

the National Parks," in *Our Common Lands: Defending The National Parks*, ed. David J. Simon (Washington, D.C.: Island Press, 1988), 465–98; Alton Coal Development, LLC, "Federal Emergency Lease within the Alton Amphitheater within Sections 18 and 19 Township 39 South, Range 5 West, SLB&M" (Cedar City, Utah: Alton Coal Development, LLC, March 2016).

315 "Western Coal Fields Declared Unsuitable for Mining Amidst Legal Challenges to §522 of the Surface Mining Act," *Environmental Law Reporter* 11, no. 2 (February 1981): 10049.

316 Philip Shabecoff, "Watt Acts to End Ban on Utah Mine," *The New York Times*, September 22, 1981.

317 Bill Prochnau and Valarie Thomas, "The Watt Controversy," *Washington Post*, June 30, 1981; United States Congress House Committee on Government Operations Environment, Energy, and Natural Resources Subcommittee, *Secretary*

significantly cut budgetary allocations to the U.S. Forest Service, eliminating many of the staff positions that had been created in the late 1970s to address the then-burgeoning regulatory need, while the Presidential administration pushed for another round of amendments to the Clean Air Act to reconsider provisions including those for Prevention of Significant Deterioration.[318]

Though a federal judge denied Watt's redesignation request, Utah International continued submitting reconfigured permit applications for surface mining on the areas outside those deemed unsuitable through 1987, when it withdrew its application and ultimately relinquished its leases back to the Bureau of Land Management.[319] The matter, however, remained somewhat unsettled: applications for surface mining on state-owned lands in the Alton coal field were received in 2004 and approved in 2009 over the objection of the National Park Service and the Environmental Protection Agency, with proposals to expand this activity onto federal lands currently tied up in litigation.[320] Regardless, per a Bureau of Land Management report, coal production in state of Utah rose from 12 million tons per year to 27 million tons between 1985 and 2008, with new leases for some 540 million tons of coal located on federal and state lands issued in those same years.[321]

It could be argued, as some critics in the period indeed pointed out, that the growing role of cost-benefit analysis and other modes of economic valuation in environmental-regulatory practice in

Watt's Refusal to Cooperate with Congress: Hearing Before a Subcommittee of the Committee on Government Operations, House of Representatives, Ninety-Seventh Congress, Second Session (Washington, D.C.: U.S. Government Printing Office, 1982); "The Legacy of James Watt," *Time*, October 24, 1983.

318 Williams, *The USDA Forest Service—The First Century*, 130; Philip Shabecoff, "Watt May Lift Ban on Mining Near Park," *New York Times*, September 3, 1981, sec. A.

319 "Judge Rebuffs Interior Secretary on Bryce Canyon Mining Request"; Joanne Omang, "Watt Is Rebuffed In Bid to Alter Mining Decision," *Washington Post*, January 19, 1982.

320 Alton Coal Development, LLC, "Federal Emergency Lease within the Alton Amphitheater within Sections 18 and 19 Township 39 South, Range 5 West, SLB&M"; Theo Spencer, "The Fight to Stop a Strip Mine Near Bryce Canyon: A History," *Natural Resources Defense Council* (blog), June 5, 2017, https://www.nrdc.org/experts/timeline-alton.

321 Joe Bauman, "Utah's Coal Reserves Raise a Burning Question," *Deseret News*, January 12, 2008.

this period afforded new mechanisms by which policy provisions intended to protect scenic quality could be exploited toward particular kinds of economic-developmental ends. Another view, however, would suggest the administrative state's ongoing project of quantification was simply furnished here with novel mechanisms for working out existing conflictual relations in support of what were in fact already long-entrenched drives.[322] The robustly interdisciplinary regulatory and bureaucratic apparatuses forged to reconcile the material, the scenic, and the economic along these lines, whose reliance on recently developed analog and computer-generated visualization techniques embedded in analytical frameworks requiring double recourse to theories of signal detection, promised to facilitate the reconciliation, however uneven, of deep-seated tensions between federal and local control, between trained expertise and public preference, between economic development and the preservation of "nature," and between the individual and the impersonal. But, as one sociologist employed by the Forest Service in the period put it: "it is impossible to maximize both efficiency and democracy. The preservation of some degree of freedom in our complex society is dependent on working out a method of optimizing these conflicting values."[323] For a brief moment, this heterogenous chain of techniques promised this very possibility.

---

[322] Some legal scholars have projected that the administrative state in the U.S. has and will become increasingly reliant on automation in carrying out its decision-making responsibilities; this chapter, by comparison, highlights the early, significant investment of labor and resources into making the thing that has been called "automation" incrementally possible. For a contemporary projection of the administrative state's future reliance on "digital automation" as a form of "algorithmic governance," see Cary Coglianese, "Administrative Law in the Automated State," *Daedalus* 150, no. 3 (July 1, 2021): 104–20.

[323] William Stewart Folkman, *Public Involvement in the Decision-Making Process of Natural Resource Management Agencies: With Special Reference to the Pacific Northwest*, University of Washington (Seattle: Institute of Governmental Research, University of Washington, 1973). Quoted in Ernst Valfer, Stephen Laner, and Daina Dravnieks, "Public Involvement Processes and Methodologies: An Analysis" (Berkeley, CA: U.S. Department of Agriculture, Forest Service, Management Sciences Staff, 1977), 6.

Conclusion

By the early 1970s, an increasingly unmanageable visual environment prompted a period of broad-based managerial invention in the workings of the administrative state in the U.S. Under newly charged pressure to administer its nature, federal agencies confronted a notion of environment which had been subject to significant discursive and legal redefinition. Bureaucratic agents, cultural critics, and the general public alike had together reconstituted a notion of environmental quality composed of an increasingly exhaustive assemblage of physical, material, perceptual, and cognitive factors—not least of which bore on the newly pressing matters of aesthetics and visual quality. The aesthetic, however, had evaded strict legal specification and had long stressed systems of legality in this country; despite being made target of significant legislative reform, it had proven especially resistant to regulatory management. Visual matters required deft handling of multiple forms of difference, contending with the individuality of perception and the particularity of landscapes, as well as negotiation across asymmetrical power relations. The matter, in this way, posed especial challenges to renewed conflicts among federal, state, local, and individual control and coincident debates over expertise and public taste—imbricated concerns which had come to the fore in this period in newly urgent ways.

This acute problem of governance necessitated the significant investment of creative, technical, and bureaucratic labor to contend with these multiple forms of unmanageability. In pursuit of legally objective techniques for managing what were largely understood to be subjective and geographically specific concerns, federal agencies required newfound recourse to architectural skillsets to make possible the production of images charged with remediating the visual and rendering it available to new managerial procedures. Architects—understood to afford particular expertise in taking complex, multidimensional realities and abstracting them into visualizations—were hired, contracted, and retained in significant numbers by federal agencies, planning firms, and infrastructure companies, where they served, increasingly, as managers, researchers, and environmental consultants, rather than as designers, narrowly construed. Interpolated in this way into a redefinition of architectural activity understood as more or less coterminous with the production of images, which, to be sure, had been subject to significant, contemporaneous theorization elsewhere in the field, these architects offered key skills in the development of novel image-making procedures, the results of which were to be deputized as surrogates for managing the environment. If architectural historiography has in many ways tended to maintain structuring oppositions between fantasies of creative freedom and technocratic practice, this distinction has failed to consider the manifold forms of invention foundational to the development of new technocratic regimes required especially after 1970. Against narratives which have suggested a narrowing of architects' agency in the period, then, this reorientation in fact suggested a redistribution of architectural skills across multiple domains of practice beyond immediately disciplinary purviews.

If these architectural procedures had made possible the exchange of the management of the visual for the management of images, subsequent cross-disciplinary techniques in turn labored to facilitate the conversion of this management of images into the management of information. Architectural visualizations were embedded in a chain of techniques, sampling widely from applied and theoretical research in psychology, visual studies, and economics, which together conspired to convert the visual register, now recast as images and pixels, into data points, aggregated survey findings, classification scores, environmental quality indices, maps, charts, and graphs, captured in burgeoning documentary instrumentation including environmental impact statements and regularized agency reporting. It was by this process that architectural visualization became a bureaucratic instrument, implanted in formidable decisions over infrastructure development and territorial management, thus shaping built and natural environments in ways less immediately visible, but in many ways decidedly more insidious and pervasive, than buildings conventionally construed.

A historically specific development, this recasting of the environmental-managerial problem as a problem of information management effectively refashioned governance along a computational model, in which the administrative state's burgeoning capacity to quantify, compute, and manage geographic and contextual specificity within a generalized system of accounting sought to introduce new forms of homeostasis into the environment—as a legally and culturally circumscribed entity—thus addressing broader challenges to late twentieth-century political, discursive, and practical arrangements in the United States. The production of this administrative power sought to resolve conflicts between what Lady Bird Johnson had initially identified as beauty, on the one hand, and democracy, on the other. Through a legal elision of "natural beauty" into "aesthetics" and ultimately into "visual quality," a discursive aesthetic tradition which had historically situated beauty between the individual and the collective was de- and re-subjectivized through novel techniques allowing it to be imposed upon such reluctant objects as nuclear power generators, highways, and strip mines. That is, the particular mechanisms by which "beauty" had been rebranded "the visual" rendered the aesthetic both depersonalized and dehistoricized—what had been identified elsewhere in the period as a "new empirical aesthetics." Through these procedures, beauty came to constitute a technique useful to "democracy" in this country in powerful, new ways.

Figures

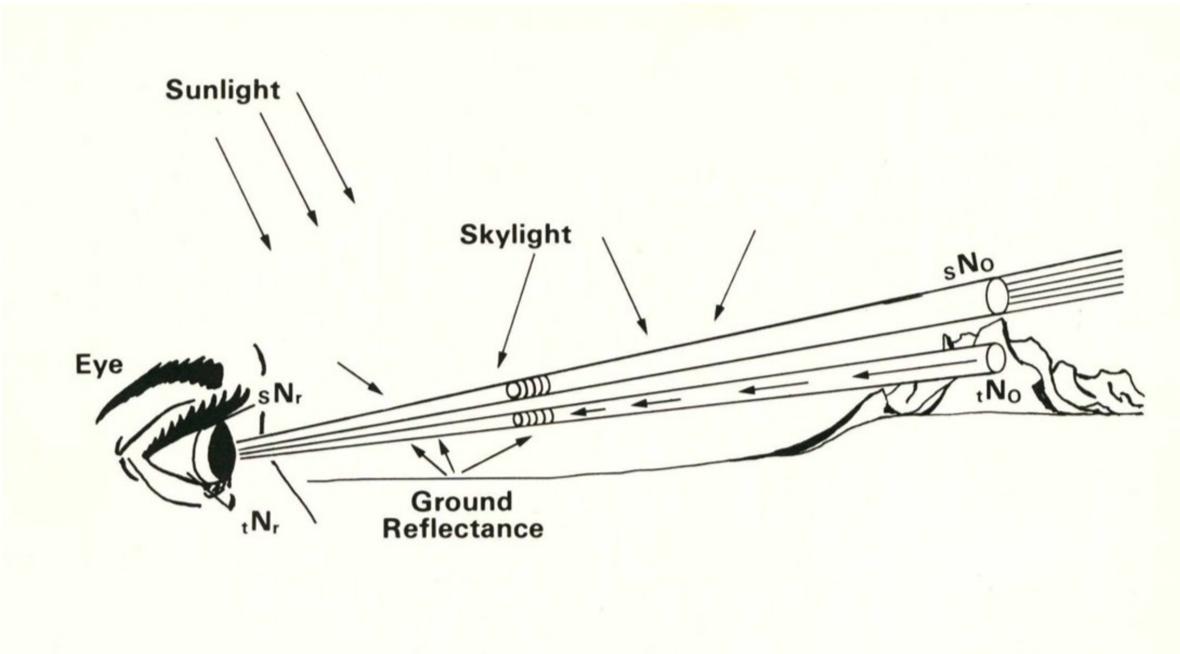
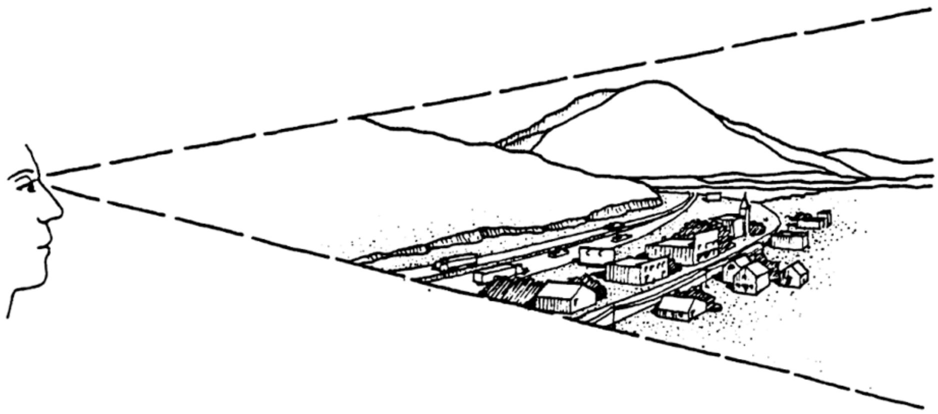
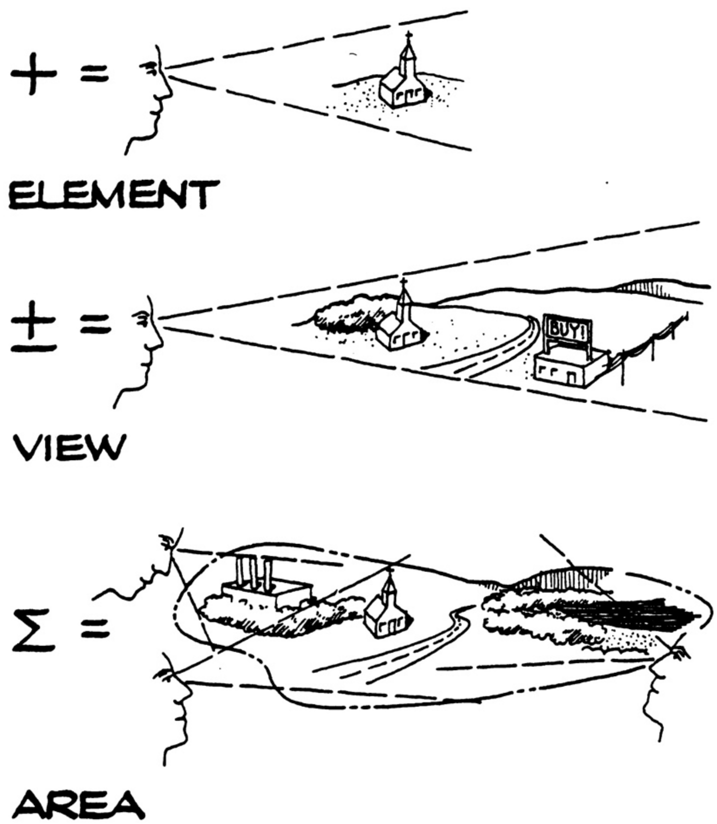


Figure 0.1 Schematic Representation of Vision through the Atmosphere. In William C. Malm, Karen K. Leiker, and John V. Molenar, "Human Perception of Visual Air Quality," in *A Specialty Conference on View of Visibility – Regulatory and Scientific (November 26-28, Denver, CO)* (Air Pollution Control Association, 1979): p. 54.





Figures 0.2 and 0.3 Viewer Sensitivity and Visual Quality Evaluation Types. In William G.E. Blair, Peter Harvard, and Jones & Jones, *Esthetics and Visual Resource Management for Highways: Seminar Notes, 1979–1980* (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1979): p. 33, 79.

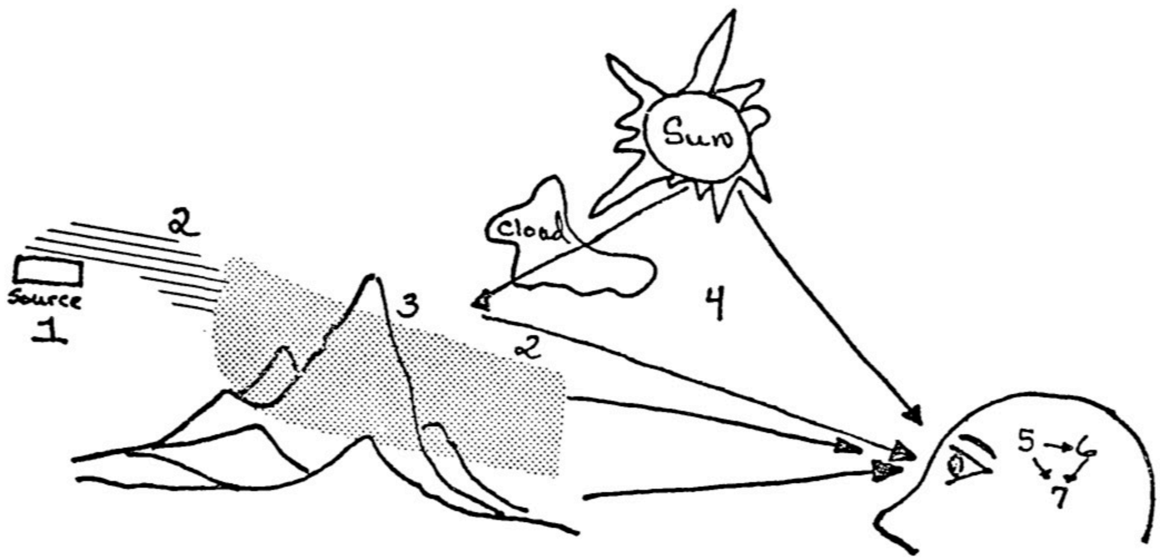


Figure 0.4 Inputs to the Economic Visibility Benefit Assessment Process [1: Source of Pollutant; 2: Spatial Dispersion of Pollutant; 3: Scenic Content; 4: Atmospheric Conditions; 5: Human Perception; 6: Psychological Effect; 7: Economic Valuations of Impacts in Terms of Willingness to Alter Time or Dollar Expenditures]. In U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program, *Visibility Benefits Assessment Guidebook* (Research Triangle Park, NC: U.S. Environmental Protection Agency, 1981): p. 1-6.

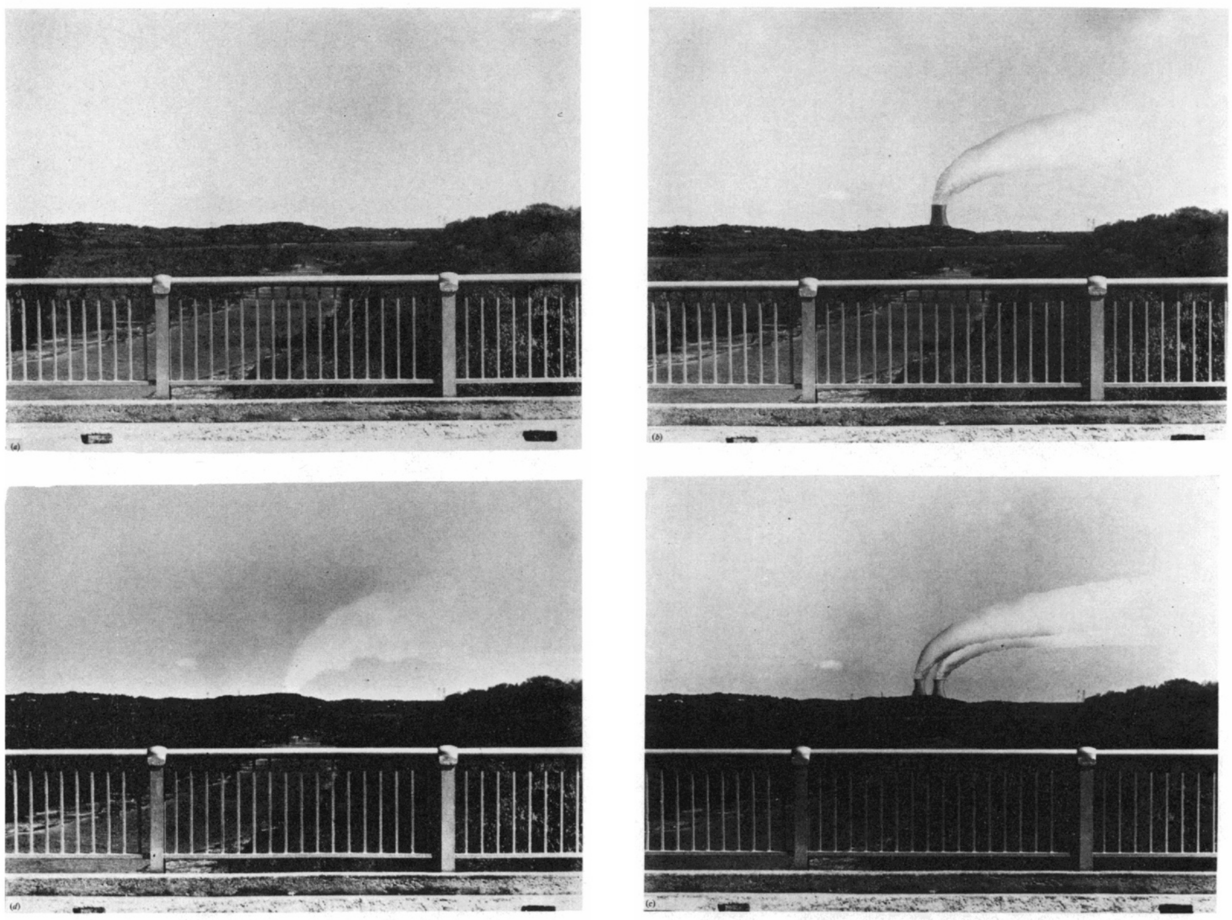


Figure 1.1 As-found and composite views looking northeast toward the Athens site for Greene County Nuclear Power Plant from the Rip Van Winkle Bridge, Oak Ridge National Laboratory, 1978. In U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549* (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979): p. M-41.

Figure 1.2 Photograph of as-found southwesterly view from the east side of the Hudson River north of Germantown toward Greene County Nuclear Power Plant site, Carl Petrich, 1978. In U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549* (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979): p. M-16.

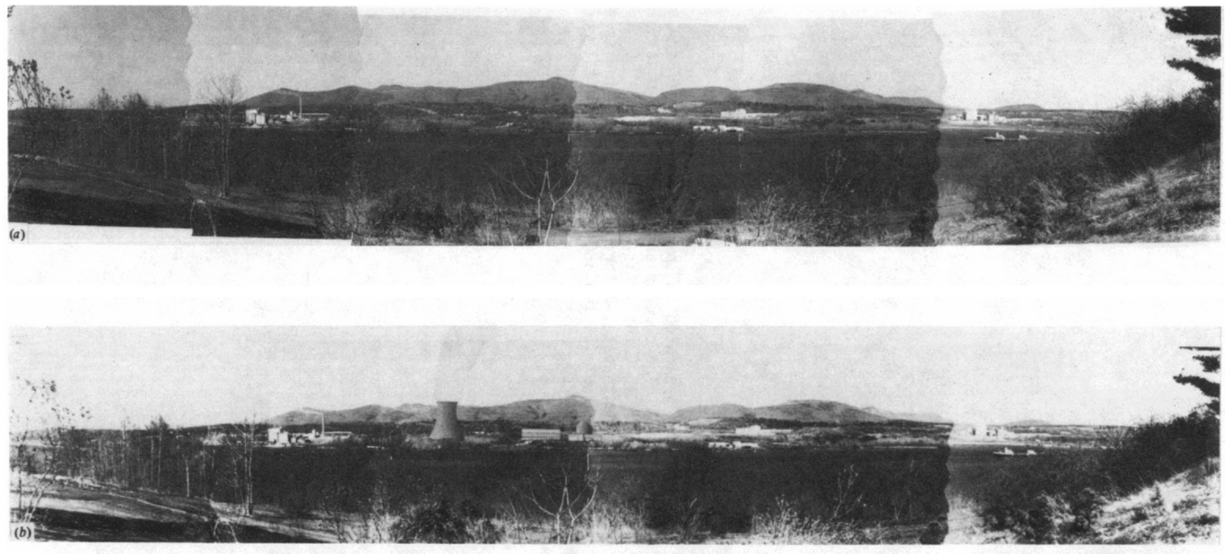


Figure 1.3 As-found (top) and composite (bottom) panoramic views from Germantown looking west toward Greene County Nuclear Power Plant, Oak Ridge National Laboratory, 1978. In U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549* (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979): p. M-23.

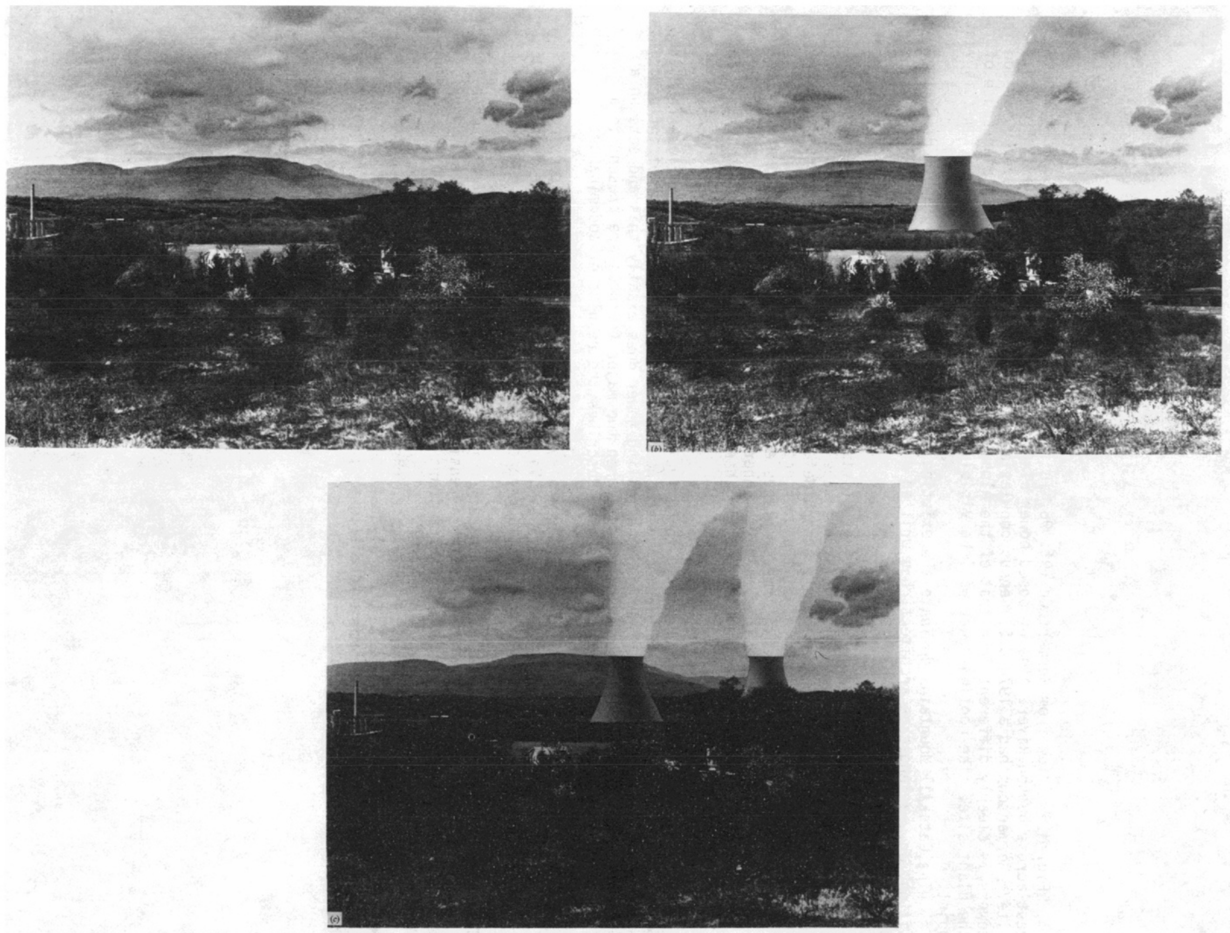
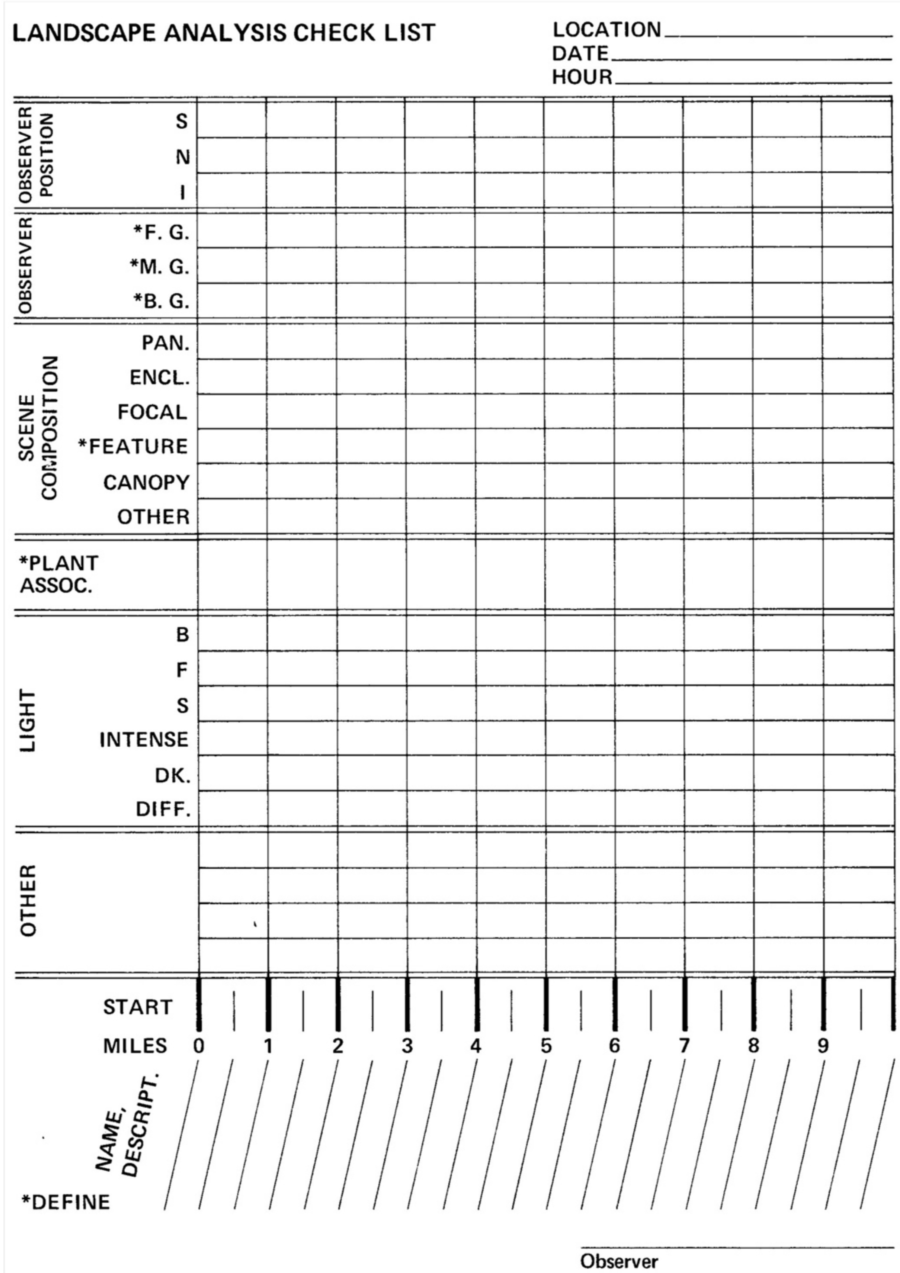


Figure 1.4 Composite views of Greene County Nuclear Power Plant from Germantown looking west across Hudson River, Oak Ridge National Laboratory, 1978 In U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549* (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979): p. M-20.



LANDSCAPE ANALYSIS CHECK LIST

LOCATION ____________
DATE ____________
HOUR ____________

OBSERVER POSITION	S										
	N										
	I										
OBSERVER	*F. G.										
	*M. G.										
	*B. G.										
SCENE COMPOSITION	PAN.										
	ENCL.										
	FOCAL										
	*FEATURE										
	CANOPY										
	OTHER										
*PLANT ASSOC.											
LIGHT	B										
	F										
	S										
	INTENSE										
	DK.										
	DIFF.										
OTHER											
	START										
	MILES	0	1	2	3	4	5	6	7	8	9
	NAME, DESCRIPT.										

*DEFINE

Observer ____________

Figure 1.5 Landscape Analysis Check List. In R. Burton Litton, *Forest Landscape Description and Inventories - A Basis for Land Planning and Design*, Res. Paper PSW-RP-049 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1968): p. 63.

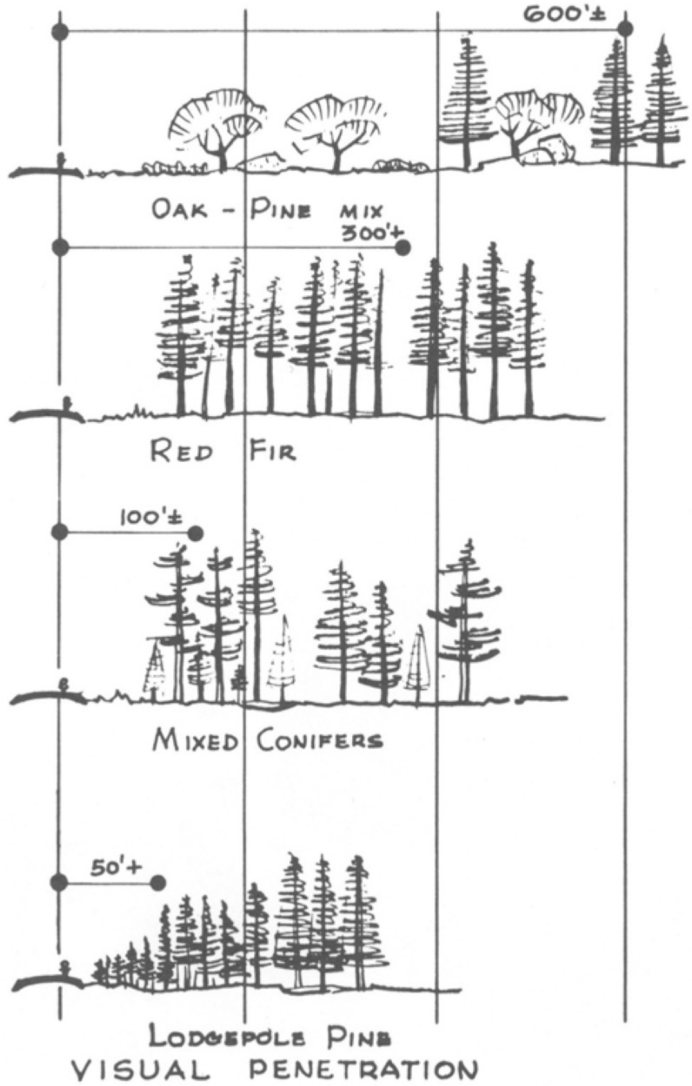


Figure 1.6 Visual Penetration diagram. In R. Burton Litton, *Forest Landscape Description and Inventories - A Basis for Land Planning and Design*, Res. Paper PSW-RP-049 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1968): p. 38.

Figure 1.7 Frederic Edwin Church, *Winter Scene, Olana*, 1870


The hillside between the lake and house (**4**) has been opened up by removing trees, but originally, as an old photograph shows (**5**), the planting was a perfect example of the picturesque landscape. The house afforded Church variously calculated vistas framed by elaborate porches (**27**) and by amber-stencilled borders (**23, 54**); cloud formations can be studied through amber-paned windows (**33**). The entire house is assembled with an artist's eye: juxtapositions of dark and light rooms along the axial plan, and of cold and warm light in the same room (**33**), sensitive placements of furniture and sculpture so that light and shadow will fall on them to best effect (**36, 37, 38, 40, 48, 50**), and great variety of paintings, furniture, and objects (**28–54**) many exactly where they were when photographed 75 years ago (**49**). The many Persian and Moorish-style decorations—stencilled doors and borders and patterned pieces—give the interiors the polychromed effect of Eastern opulence. (Photos this page, courtesy Prof. David Huntington.)

Figure 1.8 Vincent Scully, "Palace of the Past," *Progressive Architecture* 46, May 1965: pp. 186–187. Photographs by David Huntington.

LANDSCAPE PREFERENCES IN THE MID-HUDSON REGION

The Oak Ridge National Laboratory in Oak Ridge, Tennessee is studying what types of landscapes people in this region like to see and why they like them. We are especially interested in learning how the construction of a large industrial facility such as a power plant might affect the scenic quality of the Hudson Valley in this region.

These pictures were all taken in the Greene and Columbia County areas. Some have been retouched by artists to suggest possible future developments such as operation of new cement facilities or cooling towers like those associated with electrical power generating plants.

<u>Instructions</u>

First, please look through the pictures quickly to get a general feeling for what they are about. Then, go back and RATE <u>EACH</u> OF THE PHOTOGRAPHS AS TO <u>HOW MUCH YOU LIKE IT</u>.

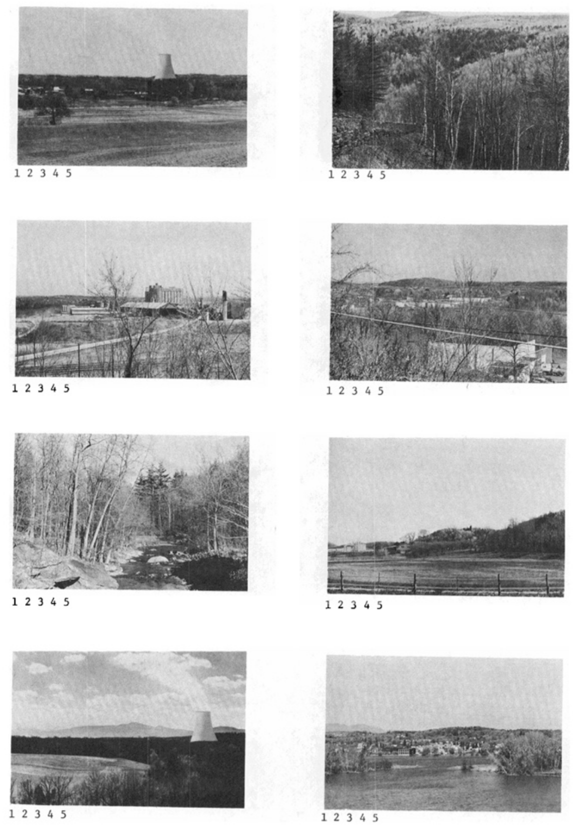
All you need to do is circle the number below EACH photograph to indicate whether you like it:

1 = not at all
2 = a little
3 = somewhat
4 = quite a bit
5 = very much

There are a few questions at the back which will help us interpret the ratings of the photographs and better understand the feelings and values local residents attach to their surroundings. We appreciate your cooperation in responding to these questions.

THANK YOU

Carl H. Petrich
Oak Ridge National Laboratory
Oak Ridge, Tennessee



Figures 1.9 and 1.10 Landscape Preferences Questionnaire, Oak Ridge National Laboratory, 1978. In U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549* (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979): p. N-4, N-8.

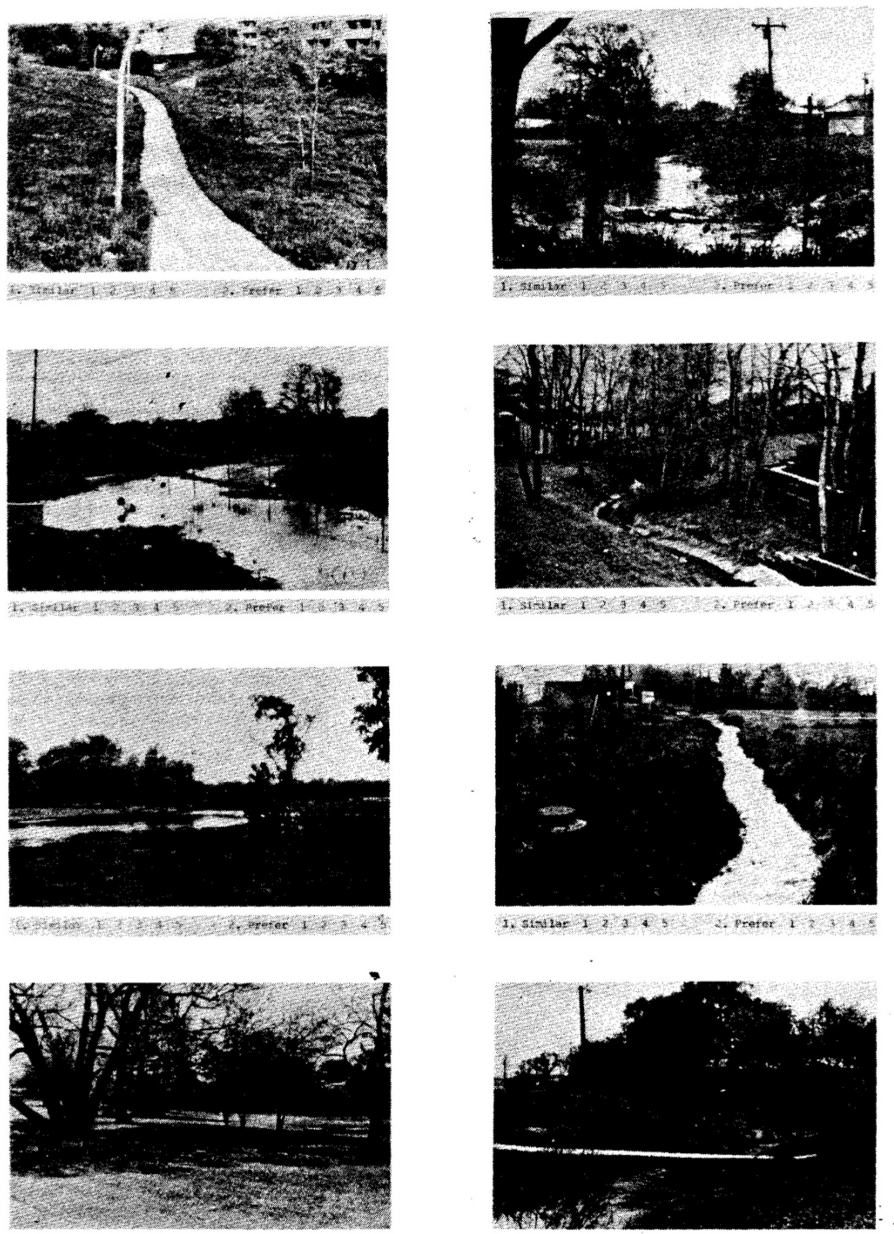


Figure 1.11 Photoquestionnaire for Swift Run Drain study, 1977. In Rachel Kaplan, "A Methodology for Simultaneously Obtaining and Sharing Information," in *Assessing Amenity Resource Values*, USDA Forest Service General Technical Report RM-68, 1979: p. 60.

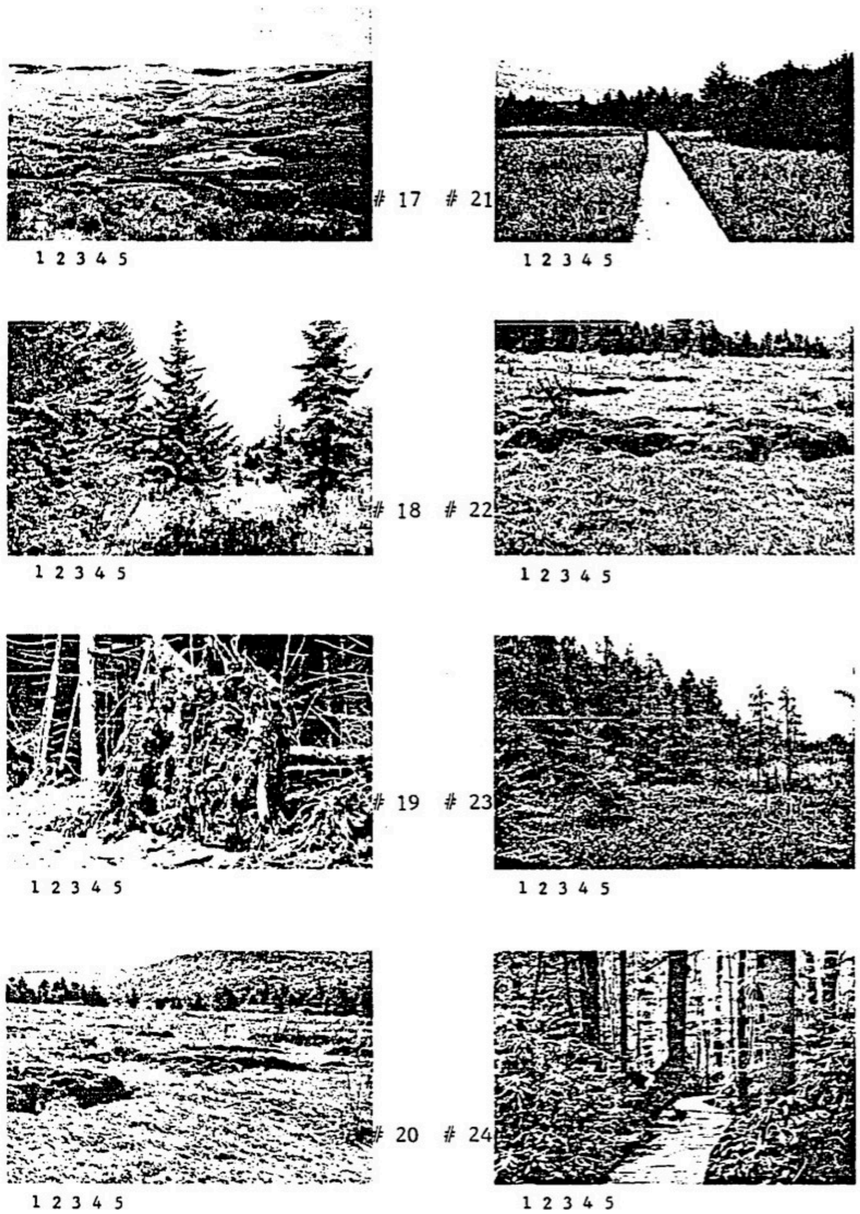


Figure 1.12 Visual Preferences of Cranberry Glades survey. In William Edgar Hammitt, "Visual and User Preference for a Bog Environment" (Ann Arbor, University of Michigan, 1978): p. 140.

Level of Interpretation	Making Sense	Involvement
The Visual Array	Coherence	Complexity
Three-Dimensional Space	Legibility	Mystery

Figure 1.13 Preference Matrix. In Stephen Kaplan, "Perception and Landscape: Conceptions and Misconceptions," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979): p. 245.

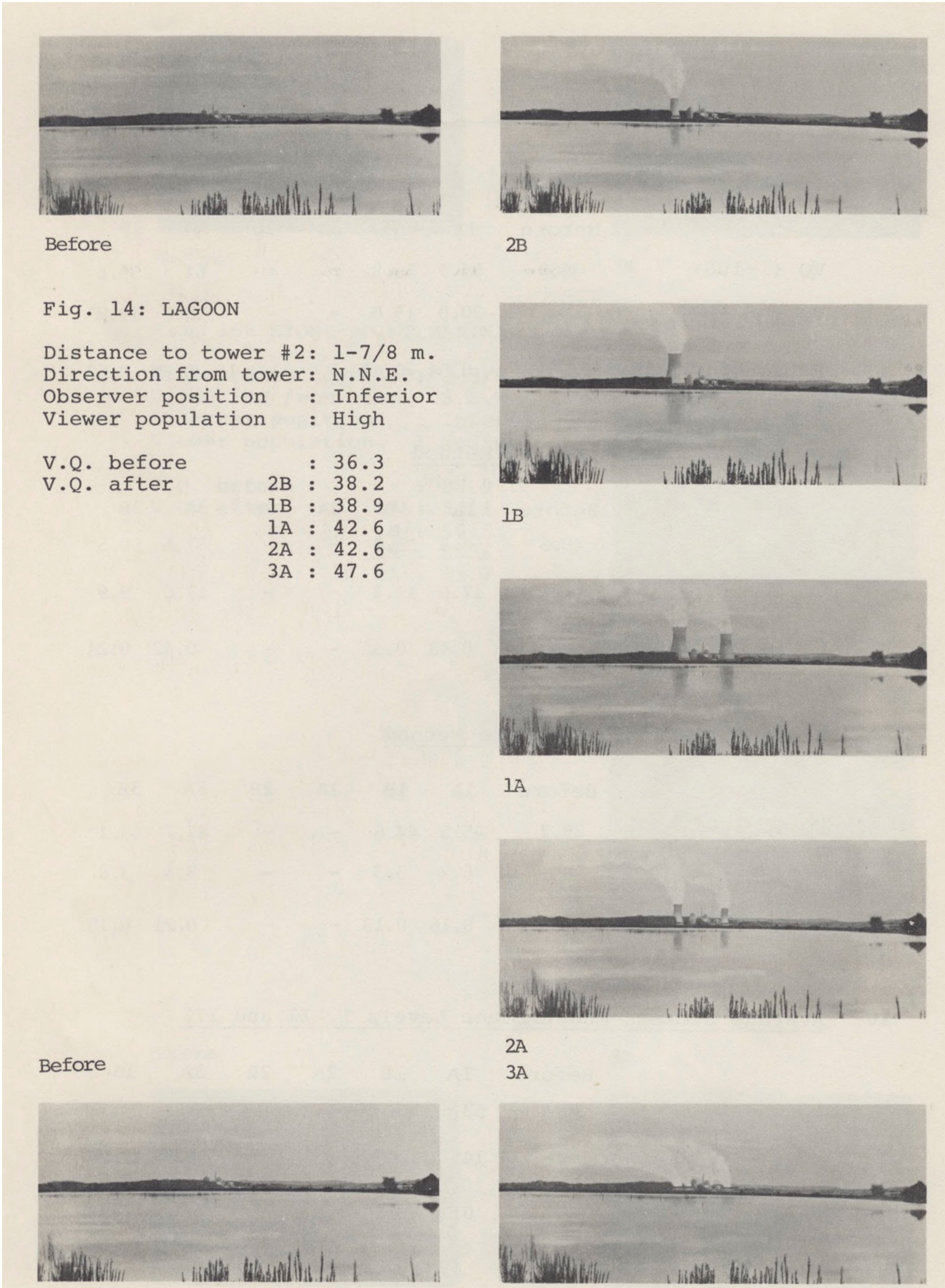


Figure 1.14 Composite views of Indian Point Nuclear Generating Plant and visual quality scoring from lagoon viewpoint. In Jones & Jones et al., *Visual Impact Study: Statement of Findings, Alternative Closed Cycle Cooling Systems, Indian Point Nuclear Generating Plant* (Seattle: Jones & Jones, 1975): p. 49.

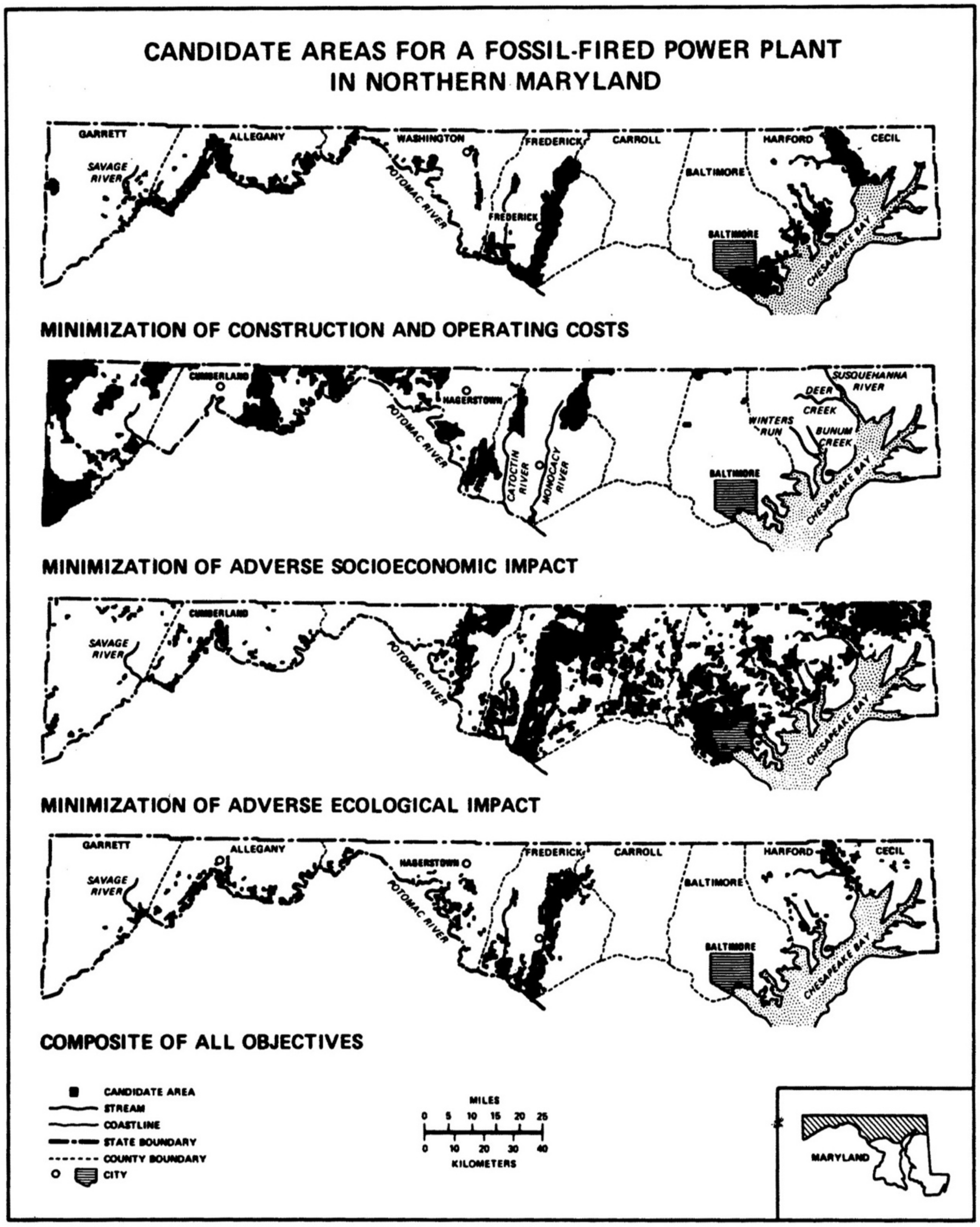
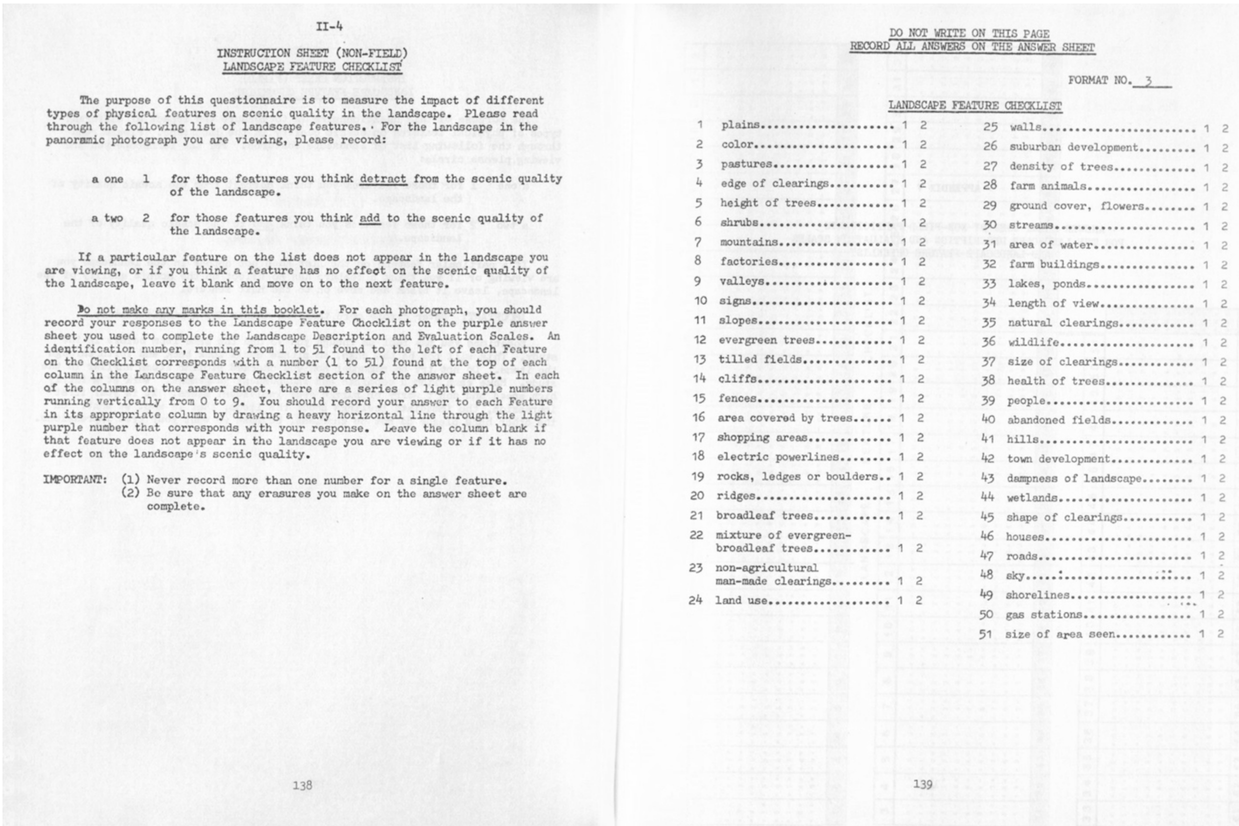


Figure 1.15 Candidate Areas for a Fossil-Fired Power Plant in Northern Maryland. In Jerome E. Dobson, "A Regional Screening Procedure for Land Use Suitability Analysis," *Geographical Review* 69, no. 2 (1979): p. 227.



II-4

INSTRUCTION SHEET (NON-FIELD)
LANDSCAPE FEATURE CHECKLIST

The purpose of this questionnaire is to measure the impact of different types of physical features on scenic quality in the landscape. Please read through the following list of landscape features. For the landscape in the panoramic photograph you are viewing, please record:

a one 1 for those features you think detract from the scenic quality of the landscape.

a two 2 for those features you think add to the scenic quality of the landscape.

If a particular feature on the list does not appear in the landscape you are viewing, or if you think a feature has no effect on the scenic quality of the landscape, leave it blank and move on to the next feature.

Do not make any marks in this booklet. For each photograph, you should record your responses to the Landscape Feature Checklist on the purple answer sheet you used to complete the Landscape Description and Evaluation Scales. An identification number, running from 1 to 51 found to the left of each Feature on the Checklist corresponds with a number (1 to 51) found at the top of each column in the Landscape Feature Checklist section of the answer sheet. In each of the columns on the answer sheet, there are a series of light purple numbers running vertically from 0 to 9. You should record your answer to each Feature in its appropriate column by drawing a heavy horizontal line through the light purple number that corresponds with your response. Leave the column blank if that feature does not appear in the landscape you are viewing or if it has no effect on the landscape's scenic quality.

IMPORTANT: (1) Never record more than one number for a single feature.
(2) Be sure that any erasures you make on the answer sheet are complete.

138

DO NOT WRITE ON THIS PAGE
RECORD ALL ANSWERS ON THE ANSWER SHEET

FORMAT NO. 3

LANDSCAPE FEATURE CHECKLIST

1	plains	1	2
2	color	1	2
3	pastures	1	2
4	edge of clearings	1	2
5	height of trees	1	2
6	shrubs	1	2
7	mountains	1	2
8	factories	1	2
9	valleys	1	2
10	signs	1	2
11	slopes	1	2
12	evergreen trees	1	2
13	tilled fields	1	2
14	cliffs	1	2
15	fences	1	2
16	area covered by trees	1	2
17	shopping areas	1	2
18	electric powerlines	1	2
19	rocks, ledges or boulders	1	2
20	ridges	1	2
21	broadleaf trees	1	2
22	mixture of evergreen-broadleaf trees	1	2
23	non-agricultural man-made clearings	1	2
24	land use	1	2
25	walls	1	2
26	suburban development	1	2
27	density of trees	1	2
28	farm animals	1	2
29	ground cover, flowers	1	2
30	streams	1	2
31	area of water	1	2
32	farm buildings	1	2
33	lakes, ponds	1	2
34	length of view	1	2
35	natural clearings	1	2
36	wildlife	1	2
37	size of clearings	1	2
38	health of trees	1	2
39	people	1	2
40	abandoned fields	1	2
41	hills	1	2
42	town development	1	2
43	dampness of landscape	1	2
44	wetlands	1	2
45	shape of clearings	1	2
46	houses	1	2
47	roads	1	2
48	sky	1	2
49	shorelines	1	2
50	gas stations	1	2
51	size of area seen	1	2

139

Figure 1.16 Landscape Feature Checklist. In Ervin H. Zube, David G. Pitt, and Thomas W. Anderson, "Perception and Measurement of Scenic Resources in the Southern Connecticut River Valley" (Amherst, MA: Institute for Man and His Environment, University of Massachusetts, 1974): pp. 138–139.

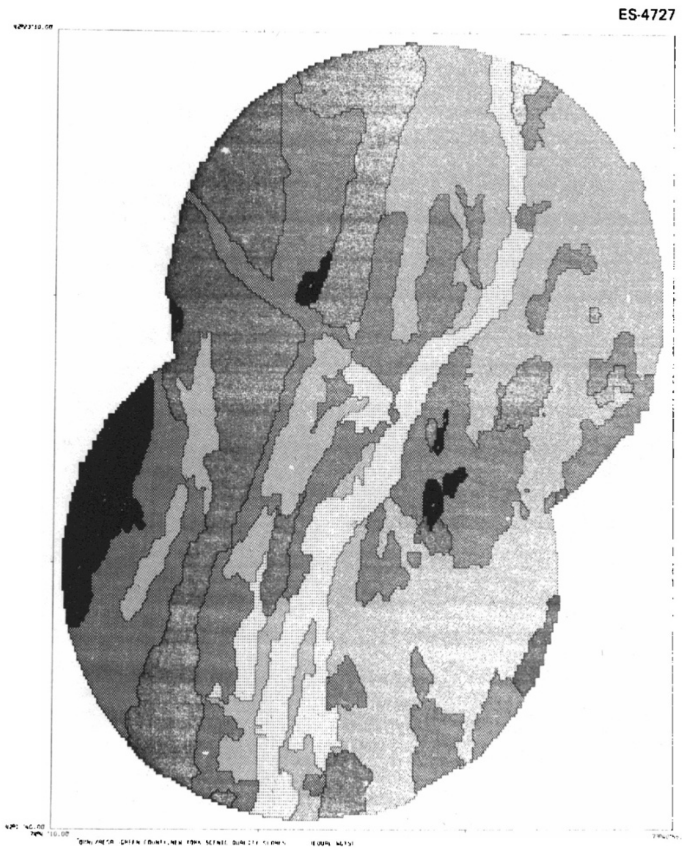


Fig. M.17. Ten-mile radius around Cementon and Athens sites. Polygons of highest scenic quality are in darkest shades. Equal weights applied.

Figure 1.17 Map of degrees of scenic quality, Oak Ridge National Laboratory, 1978. In U.S. Nuclear Regulatory Commission, ed., *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549* (Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979): p. M-51.

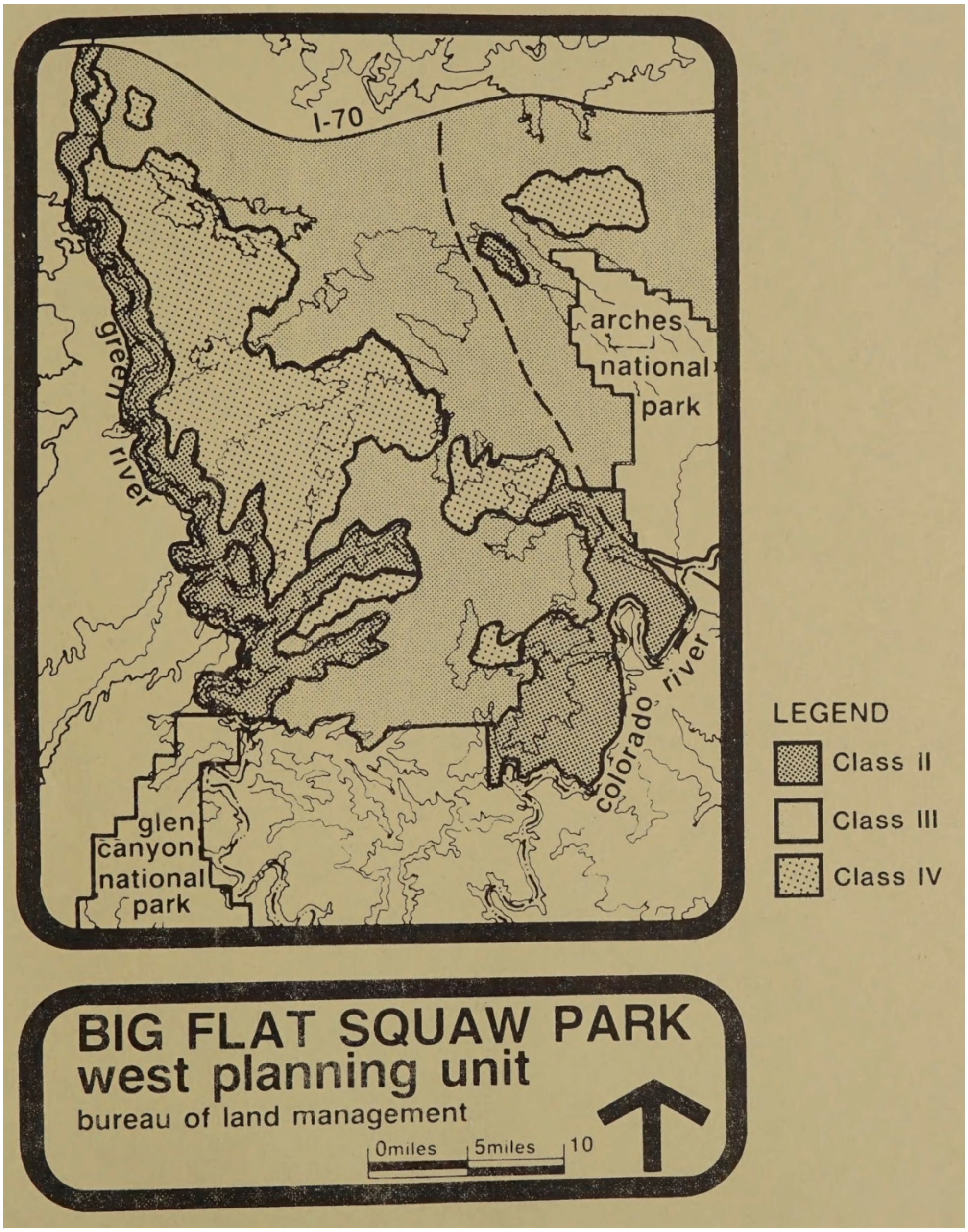


Figure 1.18 Visual Resource Inventory Class Overlay for Big Flat Squaw Park. In U.S. Bureau of Land Management, *Visual Resource Inventory*, Manual Handbook 8410-1 (Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986): illustration 12.

Form 8400–1
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

SCENIC QUALITY FIELD INVENTORY

Date Aug. 15, 1985
District Moab
Resource Area Grand
Scenic quality rating unit 024

1. Evaluators *(names)*

Bob Tumwater, Russ Grimes, Pete Jordon

2. LANDSCAPE CHARACTER *(Feature)*

	a. LANDFORM/WATER	b. VEGETATION	c. STRUCTURE *(General)*
FORM	deeply cut side canyons with vertical walls leading into flat open valley w/slow meandering river	simple forms created by patterns in vegetation	oval, elongated, and linear.
LINE	horizontal & vertical in cliff formations, jagged ridge lines, and meandering river	irregular, indistinct	rounded, vertical
COLOR	orange and greys dominant, deep blue in settling pond	dark green in river bottom, grey elsewhere	light green & grey
TEXTURE	Course	medium grain, sparse, and uneven random	uneven

3. Narrative This SQRU includes the flat and meandering river bed of the Colorado River and the deeply dissected canyons to the North. It differs in landform and vegetation from the surrounding areas. The rock formations and topography are fairly common in the physiographic province but it is uncommon to have a river flowing through this type of landscape. The potash plant which lies in the middle of this area is a major visual intrusion which can be seen from several overlooks and the river.

4. SCORE *(Circle Appropriate Level)**

	HIGH	MEDIUM	LOW	EXPLANATION OR RATIONALE
a. Landform	5 4	3	1	
b. Vegetation	5	3 2	1	
c. Water	5	3	0	
d. Color	5	3	1	
e. Adjacent Scenery	5 4	3	0	See explanation on reverse
f. Scarcity	5+	3	1	
g. Cultural Modification	2	0	-3 -4	
TOTALS	18 + 5 +(-3) = 20			

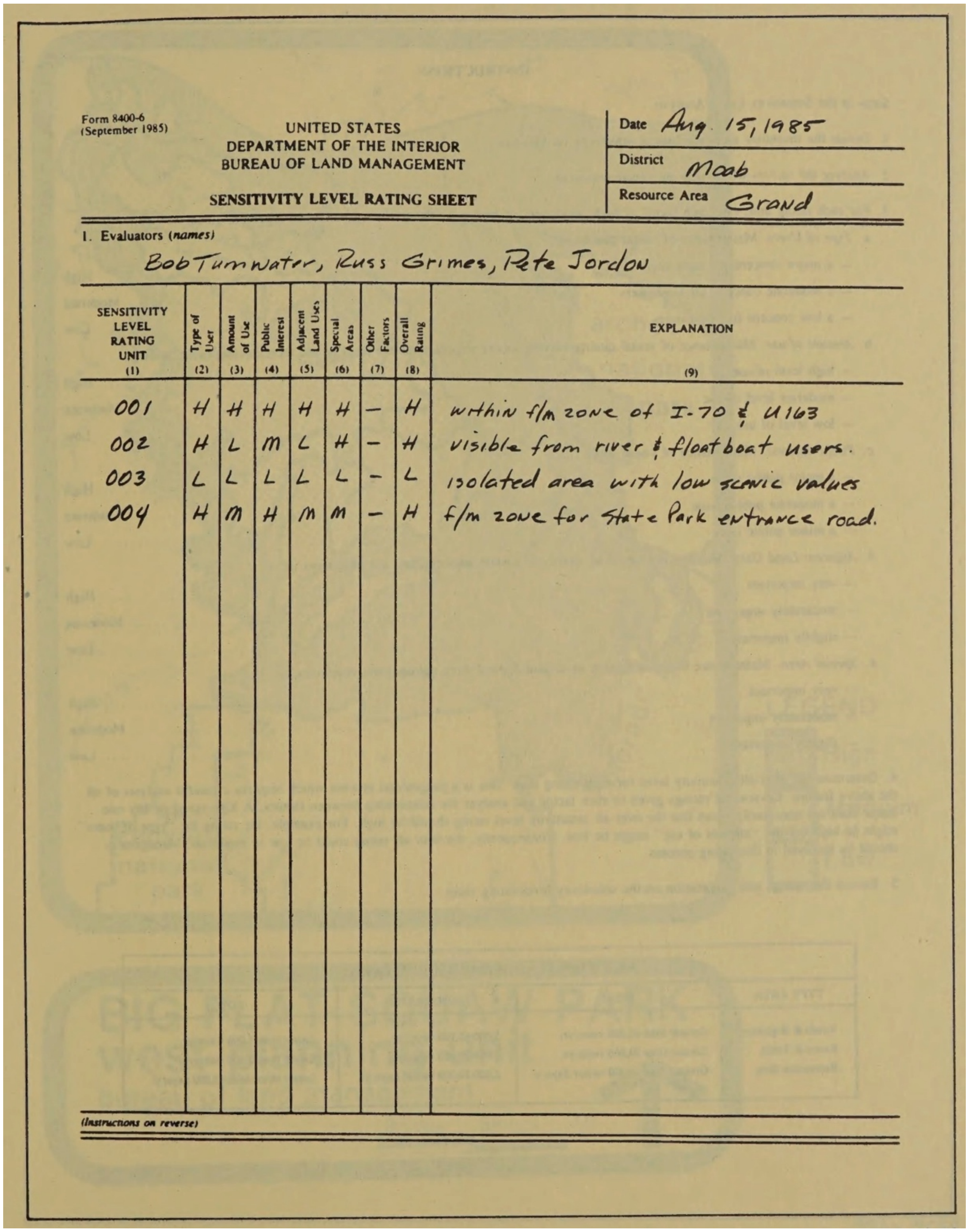
SCENIC QUALITY CLASSIFICATION

- [x] A – 19 or more
- [ ] B – 12–18
- [ ] C – 11 or less

(Instructions on reverse)

Figure 1.19 Scenic Quality Field Inventory Form. In U.S. Bureau of Land Management, *Visual Resource Inventory*, Manual Handbook 8410-1 (Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986): illustration 3.

Figure 1.20 Scenic Quality Map. In U.S. Bureau of Land Management, *Visual Resource Management Program* (Washington, D.C.: Department of the Interior, Bureau of Land Management, Division of Recreation and Cultural Resources, 1980): p. 19.


Form 8400-6
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

SENSITIVITY LEVEL RATING SHEET

Date Aug. 15, 1985
District Moab
Resource Area Grand

1. Evaluators (*names*)
Bob Tumwater, Russ Grimes, Pete Jordon

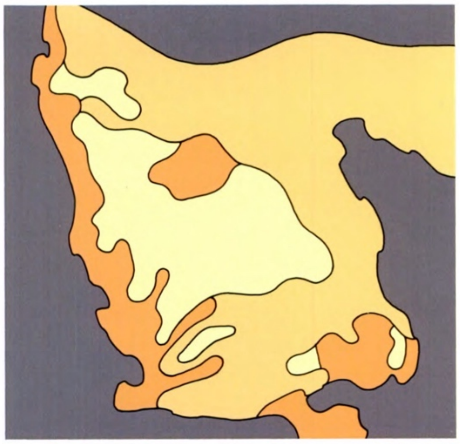
SENSITIVITY LEVEL RATING UNIT (1)	Type of User (2)	Amount of Use (3)	Public Interest (4)	Adjacent Land Uses (5)	Special Areas (6)	Other Factors (7)	Overall Rating (8)	EXPLANATION (9)
001	H	H	H	H	H	–	H	within f/m zone of I-70 & U163
002	H	L	M	L	H	–	H	visible from river & floatboat users.
003	L	L	L	L	L	–	L	isolated area with low scenic values
004	H	M	H	M	M	–	H	f/m zone for State Park entrance road.

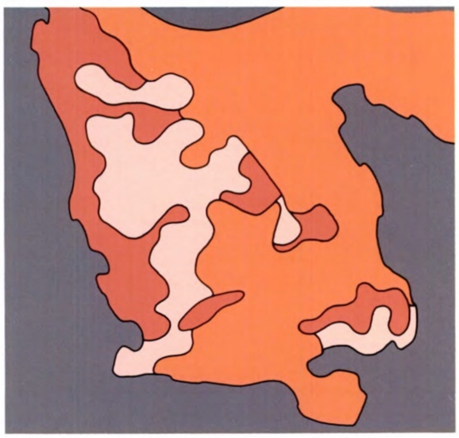
(*Instructions on reverse*)

Figure 1.21 Sensitivity Level Rating Sheet. In U.S. Bureau of Land Management, *Visual Resource Inventory*, Manual Handbook 8410-1 (Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986): illustration 8.

Sensitivity Level Matrix

Sensitivity	High				Medium			Low	
User Attitude	H	H	M	H	L	M	M	L	L
Use Volume	H	M	H	L	H	M	L	M	L





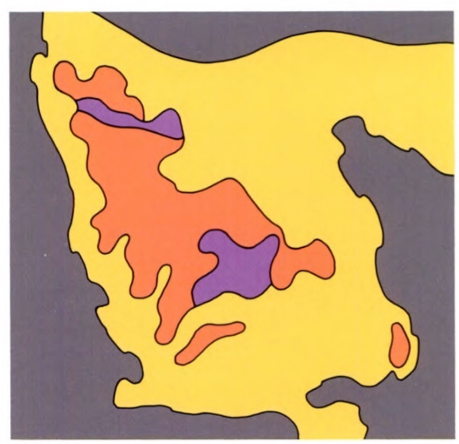


Figure 1.22 Sensitivity level maps and matrix. In U.S. Bureau of Land Management, *Visual Resource Management Program* (Washington, D.C.: Department of the Interior, Bureau of Land Management, Division of Recreation and Cultural Resources, 1980):

Management Classes

Management Classes describe the different degrees of modification allowed to the basic elements of the landscape. Class designations are derived from an overlay technique that combines the maps of Scenic Quality, Sensitivity Levels and Distance Zones. The overlays are used to identify areas with similar combinations of factors. These areas are assigned to one of five Management Classes according to predetermined criteria. The resulting map of contiguous areas sharing the same VRM class is an important document for all Bureau land use planning decisions, and it is also used to assess the visual impact of proposed development.

Management Classes

Class 1
Class 2
Class 3
Class 4
Class 5

Visual Sensitivity	H			M			L
Special Areas	1	1	1	1	1	1	1
Scenic Quality A	2	2	2	2	2	2	2
B	2	3	3	3	4	4	4
C	3	4	4	4	4	4	4
Distance Zones	FG MG	BG	SS	FG MG	BG	SS	SS

Note: Class 5 areas are those that have been identified in the VRM planning system which require rehabilitation or enhancement and therefore are not included in this chart.

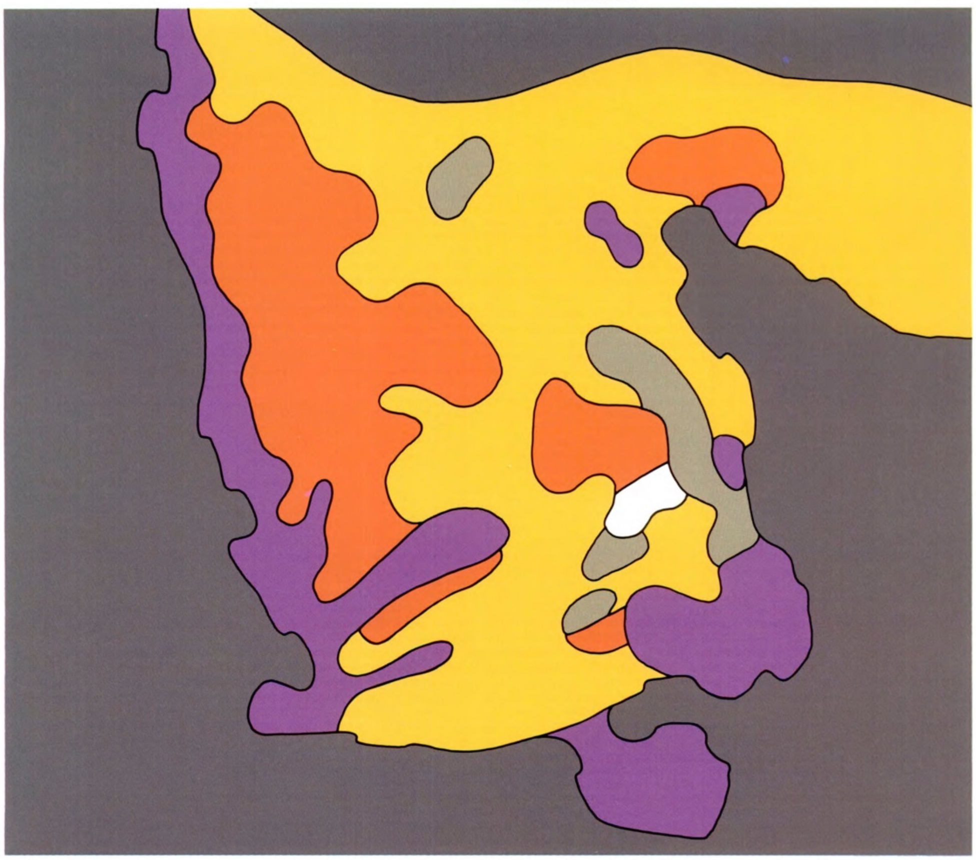
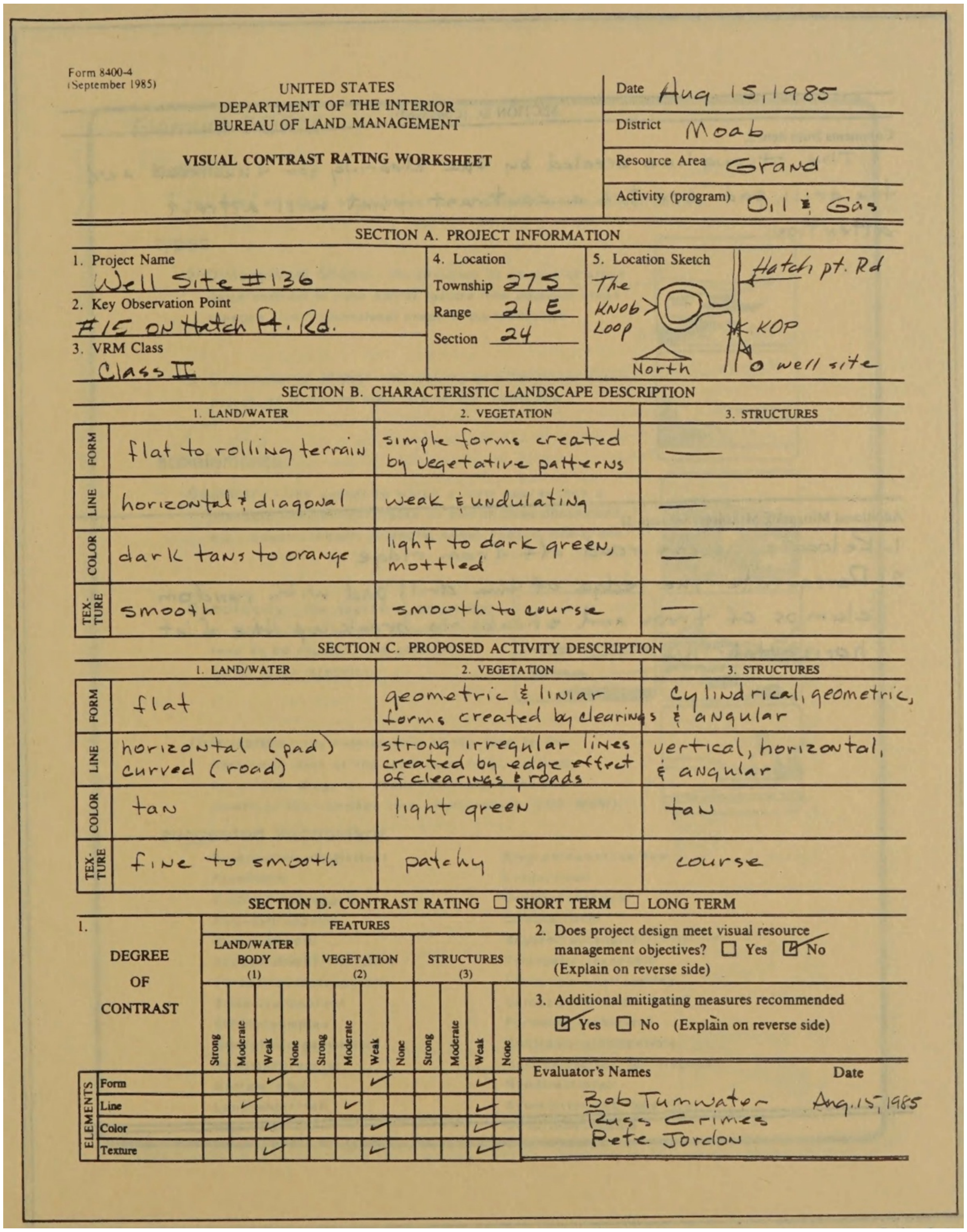


Figure 1.23 Matrix of analytic factors and overlay maps for management classification. In U.S. Bureau of Land Management, *Visual Resource Management Program* (Washington, D.C.: Department of the Interior, Bureau of Land Management, Division of Recreation and Cultural Resources, 1980): p. 24.



Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date Aug 15, 1985
District Moab
Resource Area Grand
Activity (program) Oil & Gas

SECTION A. PROJECT INFORMATION

1. Project Name: Well Site #136
2. Key Observation Point: #15 on Hatch Pt. Rd.
3. VRM Class: Class II
4. Location: Township 27S; Range 21E; Section 24
5. Location Sketch: Hatch pt. Rd; The Knob Loop; KOP; North; o well site

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	flat to rolling terrain	simple forms created by vegetative patterns	—
LINE	horizontal & diagonal	weak & undulating	—
COLOR	dark tans to orange	light to dark green, mottled	—
TEXTURE	smooth	smooth to course	—

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	flat	geometric & liniar forms created by clearings	cylindrical, geometric, & angular
LINE	horizontal (pad) curved (road)	strong irregular lines created by edge effect of clearings & roads	vertical, horizontal, & angular
COLOR	tan	light green	tan
TEXTURE	fine to smooth	patchy	course

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONTRAST

ELEMENTS	Land/Water Body (1) Strong	Moderate	Weak	None	Vegetation (2) Strong	Moderate	Weak	None	Structures (3) Strong	Moderate	Weak	None
Form			✓				✓				✓	
Line		✓				✓					✓	
Color			✓				✓				✓	
Texture			✓				✓				✓	

2. Does project design meet visual resource management objectives? ☐ Yes ☑ No (Explain on reverse side)

3. Additional mitigating measures recommended ☑ Yes ☐ No (Explain on reverse side)

Evaluator's Names: Bob Tumwater, Russ Grimes, Pete Jordon
Date: Aug. 15, 1985

Figure 1.24 Visual Contrast Rating Worksheet. In U.S. Bureau of Land Management, *Visual Resource Contrast Rating*, Manual Handbook 8431-1 (Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986): illustration 2.

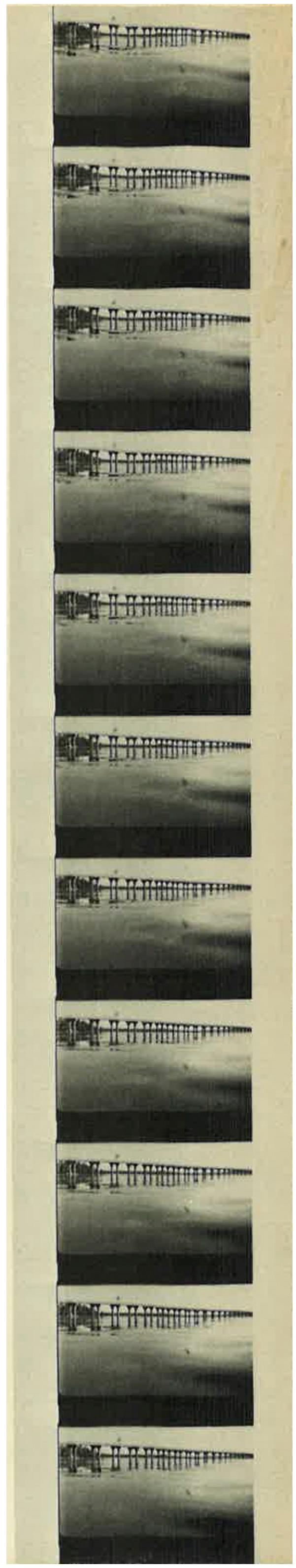


Figure 2.1 Environmental Simulation Laboratory, Film strip of simulated boat ride for I-220 highway bypass over Cross Lake, Shreveport, Louisiana. In Jones and Jones, *I-220: Cross Lake Visual Impact Assessment Final Report* (September 1983): cover.

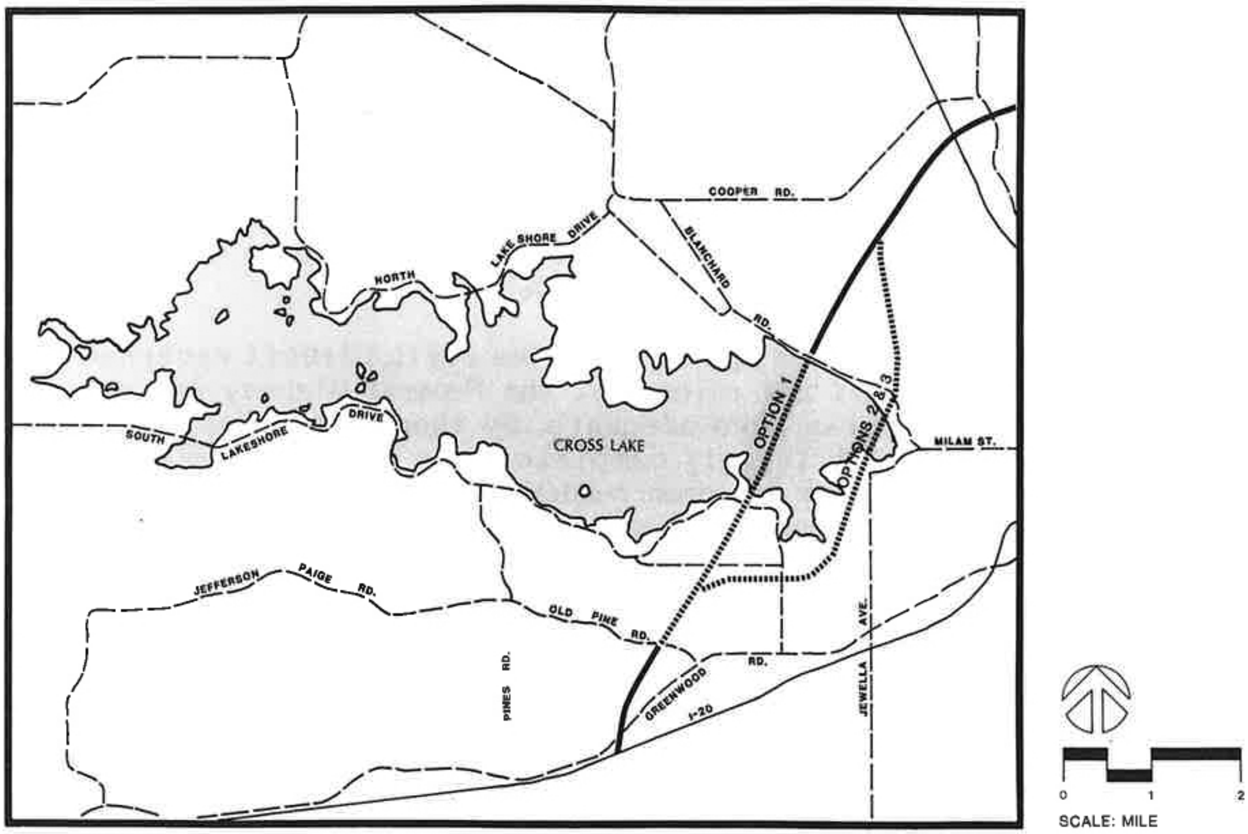


Figure 2.2 Map of proposed I-220 highway bypass with three alternatives for bridge over Cross Lake. In Jones and Jones, *I-220: Cross Lake Visual Impact Assessment Final Report* (September 1983): p. 4.

Figure 2.3 U.S. Department of the Interior, Fred Farr Presenting at the White House Conference on Natural Beauty, May 24, 1965. Archives & Special Collections of California State University, Monterey Bay.

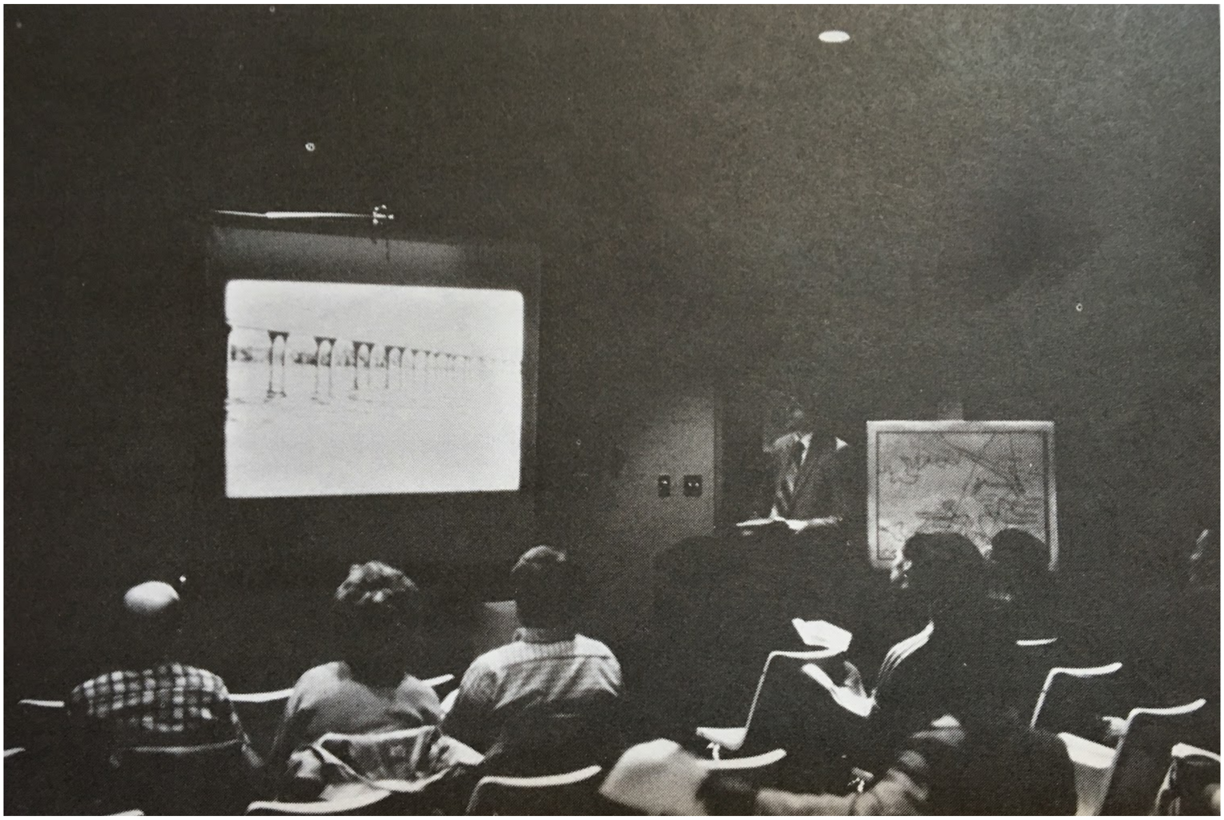
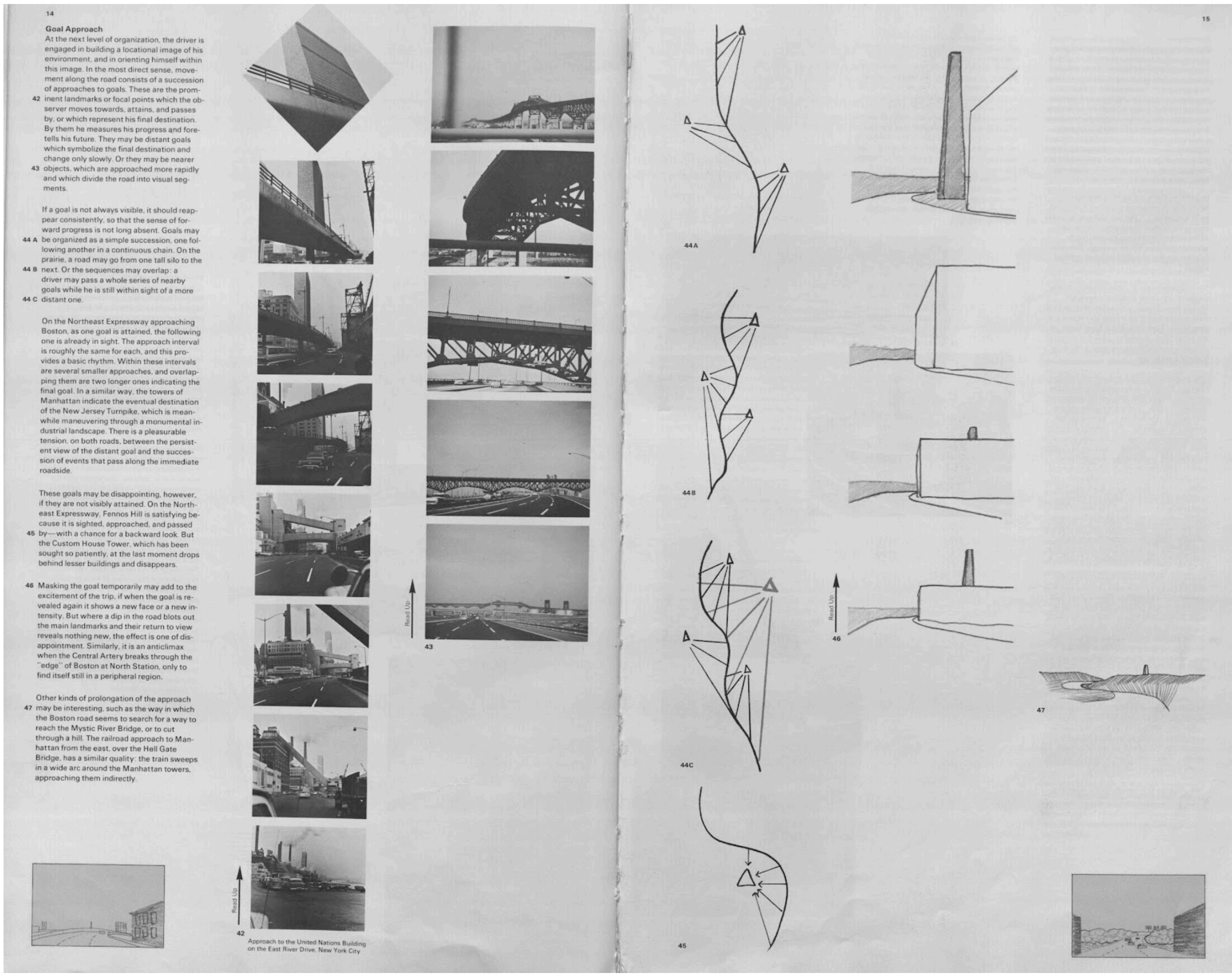


Figure 2.4 Unidentified photographer, Screening of Film Simulation of Proposed Cross Lake bridge in Shreveport, Louisiana, produced by UC Berkeley Environmental Simulation Laboratory, 1983. In William G. E. Blair, "Visual Impact Assessment in Urban Environments," in *Foundations for Visual Project Analysis*, eds. Richard C. Smardon, James F. Palmer, and John P. Felleman (New York: John Wiley & Sons, 1986): p. 242.

Figures 2.5 and 2.6 Unidentified photographers, Environmental Simulation Laboratory with Donald Appleyard at work (top), ca. 1979. *Environmental Design Archives Exhibitions*, courtesy Peter Bosselmann.



14

Goal Approach

At the next level of organization, the driver is
engaged in building a locational image of his
environment, and in orienting himself within
this image. In the most direct sense, move-
ment along the road consists of a succession
of approaches to goals. These are the prom-
42 inent landmarks or focal points which the ob-
server moves towards, attains, and passes
by, or which represent his final destination.
By them he measures his progress and fore-
tells his future. They may be distant goals
which symbolize the final destination and
change only slowly. Or they may be nearer
43 objects, which are approached more rapidly
and which divide the road into visual seg-
ments.

If a goal is not always visible, it should reap-
pear consistently, so that the sense of for-
ward progress is not long absent. Goals may
44 A be organized as a simple succession, one fol-
lowing another in a continuous chain. On the
prairie, a road may go from one tall silo to the
44 B next. Or the sequences may overlap: a
driver may pass a whole series of nearby
goals while he is still within sight of a more
44 C distant one.

On the Northeast Expressway approaching Boston, as one goal is attained, the following one is already in sight. The approach interval is roughly the same for each, and this provides a basic rhythm. Within these intervals are several smaller approaches, and overlapping them are two longer ones indicating the final goal. In a similar way, the towers of Manhattan indicate the eventual destination of the New Jersey Turnpike, which is meanwhile maneuvering through a monumental industrial landscape. There is a pleasurable tension, on both roads, between the persistent view of the distant goal and the succession of events that pass along the immediate roadside.

These goals may be disappointing, however,
if they are not visibly attained. On the North-
east Expressway, Fennos Hill is satisfying be-
cause it is sighted, approached, and passed
45 by—with a chance for a backward look. But
the Custom House Tower, which has been
sought so patiently, at the last moment drops
behind lesser buildings and disappears.

46 Masking the goal temporarily may add to the excitement of the trip, if when the goal is revealed again it shows a new face or a new intensity. But where a dip in the road blots out the main landmarks and their return to view reveals nothing new, the effect is one of disappointment. Similarly, it is an anticlimax when the Central Artery breaks through the "edge" of Boston at North Station, only to find itself still in a peripheral region.

Other kinds of prolongation of the approach
47 may be interesting, such as the way in which
the Boston road seems to search for a way to
reach the Mystic River Bridge, or to cut
through a hill. The railroad approach to Man-
hattan from the east, over the Hell Gate
Bridge, has a similar quality: the train sweeps
in a wide arc around the Manhattan towers,
approaching them indirectly.

Figure 2.7 Donald Appleyard, Kevin Lynch, and John R. Myer, *The View from the Road* (Cambridge, MA: MIT Press, 1964): pp. 14–15.

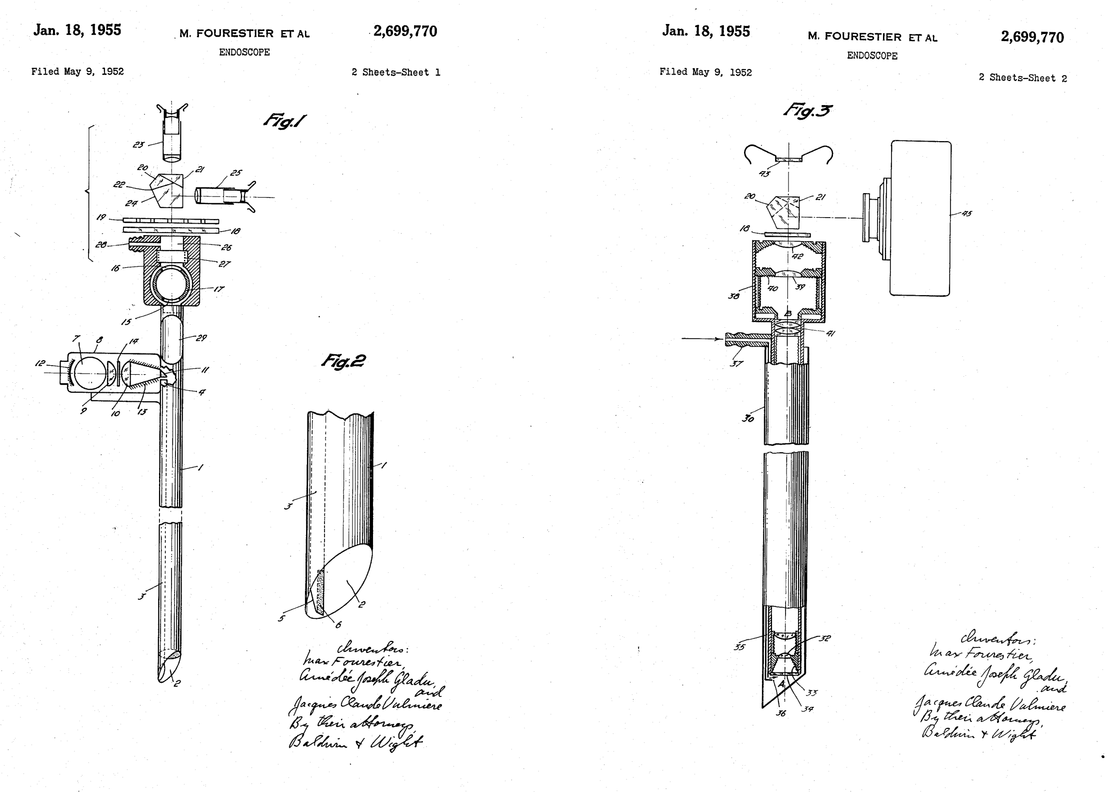
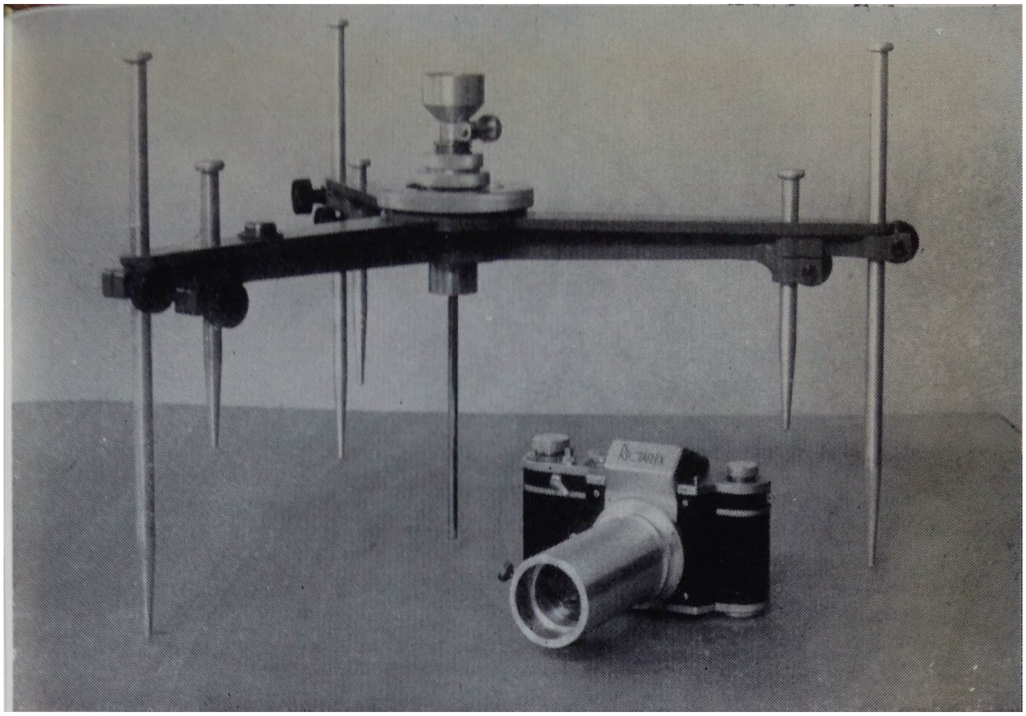
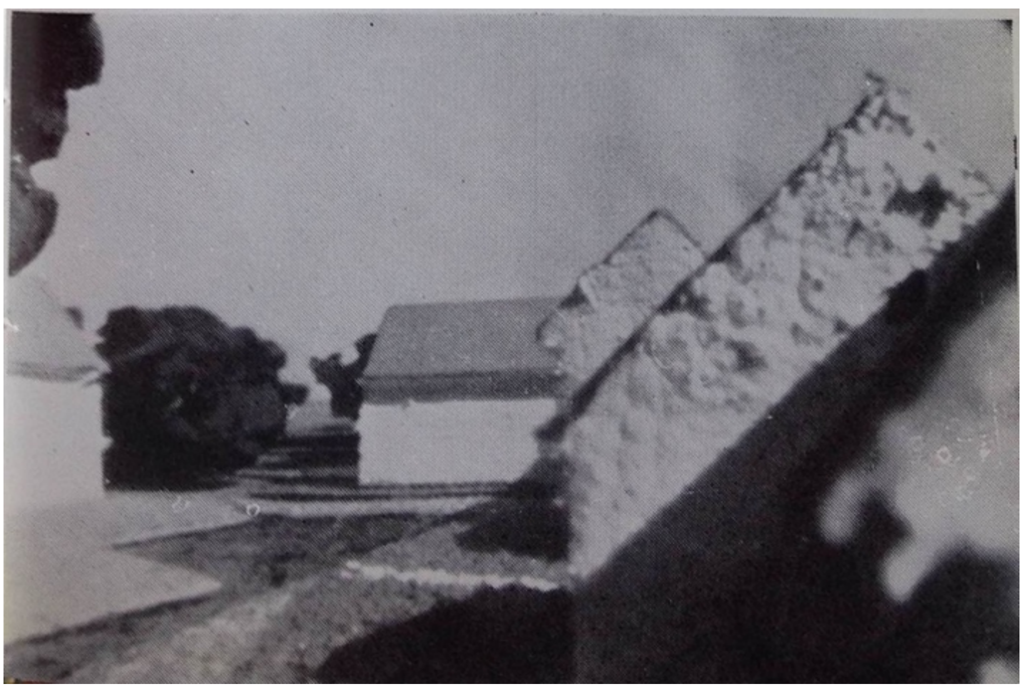
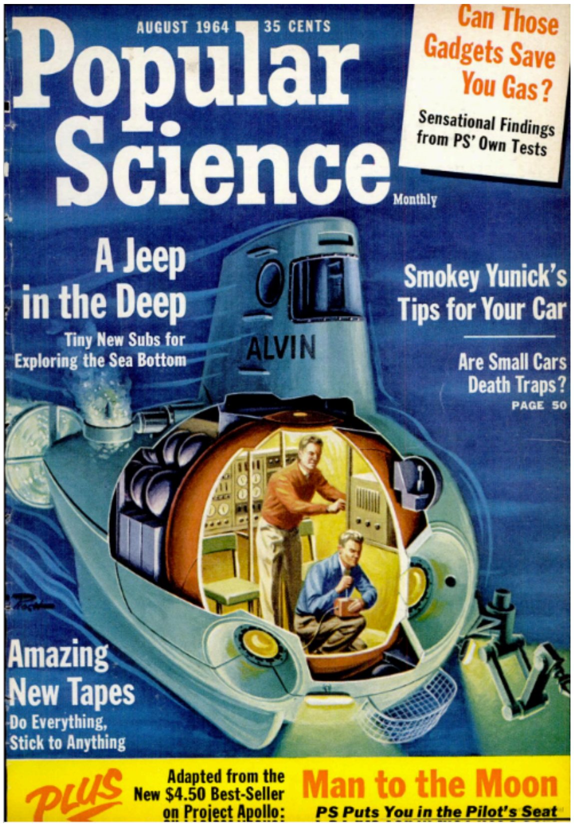


Figure 2.8 Max Fourestier, Amédée Joseph Gladu, and Jacques Claude Vulmière, assignors to Centre National de la Recherche Scientifique, Paris, France, *Endoscope*, United States Patent 2,699,770, Application May 9, 1952, Patented Jan. 18, 1955.





Figures 2.9 and 2.10 Robert Auzelle, Maquettoscope and photographic view from within an architectural model. In Robert Auzelle, *323 Citations sur l'Urbanisme* (Paris: Vincent, Freal, 1964): p. 691.



PS PICTURE NEWS

Lilliputian's-eye viewer puts you inside tiny model

A slender optical tube fitted with 18 miniature lenses provides realistic views inside architects', landscapers', town planners', and other scale models. With a camera and adapter on the eyepiece, you get photos like the circular ones at left.

The British-made Modelscope is a combination microscrope, periscope, and telescope with an aperture at one side .3 inch from the end. On the floor of a 1:200 model, this corresponds to eye level at the same scale. At other heights, it shows vistas from windows, balconies, and other points.

Made by Optec Reactors, Ltd., of London, the unit is distributed in the U.S. by H. C. I. Sales Corp., NYC.

Figures 2.11 and 2.12 "Lilliputian's-Eye Viewer Puts You Inside Tiny Model," *Popular Science* 185, no. 2 (August 1964): p. 85.

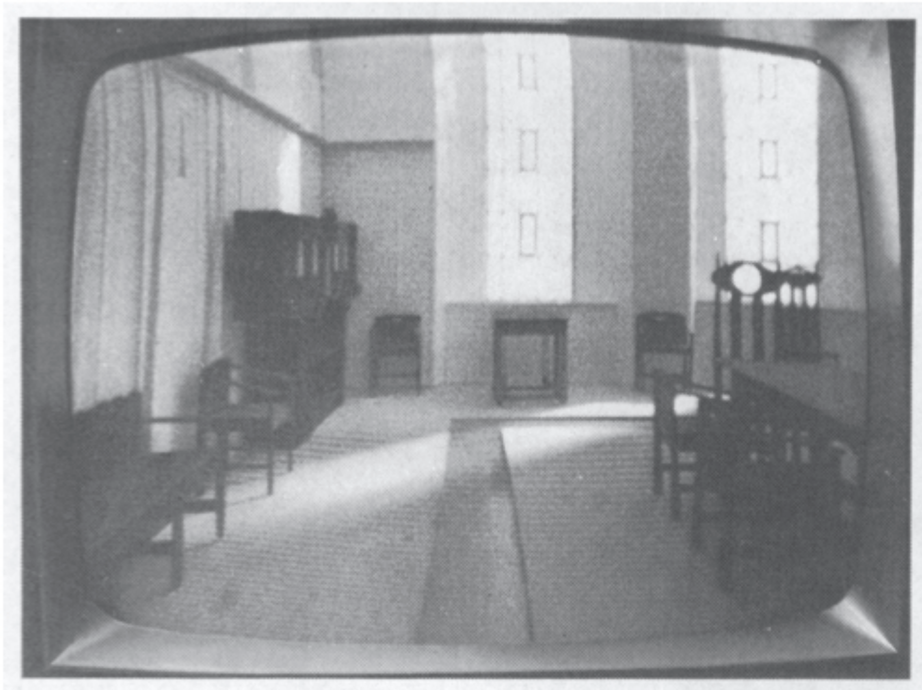
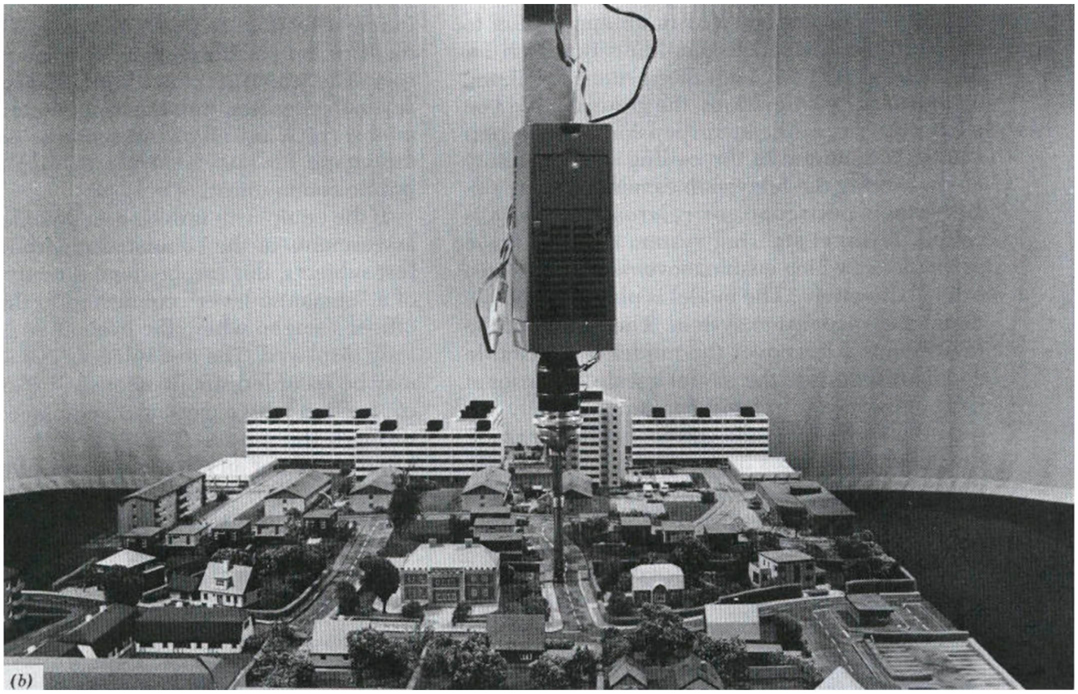
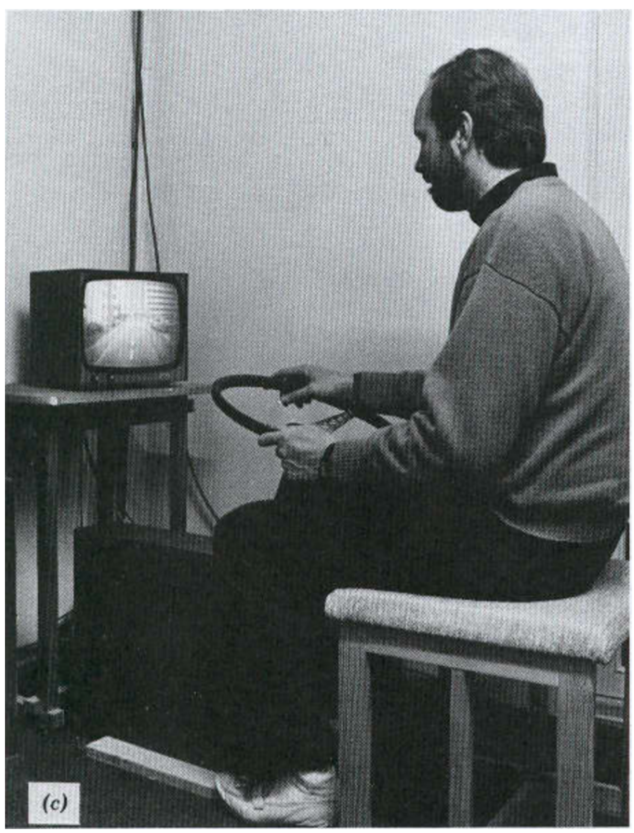


Figure 2.13 J.M. Anderson and T.E. Odling, "The Mackintosh Room 'interior' on television," ca. 1970. In J. M. Anderson, "A Television Aid to Design Presentation," *Architectural Research and Training* 1, no. 2 (November 1970): p. 23.





Figures 2.14 and 2.15 Unidentified photographers, Environmental simulator at Lund Institute of Technology, Sweden, ca. 1975. In Jan Janssens and Rikard Küller, "Utilizing an Environmental Simulation Laboratory in Sweden," in *Foundations for Visual Project Analysis*, ed. Richard C. Smardon, James F. Palmer, and John P. Felleman (New York: John Wiley & Sons, 1986): p. 268.

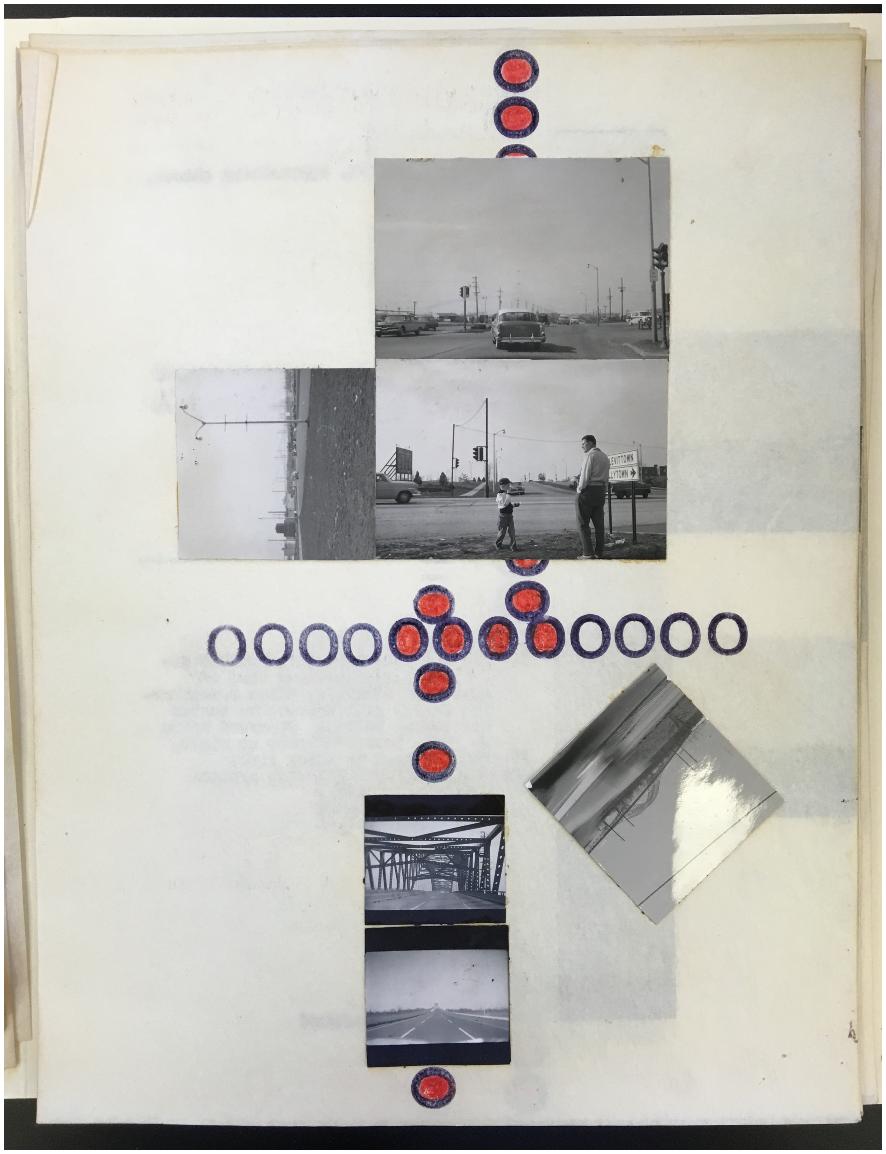


Figure 2.16 Donald Appleyard, Path Sequences in Levittown, New York. In Donald Appleyard, "Toward an Imageable Structure for Residential Areas" (Unpublished Master's Thesis, MIT, 1958), BANC MSS 83/165 c, Carton 11, Folder 11, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

Figure 2.17 Berkeley Environmental Simulation Laboratory, Validation studies comparing an automobile ride (above) to a simulated ride on film (below), ca. 1974. In Stephen Sheppard, *Visual Simulation* (New York: Van Nostrand Reinhold, 1989): n.p.

Schedule of Procedures

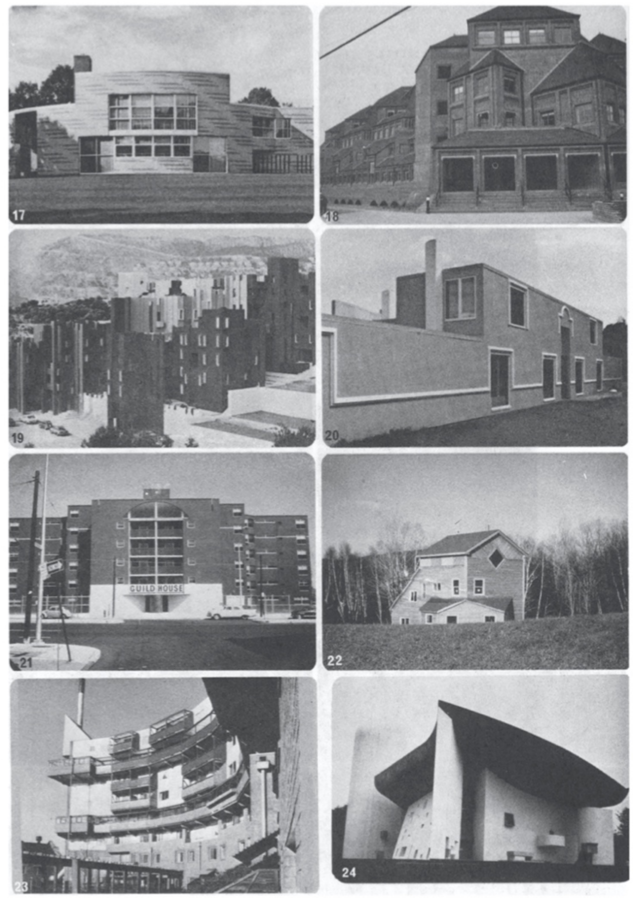
8:45	Continental Breakfast Welcome
9:00	Environmental Tour (direct-film-video; site-model)
9:40	Mood Checklist
9:55	Free Description of Tour List of Noteworthy Features List of Regions Map-sketch Route Configuration (string) Regional Q-Sort Deck Information Quizzes A and B
11:30	Coffee Break Recognition Test Environmental Inference and Description Environmental Evaluation Environmental Adjective Check List Landscape Adjective Check List Media Description Form
12:30	Lunch and Discussion (participants and staff) Film and Description of NSF Environmental Simulation Project
1:30	Personal and Environmental Background Form (including Living Room Check List) Familiarity with Tour Area Marin County Consequences Environmental Attitudes Survey Gottschaldt Figures Test Social Attitudes Test Barron-Welsh Art Scale Leisure Activities Blank Environmental Response Inventory Adjective Check List Visual Acuity Test (individually administered)
3:30- 4:30	Farewell

Figure 2.18 Environmental Simulation Laboratory, Schedule of Procedures for validation studies, 1972. In Nickolaus Reinholt Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements" (Ph.D. Dissertation, University of California, Berkeley, 1979): p. 86.

ENVIRONMENTAL ADJECTIVE CHECKLIST

1. abrupt
2. accessible
3. active
4. aesthetic
5. alive
6. amusing
7. angular
8. appealing
9. artificial
10. artistic
11. attractive
12. austere
13. awful
14. bad
15. barren
16. beautiful
17. big
18. black
19. bland
20. bleak
21. blue
22. boarded-up
23. boring
24. bright
25. brisk
26. broad
27. broken
28. brown
29. bumpy
30. busy
31. calm
32. changeable
33. chaotic
34. cheap
35. cheerful
36. classic
37. clean
38. clear
39. closed-in
40. cloudy
41. cluttered
42. cold
43. colorful
44. comfortable
45. commercial
46. commonplace
47. complex
48. confusing
49. congested
50. constructed
51. continuous
52. contrasting
53. convenient
54. cool
55. co-ordinated
56. cozy
57. crowded
58. curved
59. curving
60. dangerous
61. dark
62. dead
63. deep
64. delightful
65. dense
66. depressed
67. depressing
68. deserted
69. desolate
70. different
71. difficult
72. dignified
73. dirty
74. disgusting
75. dismal
76. disorganized
77. distant
78. distinctive
79. distracting
80. dominant
81. drab
82. dramatic
83. dry
84. dull
85. dynamic
86. easy
87. efficient
88. elegant
89. elevated
90. empty
91. engrossing
92. enormous
93. eroded
94. exciting
95. expansive
96. exposed
97. expressive
98. fair
99. familiar
100. fascinating
101. feminine
102. festive
103. filthy
104. finished
105. flat
106. flexible
107. flowery
108. flowing
109. forested
110. formal
111. free
112. fresh
113. friendly
114. funny
115. gentle
116. gloomy
117. golden
118. good
119. good-looking
120. graceful
121. grassy
122. gray
123. great
124. green
125. handsome
126. haphazard
127. happy
128. hard
129. harsh
130. hazy
131. hidden
132. hideous
133. high
134. high-rise
135. hilly
136. historic
137. horizontal
138. horrible
139. hot
140. huge
141. icy
142. impersonal
143. imposing
144. impressive
145. incomplete
146. incongruous
147. inconvenient
148. industrial
149. inefficient
150. informal
151. institutional
152. interesting
153. intriguing
154. inundated
155. inviting
156. isolated
157. large
158. lifeless
159. light
160. little
161. living
162. long
163. lonely
164. lovely
165. low
166. lush
167. maintained
168. majestic
169. marshy
170. masculine
171. messy
172. misty
173. modern
174. monotonous
175. monumental
176. mountainous
177. muddy
178. mysterious
179. narrow
180. natural
181. neat
182. new
183. nice
184. noisy
185. nondescript
186. obvious
187. odd
188. old
189. open
190. orange
191. orderly
192. ordinary
193. organized
194. ornate
195. overpowering
196. passive
197. paved
198. peaceful
199. placid
200. plain
201. planned
202. pleasant
203. poor
204. powerful
205. pretty
206. private
207. prosperous
208. public
209. pure
210. quaint
211. quiet
212. real
213. red
214. reflecting
215. refreshing
216. regular
217. relaxing
218. repetitive
219. residential
220. restful
221. rich
222. rocky
223. rolling
224. rough
225. round
226. rundown
227. rural
228. rusty
229. sad
230. safe
231. sandy
232. satisfying
233. scenic
234. secluded
235. separate
236. serene
237. shabby
238. shadowy
239. shiny
240. simple
241. sloping
242. small
243. smooth
244. soft
245. solid
246. spacious
247. square
248. stark
249. steep
250. still
251. stimulating
252. stormy
253. straight
254. strange
255. strong
256. suburban
257. sunny
258. symmetric
259. tall
260. tasteless
261. terrible
262. textured
263. threatening
264. tidy
265. tiny
266. tranquil
267. turquoise
268. typical
269. ugly
270. unattractive
271. uncluttered
272. uncomfortable
273. unfinished
274. unfriendly
275. unified
276. uniform
277. uninteresting
278. uninviting
279. unique
280. unplanned
281. unpleasant
282. unusual
283. urban
284. vacant
285. varied
286. vertical
287. visible
288. warm
289. watery
290. weak
291. well-built
292. well-known
293. well-maintained
294. wet
295. white
296. wide
297. wild
298. wonderful
299. wooded
300. yellow

Figure 2.19 Kenneth Craik, Environmental Adjective Checklist, 1972. In Nickolaus Reinholt Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements" (Ph.D. Dissertation, University of California, Berkeley, 1979): p. 142.

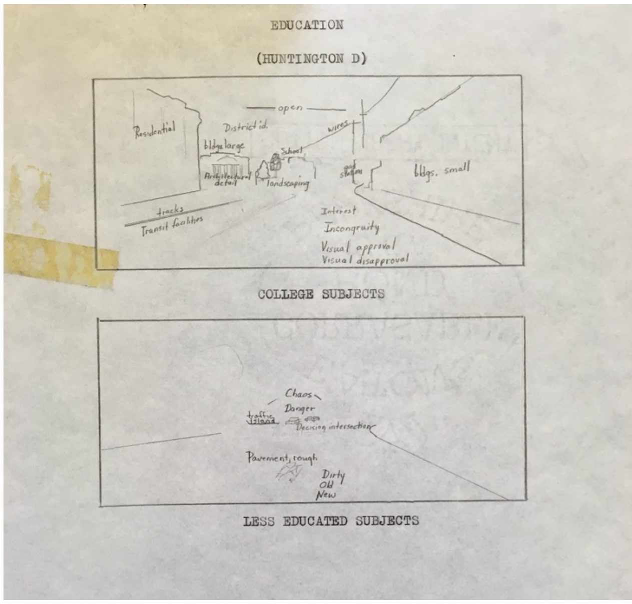


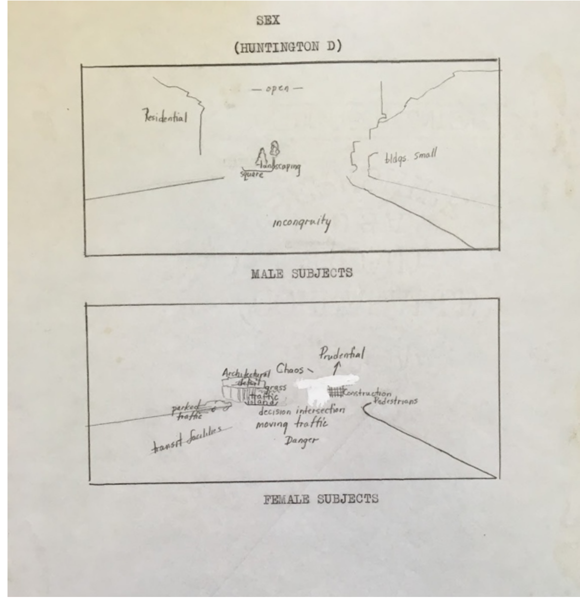
Figures 2.20 and 2.21 Linda Groat, "The Modern Set" and "The Post-Modern Set," ca. 1978. In Linda Groat, "Meaning in Post-Modern Architecture: An Examination Using the Multiple Sorting Task," *Journal of Environmental Psychology* 2 (1982): pp. 3–22.

REGIONAL Q-SORT DECK (Form III, June 1972)

1. Has spectacular views.
2. Has a different character in the daytime than at night.
3. Provides a sense of openness.
4. Has few parks and playgrounds.
5. Has notable smells and odors.
6. Has signs of heavy industry (for example, smokestacks, railroad tracks).
7. Has dense telephone and electrical wires overhead.
8. Shows evidence of water pollution (for example, oil slicks).
9. Shows evidence of air pollution (for example, smog).
10. Shows signs of neglect and deterioration.
11. Has poorly maintained roads and sidewalks.
12. Contains areas of undeveloped countryside and open land.
13. Has busy streets or highways.
14. Has many attention-getting commercial signs (for example, billboards, neon signs).
15. Has an active street life.
16. Has bars and night spots.
17. Has a street pattern which makes it difficult for people to find their way around.
18. Is a peaceful, quiet place.
19. Is primarily a residential area.
20. Is a dangerous place for children.
21. Is a dangerous place at night.
22. Has many neighborhood shopkeepers and tradesmen.
23. Contains within it several different and distinct places.
24. Has a rapid tempo of activities.
25. Has clearly separated areas (for example, commercial, residential, industrial).
26. Has cold, impersonal buildings.
27. Contains historical sites (for example, buildings, monuments).
28. Has grimy and soot-laden buildings.
29. Has stimulating sights, sounds, odors, etc.
30. Has weather conditions considered desirable by most people.
31. Possesses considerable natural beauty.
32. Has boundaries which are definite and obvious (for example, major roads, rivers, hills).
33. Is an expensive, well-to-do place.
34. Creates a gaudy, vulgar, or tasteless impression.
35. Displays signs of poor land-management (for example, erosion, poor location of buildings, scars).
36. Has people mostly of one social class.
37. Has people of diverse racial and ethnic origins.
38. Possesses high density housing (for example, apartments, townhouses).
39. Has high-rise buildings.
40. Has variations in land elevation.
41. Contains noteworthy bodies of water (for example, creeks, lakes, oceanfronts).
42. Has areas which appear to have been developed as single projects.
43. Has an abundance of mature vegetation.
44. Has office and commercial buildings whose grounds have been extensively landscaped.
45. Has residences well separated from each other.
46. Generates a vivid impression in the minds of visitors.
47. Shows evidence of community activities (for example, posters, banners, and meeting places).
48. Has a variety of recreational facilities (for example, swimming pools, basketball courts, golf courses, bowling alleys).
49. Provides a variety of cultural facilities and events (for example, concerts, fairs, museums, libraries).
50. Has countryside that provides many interesting places to explore.
51. Has many urban places to explore (for example, shops, restaurants).
52. Is fairly self-contained (that is, provides basic array of shopping, community and recreational facilities, etc.)
53. Is undergoing rapid change.
54. Has many unique and unusual people.
55. Has buildings which appear to have been individually designed and landscaped.
56. Has many public places (for example, schools, hospital, city hall, fire stations).
57. Exhibits a wide variety of architectural styles.
58. Has dramatic or unusually designed buildings.
59. Has buildings of varying ages.
60. Has residences which are well screened from streets (for example, by fences, plantings).
61. Has outdoor works of art (for example, fountains, murals, statues).
62. Undergoes marked seasonal changes.
63. Is characterized by curving or sinding streets.
64. Has public transportation facilities.
65. Has landmarks (for example, buildings, hilltops) visible from many points.
66. Conveys an atmosphere of history or bygone days.
67. Is a deserted, barren or gloomy place.

Figure 2.22 Kenneth Craik, Regional Q-Sort Deck, 1972. In Nickolaus Reinholt Feimer, "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements" (Ph.D. Dissertation, University of California, Berkeley, 1979): pp. 144–145.





Figures 2.23 and 2.24 Donald Appleyard, Street perception among different subject types, ca. 1970. in "Traveller Response to the Urban Highway Environment," Computed Data from BART Studies, BANC MSS 83/165 c, Carton 8, Folder 26, Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

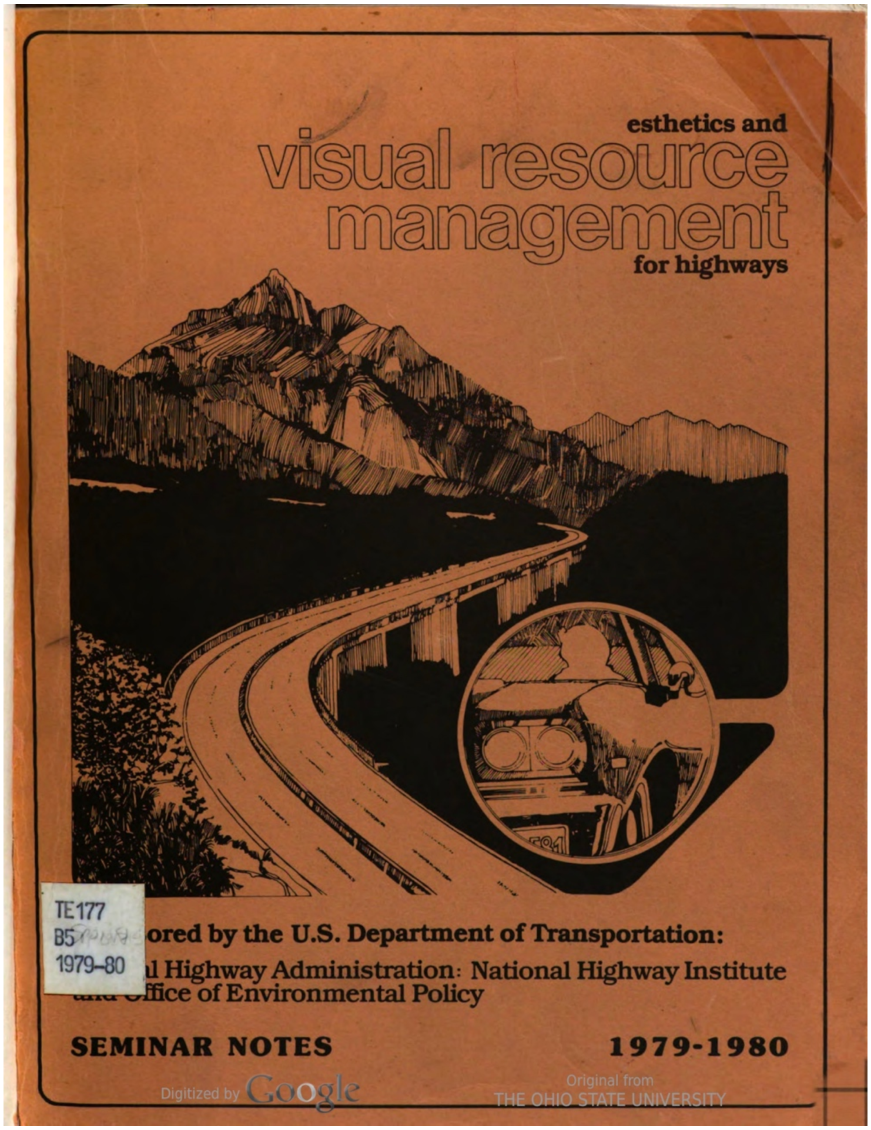


Figure 2.25 William G.E. Blair, Peter Harvard, and Jones & Jones, *Esthetics and Visual Resource Management for Highways: Seminar Notes, 1979–1980* (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1979).

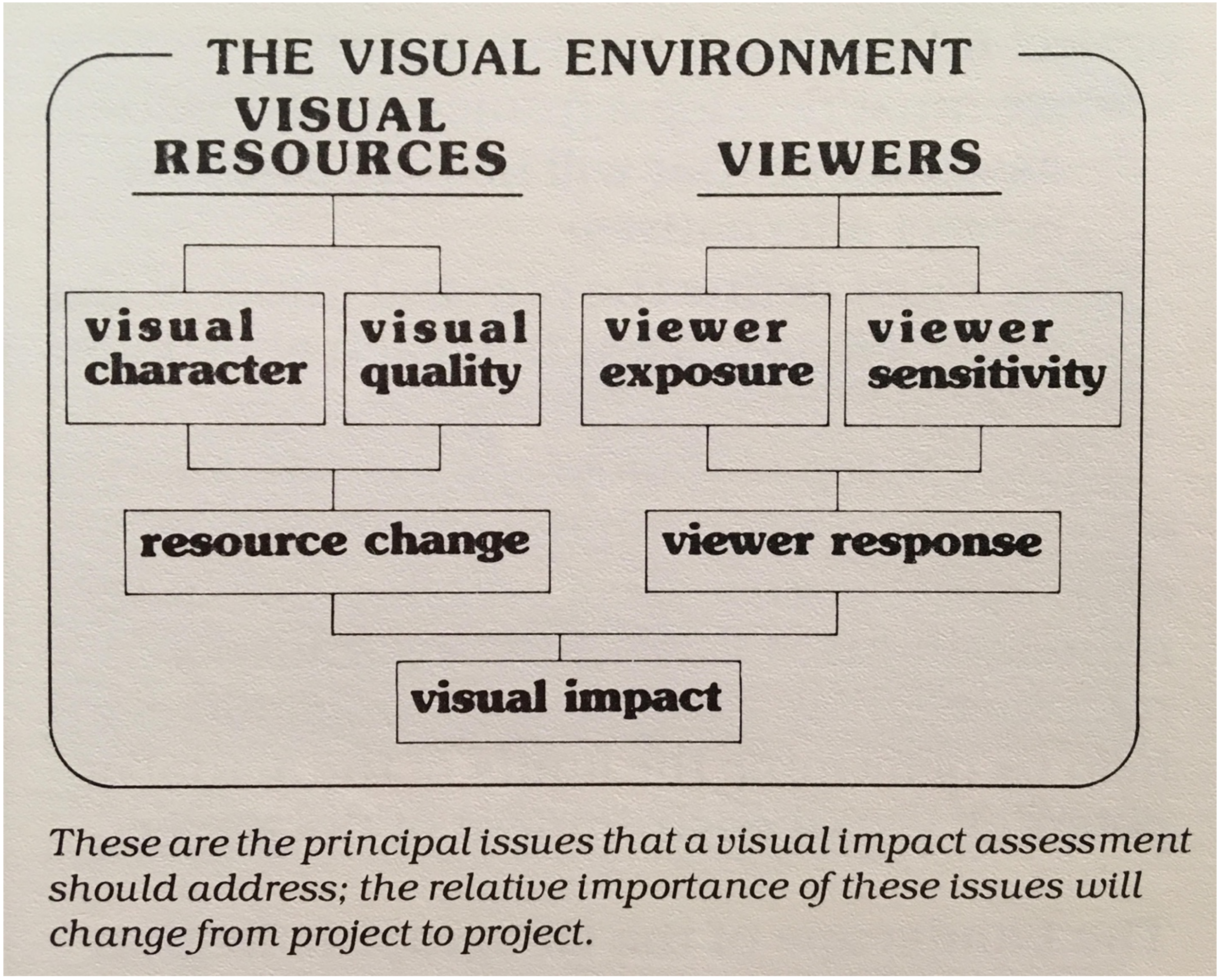


Figure 2.26 The Visual Environment. In Jones & Jones, *Visual Impact Assessment for Highway Projects*, ed. American Society of Landscape Architects and Federal Highway Administration (Washington, D.C.: Federal Highway Administration, 1981): p. 6.

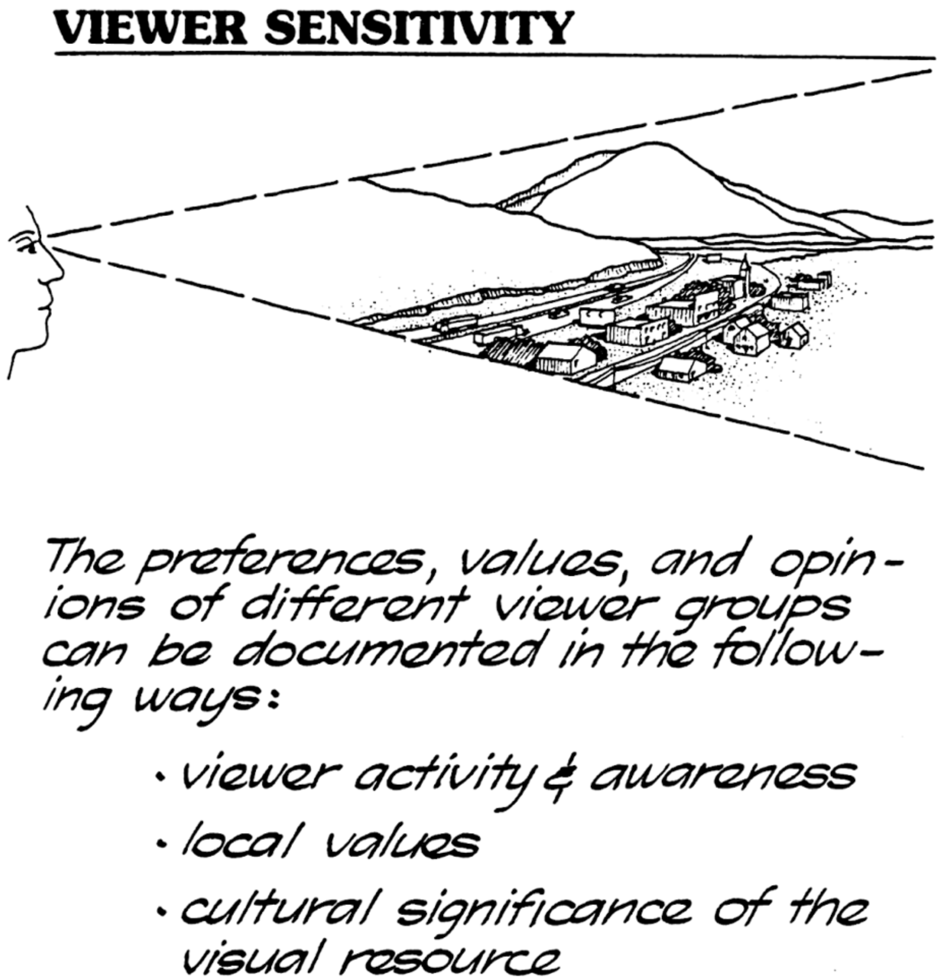


Figure 2.27 Viewer Sensitivity. In William G.E. Blair, Peter Harvard, and Jones & Jones, *Esthetics and Visual Resource Management for Highways: Seminar Notes, 1979–1980* (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1979): p. 33.

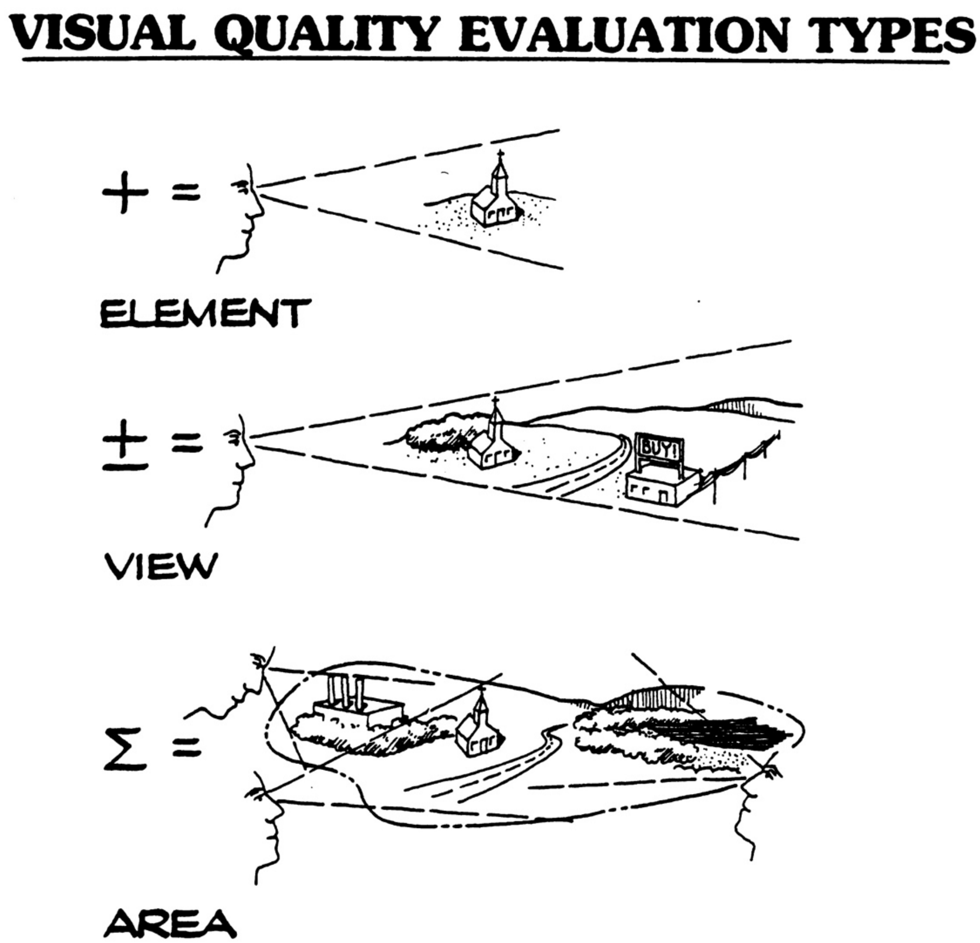


Figure 2.28 Visual Quality Evaluation Types. In William G.E. Blair, Peter Harvard, and Jones & Jones, *Esthetics and Visual Resource Management for Highways: Seminar Notes, 1979–1980* (Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1979): p. 79.

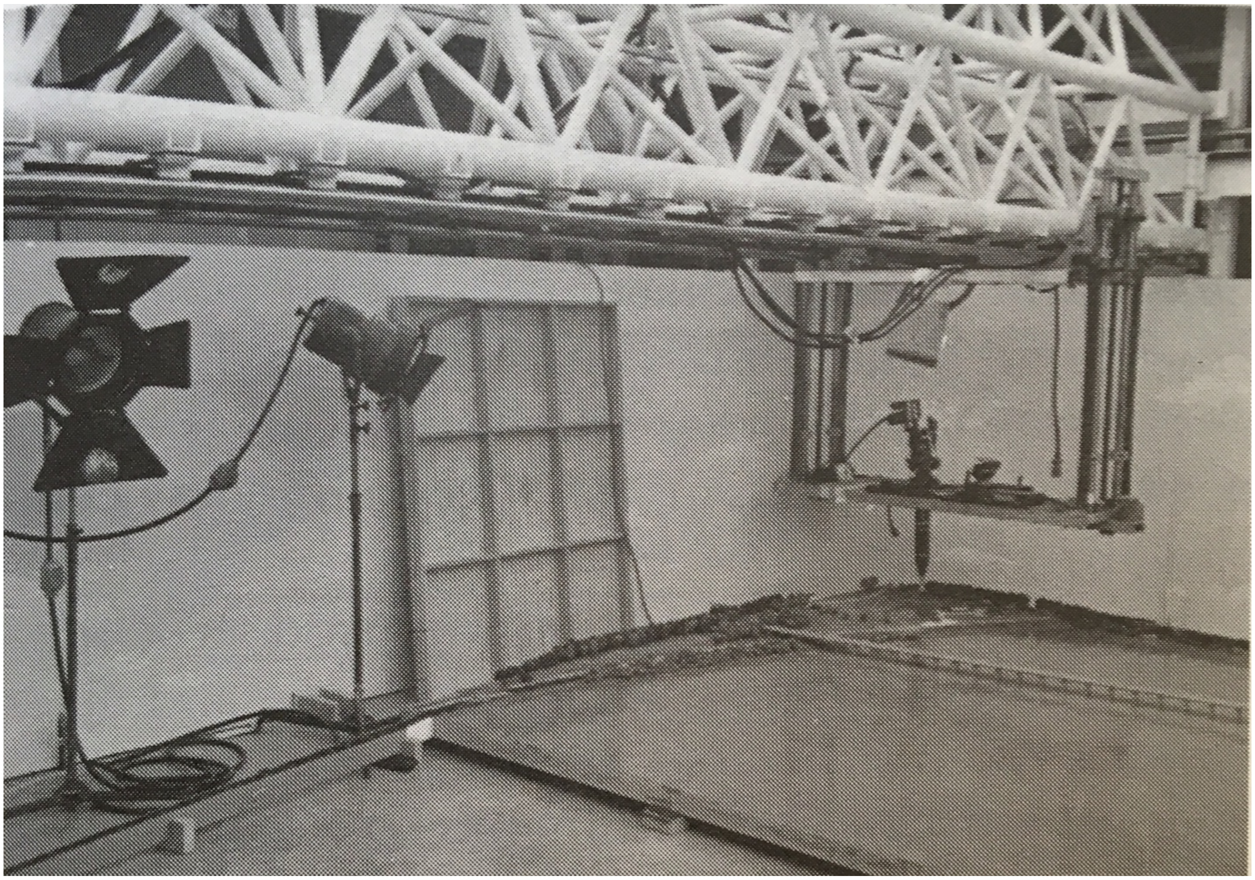


Figure 2.29 Environmental Simulation Laboratory Photographic Setup for Eyelevel View of Options 2 and 3 from Water Treatment Plant. In Jones and Jones, *I-220: Cross Lake Visual Impact Assessment Final Report* (September 1983): p. 25.

PART I

A2-3

SCENE 1

Personal Preference

like very much	like	no preference	dislike	dislike very much
☐	☐	☐	☐	☐

Natural Beauty

low natural beauty	moderately low natural beauty	moderate natural beauty	moderately high natural beauty	high natural beauty
☐	☐	☐	☐	☐

SCENE 2

Personal Preference

like very much	like	no preference	dislike	dislike very much
☐	☐	☐	☐	☐

Natural Beauty

low natural beauty	moderately low natural beauty	moderate natural beauty	moderately high natural beauty	high natural beauty
☐	☐	☐	☐	☐

SCENE 3

Personal Preference

like very much	like	no preference	dislike	dislike very much
☐	☐	☐	☐	☐

Natural Beauty

low natural beauty	moderately low natural beauty	moderate natural beauty	moderately high natural beauty	high natural beauty
☐	☐	☐	☐	☐

PART II

A2-11

SCENE (PAIR) 22

Degree of Change

no change	a little change	moderate change	quite a bit of change	a great deal of change
☐	☐	☐	☐	☐

Kind of Change

very positive change	positive change	neutral	negative change	very negative change
☐	☐	☐	☐	☐

Visual Intrusion

very out of place	out of place	neutral	appropriate	very appropriate
☐	☐	☐	☐	☐

Personal Importance

no importance	a little importance	moderate importance	quite a bit of importance	a great deal of importance
☐	☐	☐	☐	☐

SCENE (PAIR) 23

Degree of Change

no change	a little change	moderate change	quite a bit of change	a great deal of change
☐	☐	☐	☐	☐

Kind of Change

very positive change	positive change	neutral	negative change	very negative change
☐	☐	☐	☐	☐

Visual Intrusion

very out of place	out of place	neutral	appropriate	very appropriate
☐	☐	☐	☐	☐

Personal Importance

no importance	a little importance	moderate importance	quite a bit of importance	a great deal of importance
☐	☐	☐	☐	☐

Figures 2.30 and 2.31 Response Survey Instrument distributed to sample viewing film simulations of proposed Cross Lake bridge. In Jones and Jones, *I-220: Cross Lake Visual Impact Assessment Final Report* (September 1983): pp. A2-3, A2-11.

PART III

SCENE **43**

A2-23

Appreciation of Cross Lake area

increase appreciation very much	increase appreciation	neutral	decrease appreciation	decrease appreciation very much
☐	☐	☐	☐	☐

Personal Importance

no importance	a little importance	moderate importance	quite a bit of importance	a great deal of importance
☐	☐	☐	☐	☐

A2-25

Presentation. Given your knowledge of the area and the three I-220 options, please tell us how fair you think the presentation of each option has been. Please check the box below the words that match your answer most closely for each option.

Option 1

very unfairly in favor of Option 1	unfairly in favor of Option 1	fair	unfairly against Option 1	very unfairly against Option 1
☐	☐	☐	☐	☐

Option 2

very unfairly in favor of Option 2	unfairly in favor of Option 2	fair	unfairly against Option 2	very unfairly against Option 2
☐	☐	☐	☐	☐

Option 3

very unfairly in favor of Option 3	unfairly in favor of Option 3	fair	unfairly against Option 3	very unfairly against Option 3
☐	☐	☐	☐	☐

Figures 2.32 and 2.33 Response Survey Instrument distributed to sample viewing film simulations of proposed Cross Lake bridge. In Jones and Jones, *I-220: Cross Lake Visual Impact Assessment Final Report* (September 1983): pp. A2-23, A2-25.

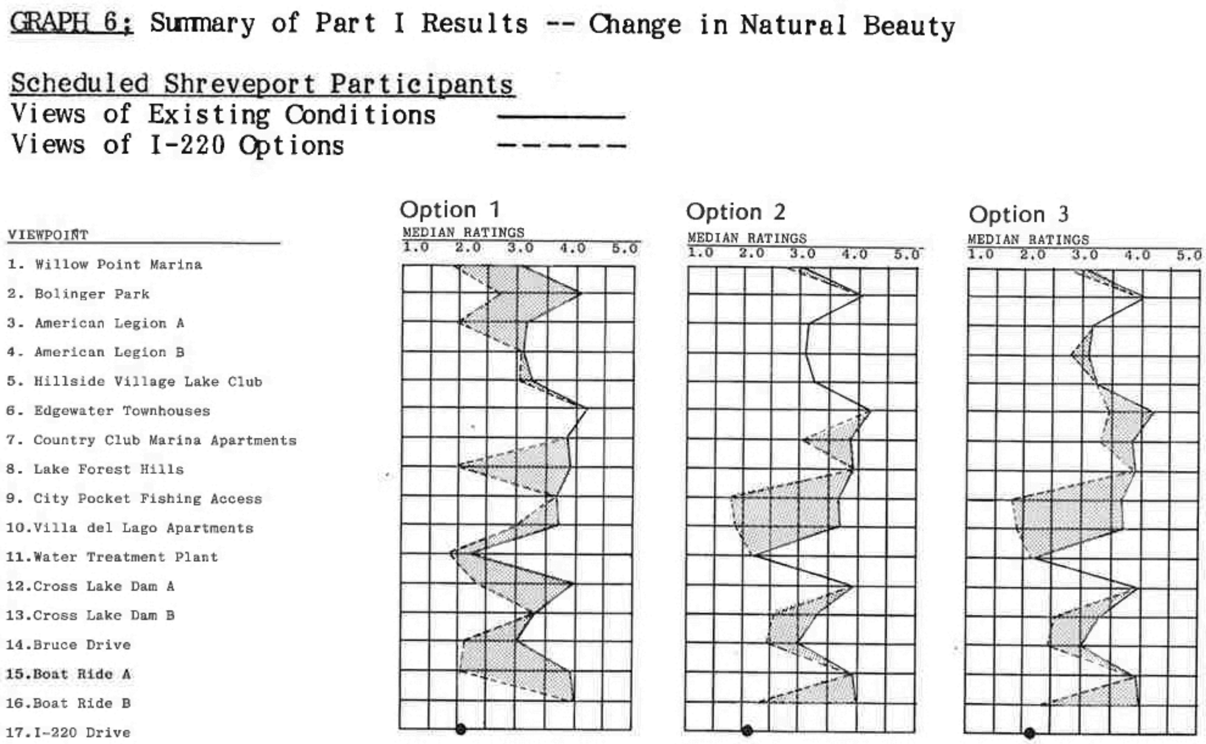
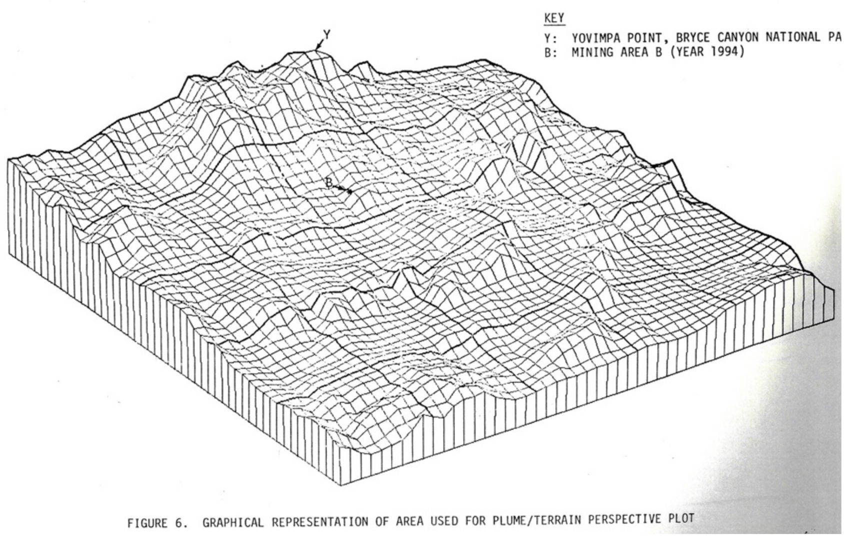
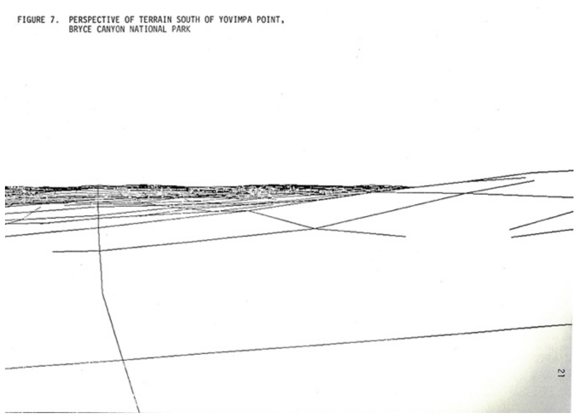
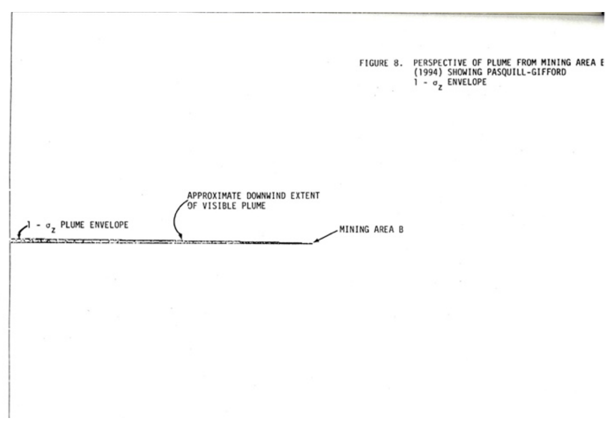


Figure 2.34 Change In Natural Beauty as measured from sample viewing film simulations of proposed Cross Lake bridge. In Jones and Jones, *I-220: Cross Lake Visual Impact Assessment Final Report* (September 1983): p. 52.







Figures 3.1, 3.2, and 3.3 Systems Applications, Inc., Digital Terrain Model for Yovimpa Point in Bryce Canyon National Park and Adjacent Areas (top); PLUVUE Visualizations for View from Yovimpa Point (left) and for Plume Associated with Surface Mining (right), to be laid atop one another. In Douglas A. Latimer, Stanley R. Hayes, and Clark D. Johnson, "Visual Impacts of Particulate Emissions From the Proposed Alton Coal Project," Prepared for U.S. Environmental Protection Agency, Region VIII, Air Programs Branch (San Rafael, CA: Systems Applications, Incorporated, September 23, 1980): p. 20–22.

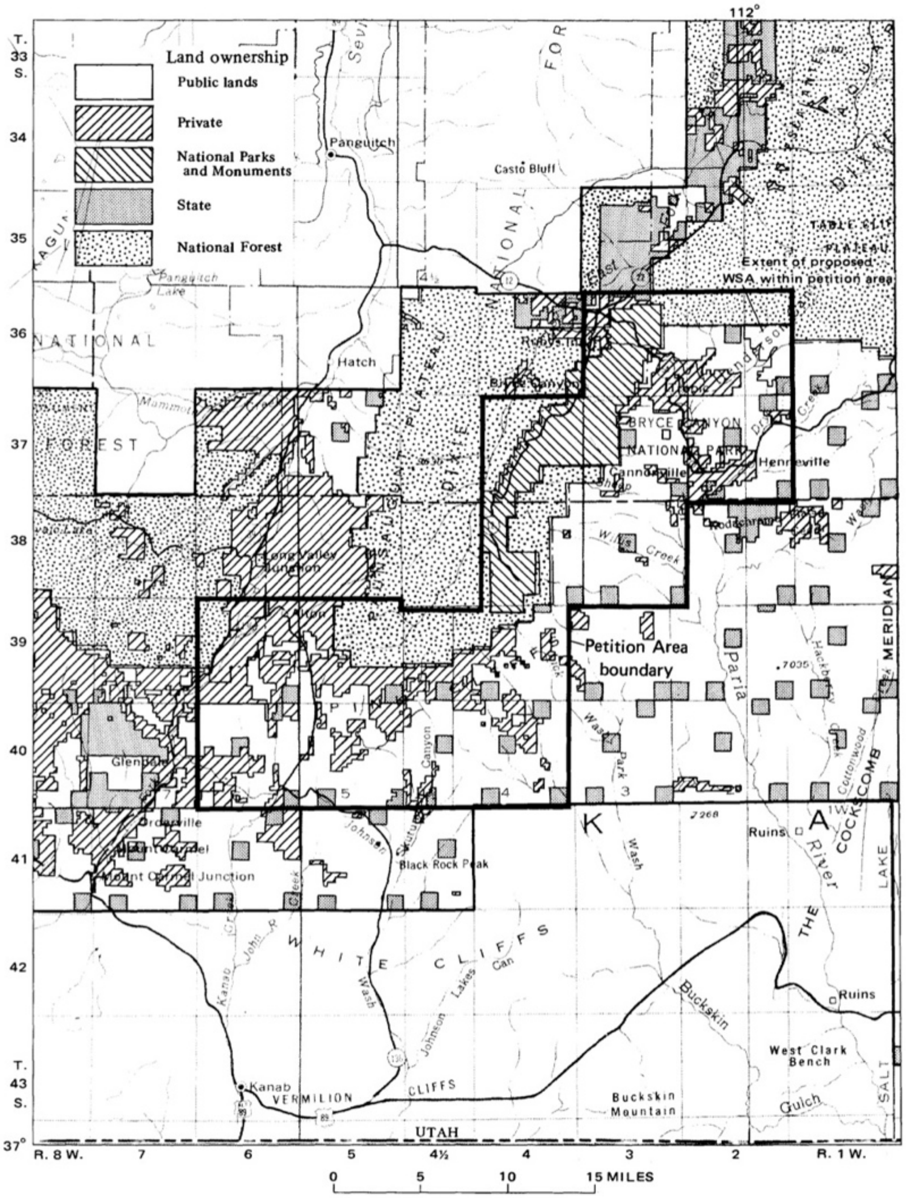


Figure 3.4 Map of the Southern Utah Petition Area Showing Land Surface Ownership. In U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4* (Washington, D.C.: U.S. Department of the Interior, 1980): p. II-12a.

Figure 3.5 Navajo Mountain from Bryce Canyon, 1978. In U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, *Protecting Visibility: An EPA Report to Congress* (Washington, D.C.: U.S. Environmental Protection Agency, 1979): p. 37.

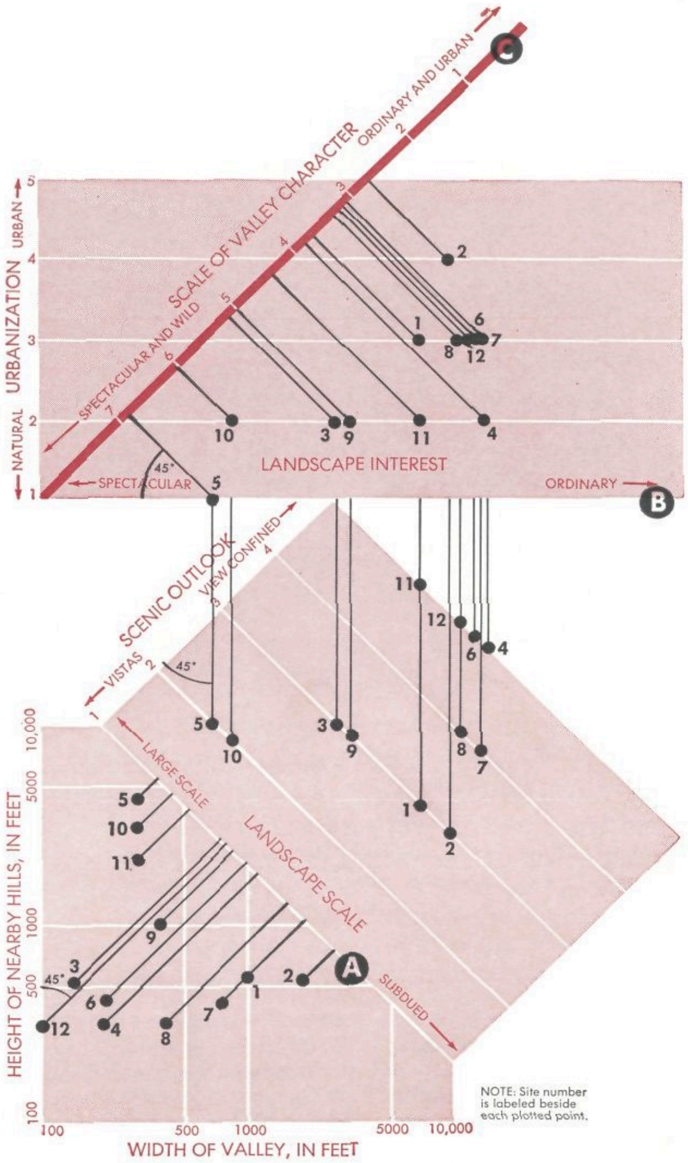


Figure 3.6 Analysis of Valley Character for Hells Canyon, Idaho. In Luna Leopold, "Landscape Esthetics: How to Quantify the Scenics of A River Valley," *Natural History*, October 1969: p. 42.

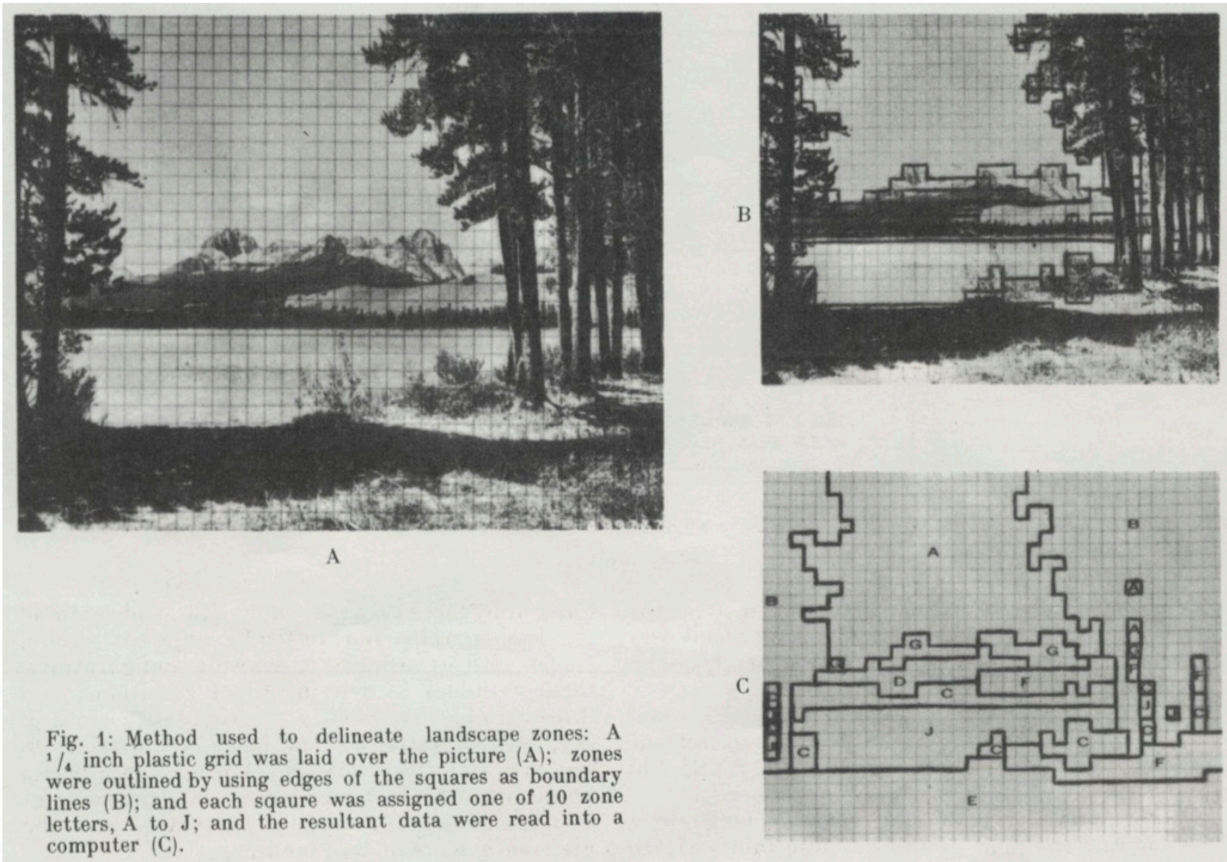


Fig. 1: Method used to delineate landscape zones: A 1/4 inch plastic grid was laid over the picture (A); zones were outlined by using edges of the squares as boundary lines (B); and each sqaure was assigned one of 10 zone letters, A to J; and the resultant data were read into a computer (C).

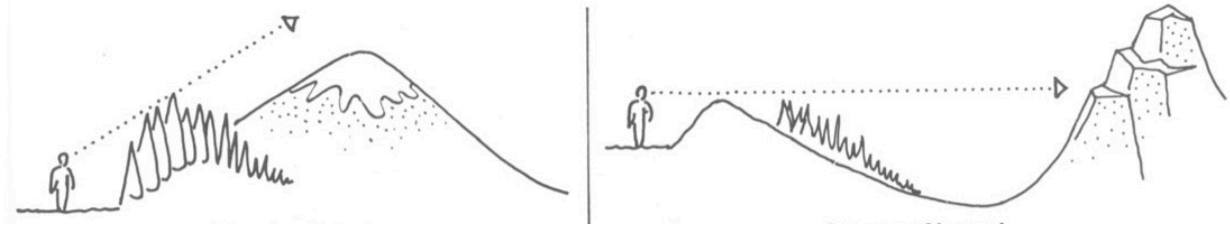
Figure 3.7 Method Used to Delineate Landscape Zones. In Elwood L. Shafer, John F. Hamilton, and Elizabeth A. Schmidt, "Natural Landscape Preferences: A Predictive Model," *Ekistics* 29, no. 173 (1970): p. 279.

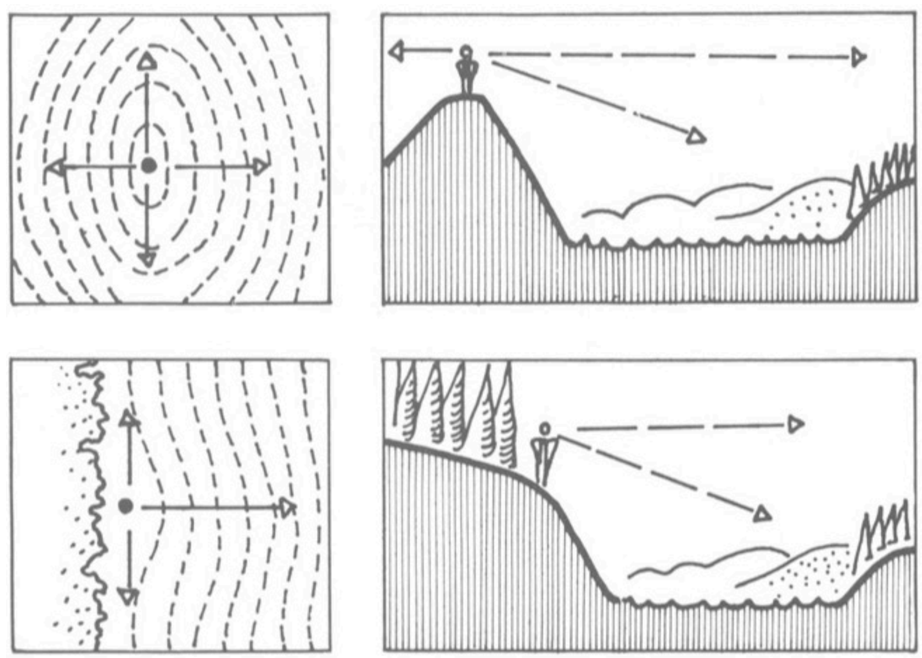
$$
\begin{aligned}
Y = {} & 184.8 - .5436\,X_1 - .09298\,X_2 + .002069\,(X_1 \,.\, X_3) \\
& + .0005538\,(X_1 \,.\, X_4) - .002596\,(X_3 \,.\, X_5) + .001634 \\
& (X_2 \,.\, X_6) - .008441\,(X_4 \,.\, X_6) - .0004131 \\
& (X_4 \,.\, X_5) + .0006666\,X_1^2 + .0001327\,X_5^2
\end{aligned}
$$

where:

X_1 = perimeter of the immediate tree-and-shrub zone.
X_2 = perimeter of intermediate other-features zone.
X_3 = perimeter of distant tree-and-shrub zone.
X_4 = area of intermediate tree-and-shrub zone.
X_5 = area of water zone.
X_6 = area of distant other-features zone.
The lower the Y value, the more preferred the landscape.

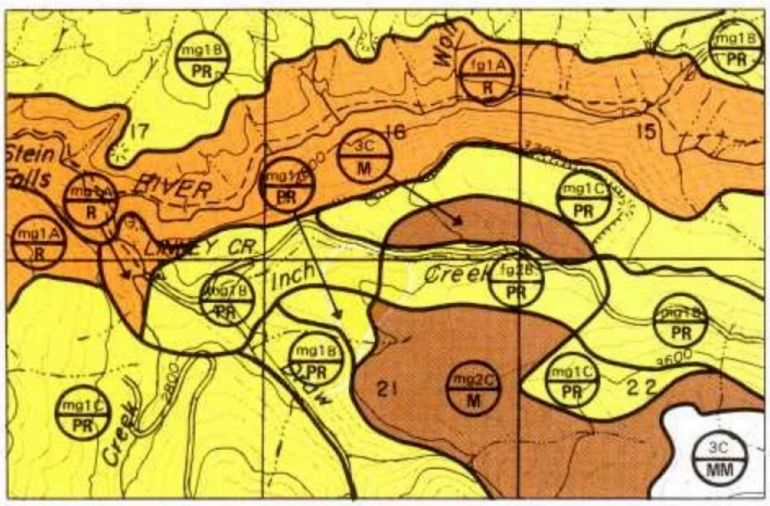
Figure 3.8 Landscape Preference Model. In Elwood L. Shafer and James Mietz, *It Seems Possible to Quantify Scenic Beauty in Photographs*, Forest Service Research Paper, NE-162 (Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, 1970): p. 2.





Figures 3.9 and 3.10 Observer Position Diagrams for Observer Inferior, Observer Normal, and Observer Superior. In R. Burton Litton, *Forest Landscape Description and Inventories - A Basis for Land Planning and Design*, Res. Paper PSW-RP-049 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1968): pp. 7, 9.

		Sensitivity Level						
		fg1	mg1	bg1	fg2	mg2	bg2	3
Variety Class	class A	R	R	R	PR	PR	PR	PR
	class B	R	PR	PR	PR	M	M	M / MM
	class C	PR	PR	M	M	M	MM	MM



Objective Map

Symbol	Objective	Color Code
R	RETENTION	
PR	PARTIAL RETENTION	
M	MODIFICATION	
MM	MAXIMUM MODIFICATION	

Preservation does not appear on the chart but is indicated by:

P	PRESERVATION	

Figure 3.11 U.S. Forest Service Visual Quality Objectives Decision Matrix and Map. In U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 1: The Visual Management System*, Agriculture Handbook 462 (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1974): p. 43.

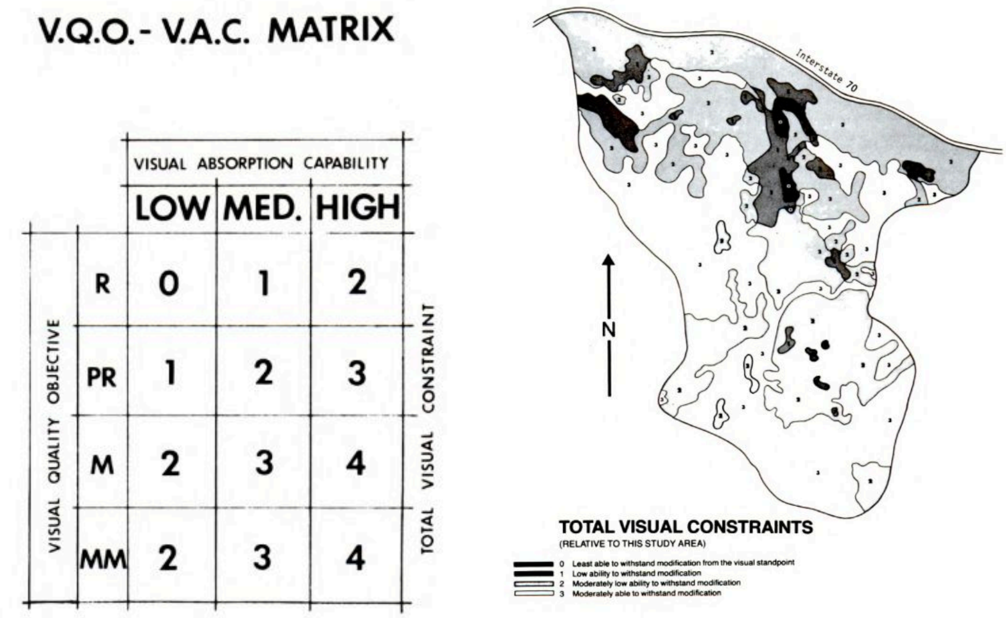
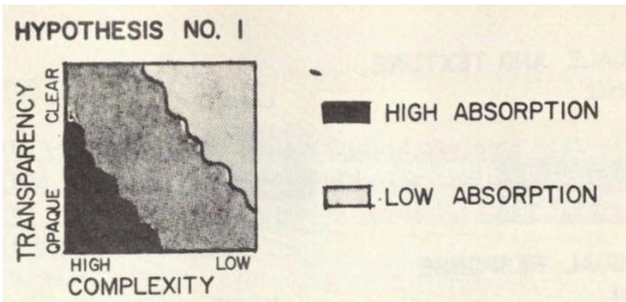
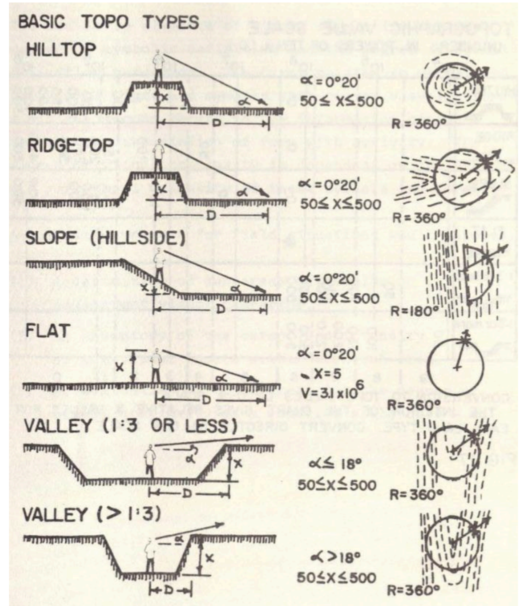


Figure 3.12 U.S. Forest Service Visual Quality Objectives and Visual Absorption Capability Decision Matrix and Map. In U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 7: Ski Areas*, Agriculture Handbook 617 (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1984): p. 18.





Figures 3.13 and 3.14 Visual Absorption as a Function of Transparency and Complexity (left), and Basic Topographic Types (right). In Peter Jacobs and Douglas Way, *Visual Analysis of Landscape Development* (Cambridge, MA: Harvard University, Graduate School of Design, Department of Landscape Architecture, 1968): p. 3, A-3.

Figure 3.15 SYMAP Map of Visual Absorption for Boston Region, Southwest Sector. In Peter Jacobs and Douglas Way, *Visual Analysis of Landscape Development* (Cambridge, MA: Harvard University, Graduate School of Design, Department of Landscape Architecture, 1968): p. 37.

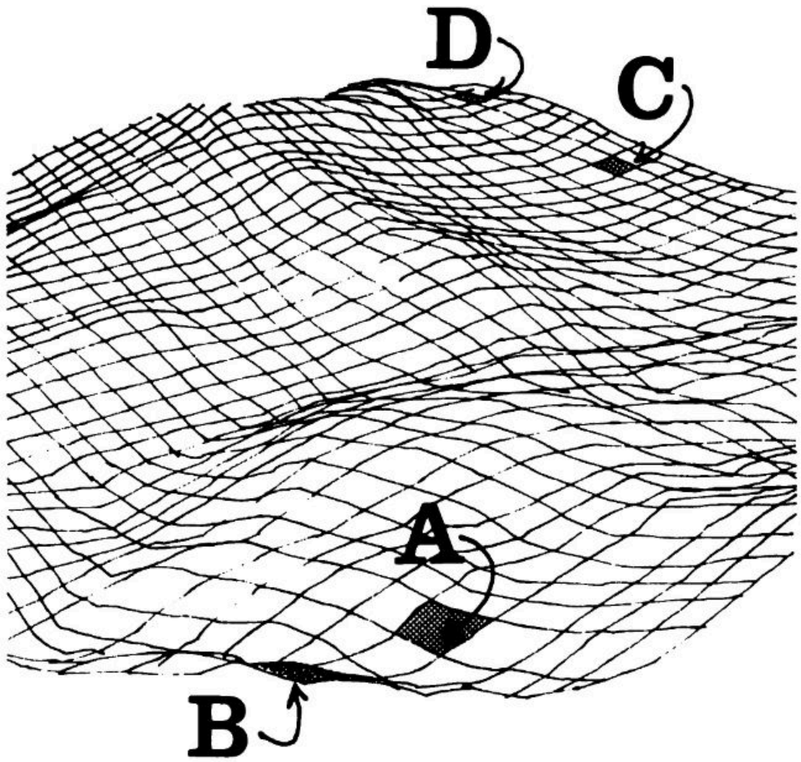


Figure 3.16 Visual Absorption Capability as a Function of Visual Magnitude, with Cell C considered to have lower absorption capability than B. In U.S. Department of Agriculture, Forest Service, *National Forest Landscape Management, Vol. 2, Ch. 5: Timber*, Agriculture Handbook 559 (Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1977): p. 59.

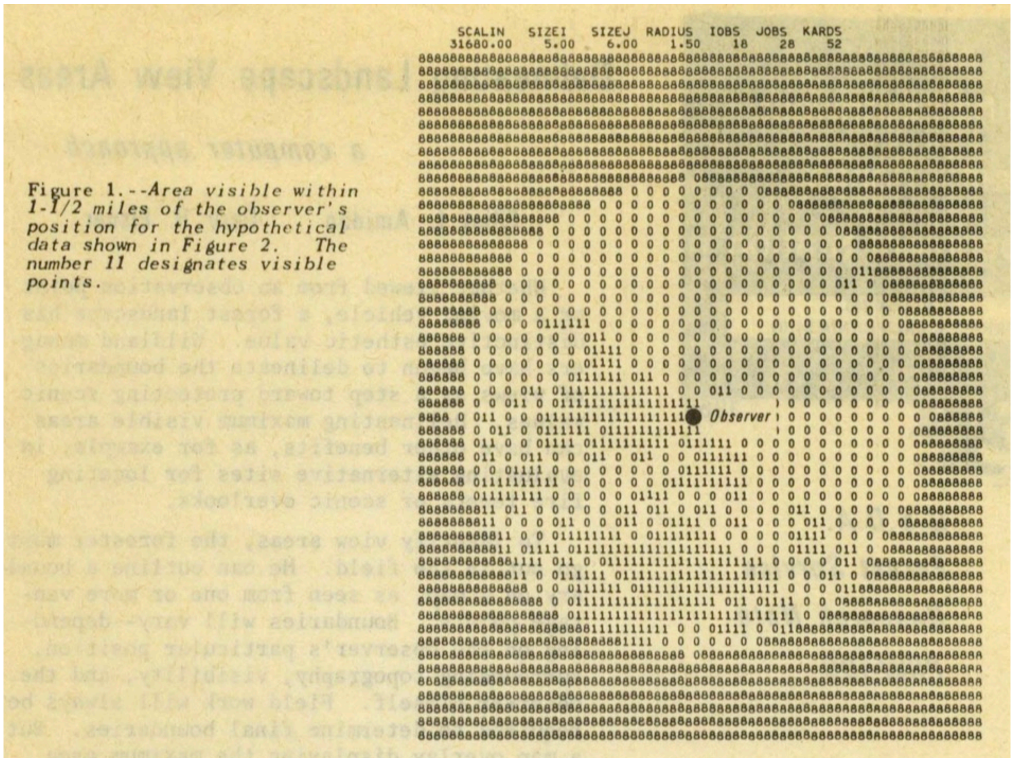


Figure 3.17 VIEWIT Map, ca. 1968. In Elliot L. Amidon and Gary H. Elsner, *Delineating Landscape View Areas… A Computer Approach*, Research Note PSW-RN-180 (Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, 1968): p. 2.

Figure 3—*Area visible within 6 miles from Harney Peak, shown in this map overlay, totaled 24,054 observer positions or 73,627 acres.*

Figure 3.18 VIEWIT Map for Harney Peak, ca. 1971. In Gary H. Elsner, *Computing Visible Areas from Proposed Recreation Developments… A Case Study*, Research Note PSW-RN-246 (Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, 1971): p. 6.

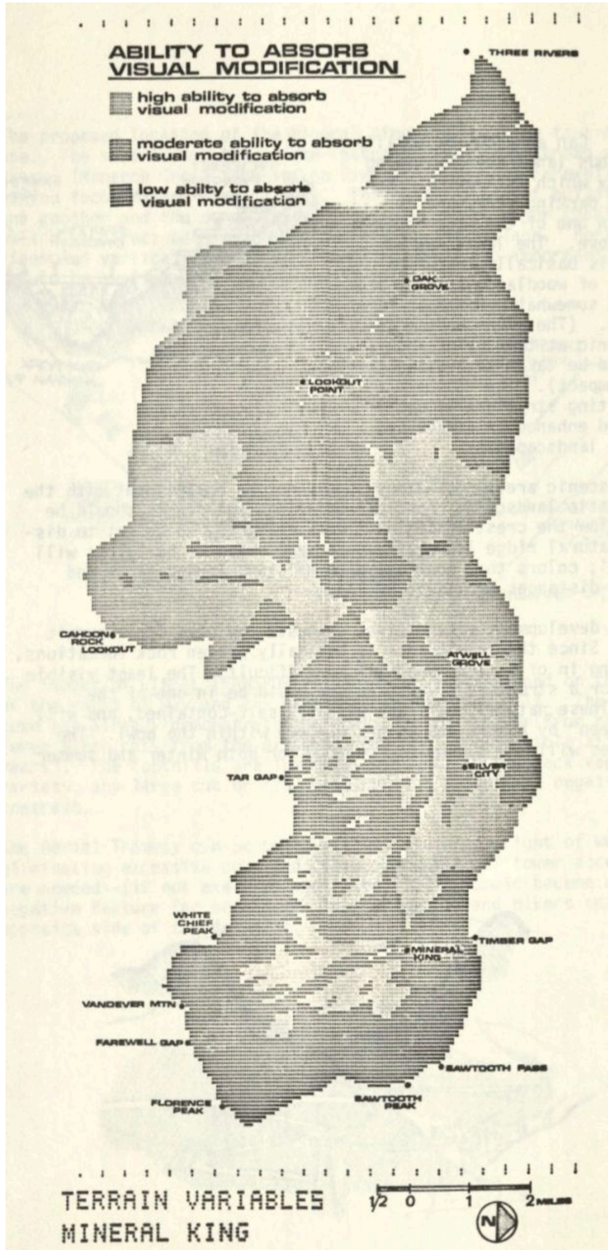


Figure 3.19 VIEWIT Map of Ability to Absorb Visual Modification for Mineral King Ski Resort. In Christine G. Johnson, *Mineral King Visual Analysis* (San Francisco, CA: U.S. Department of Agriculture, Forest Service, 1974): p. 23.

Figure 1.—Looking west toward Boulder Creek and Boulder sale area from a point 7 miles west-northwest of the summit of Mount Adams, Mount Adams Ranger District, Gifford Pinchot National Forest, Oregon.

Figure 2.—Distorted-square representation of view toward Boulder Creek, Gifford Pinchot National Forest, as drawn by PREVIEW with 100-foot spacing between elevation data points. Original drawing is 27 inches long.

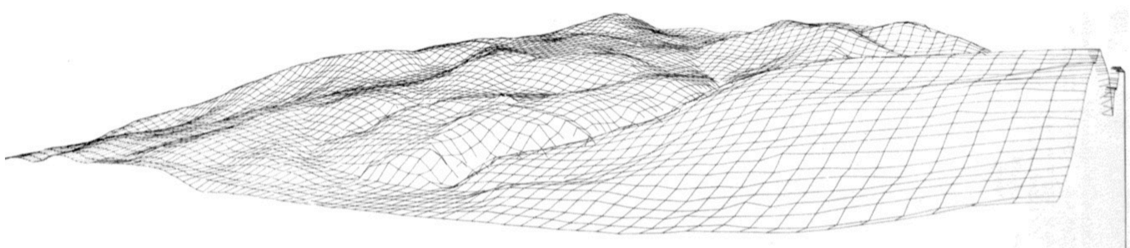


Figure 3.—Vegetation and surface-type representation of view toward Boulder Creek, Gifford Pinchot National Forest, as drawn by PREVIEW. Scale is 100 feet between data points. Road system was drawn by PREVIEW as a separate overlay but has been superimposed here. The symbols that are convex upward represent lava flows.

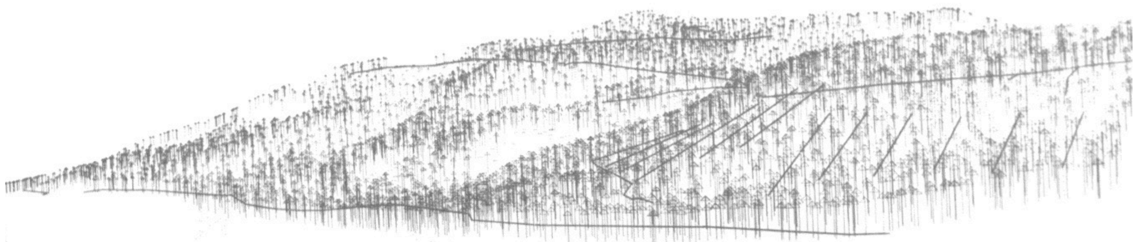


Figure 3.20 Photograph and PREVIEW Visualizations for Gifford Pinchot National Forest. In Erik Myklestad and J. Alan Wagar, *PREVIEW: Computer Assistance for Visual Management of Forested Landscapes*, USDA Forest Service Research Paper NE-555 (Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, 1976): pp. 2–3.

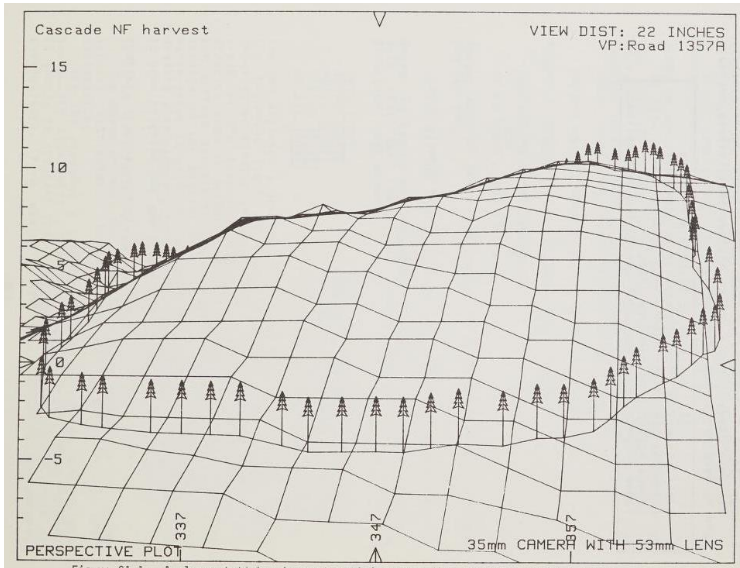


Figure C1-1. A clearcut timber harvest activity extending over the top of a ridge.

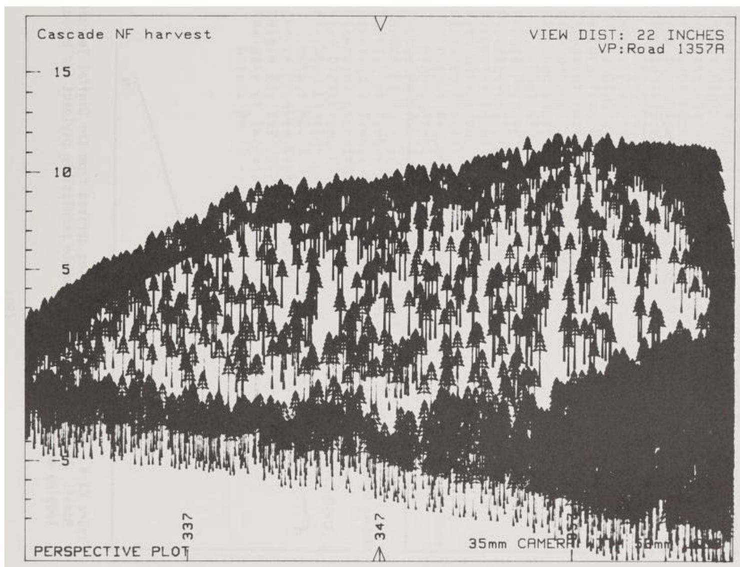


Figure C1-3. A partialcut (shelterwood) alternative to the clearcut activity. Forty-foot-wide skyline harvest corridors are shown, radiating from a ridge-top landing.

Figures 3.21 and 3.22 Perspective Plot Visualizations for Cascade National Forest. In Devon B. Nickerson, *Perspective Plot: An Interactive Analytical Technique for the Visual Modelling of Land Management Activities* (Portland, OR: U.S. Department of Agriculture, Forest Service, Division of Timber Management, 1980): pp. 94, 97.

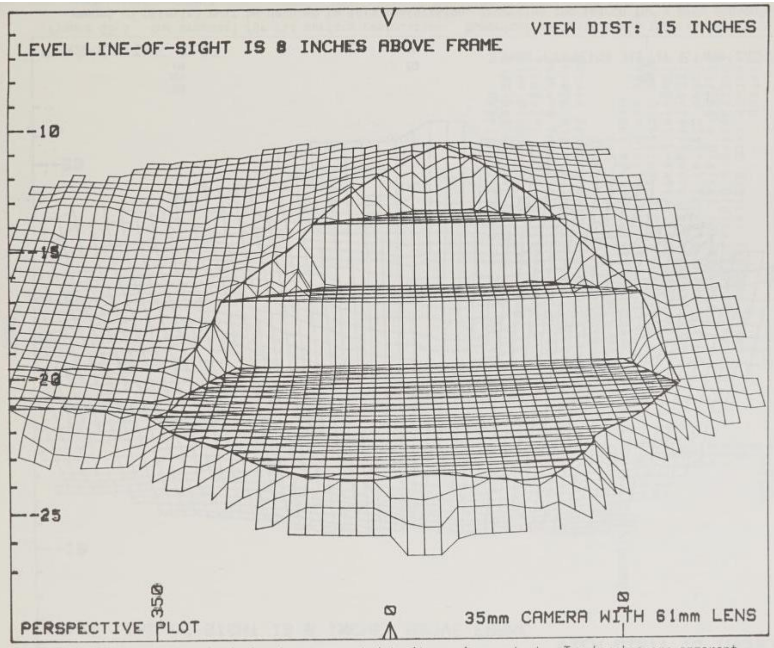


Figure C7-2. The rock pit has been excavated to its maximum extent. Two benches are apparent, above the main pit floor.

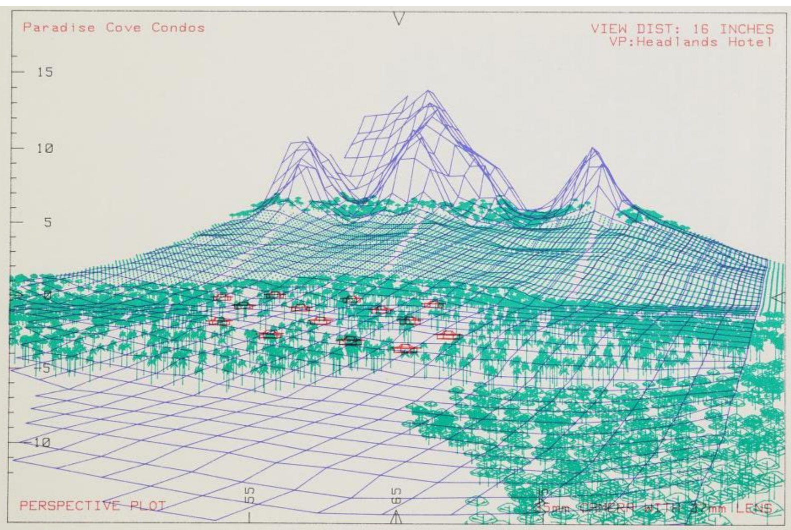


Figure C9-1. This perspective simulation shows the mixture of tropical hardwoods, coconut palms, pineapple plantation, and landforms visible from the Headland House Hotel in Paradise Cove, Hawaii. The condominium structures -- seen in red -- are centered in the landward vista, but fairly well screened by undisturbed foliage, and not of disproportionately large scale.

Figures 3.23 and 3.24 Perspective Plot Visualizations Applied to Mining and Recreation Development. In Devon B. Nickerson, *Perspective Plot: An Interactive Analytical Technique for the Visual Modelling of Land Management Activities* (Portland, OR: U.S. Department of Agriculture, Forest Service, Division of Timber Management, 1980): pp. 127, 134.

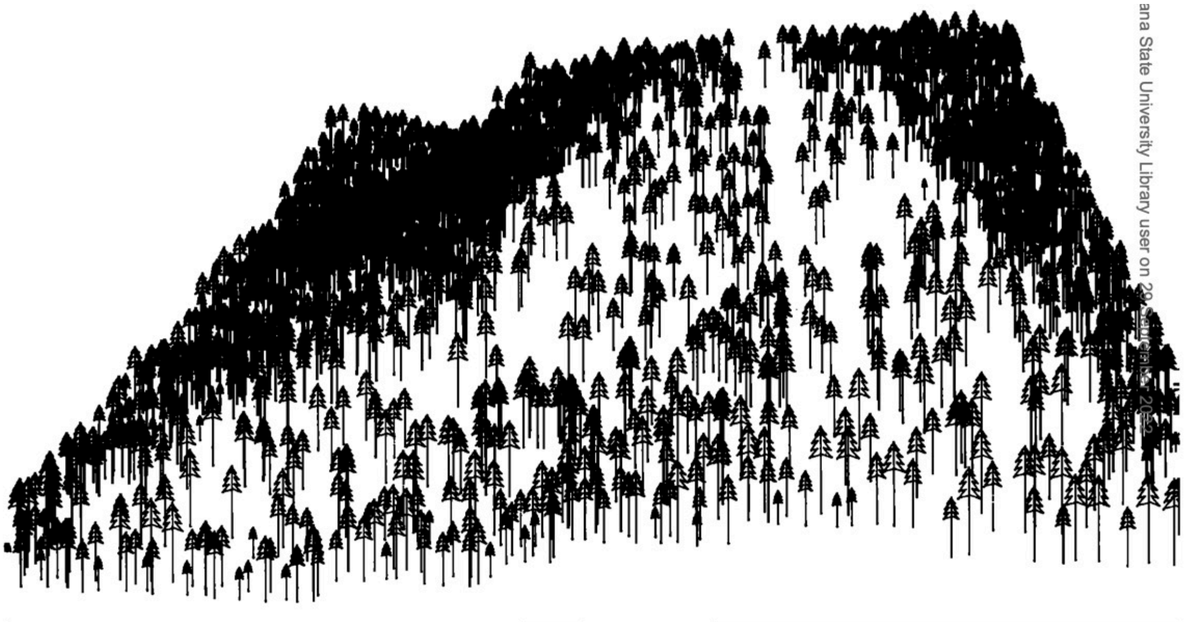


Figure 5. Perspective depiction by SCOPE of the partially cut timber stand in figure 1. One skyline corridor is quite apparent, while the other is indistinct. Note the textural change at the boundaries of the partially cut stand.

Figure 3.25 SCOPE Visualization of Partially Cut Timber Stand. In Devon B. Nickerson, "SIGHTLINE, PERSPECTIVE PLOT, SCOPE: Three Desktop Computer Programs for Forest Landscape Design," *Journal of Forestry* 77, no. 1 (January 1, 1979): p. 16.

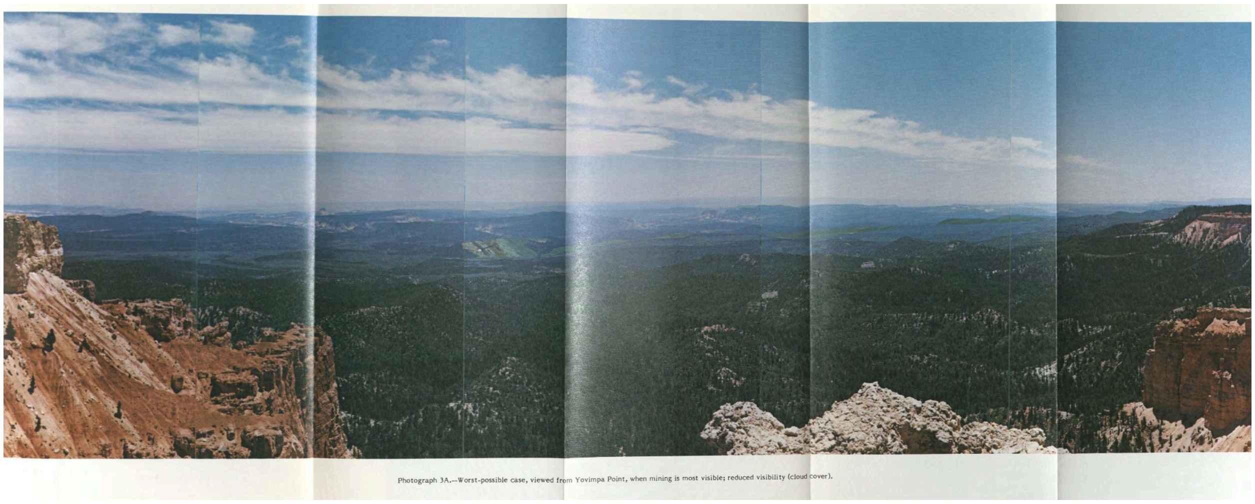


Figure 3.26 Bureau of Land Management, Composite Photograph Simulating Worst-Possible Case of Surface Mining in the Alton hills, Viewed from Yovimpa Point. In U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4* (Washington, D.C.: U.S. Department of the Interior, 1980): n.p.

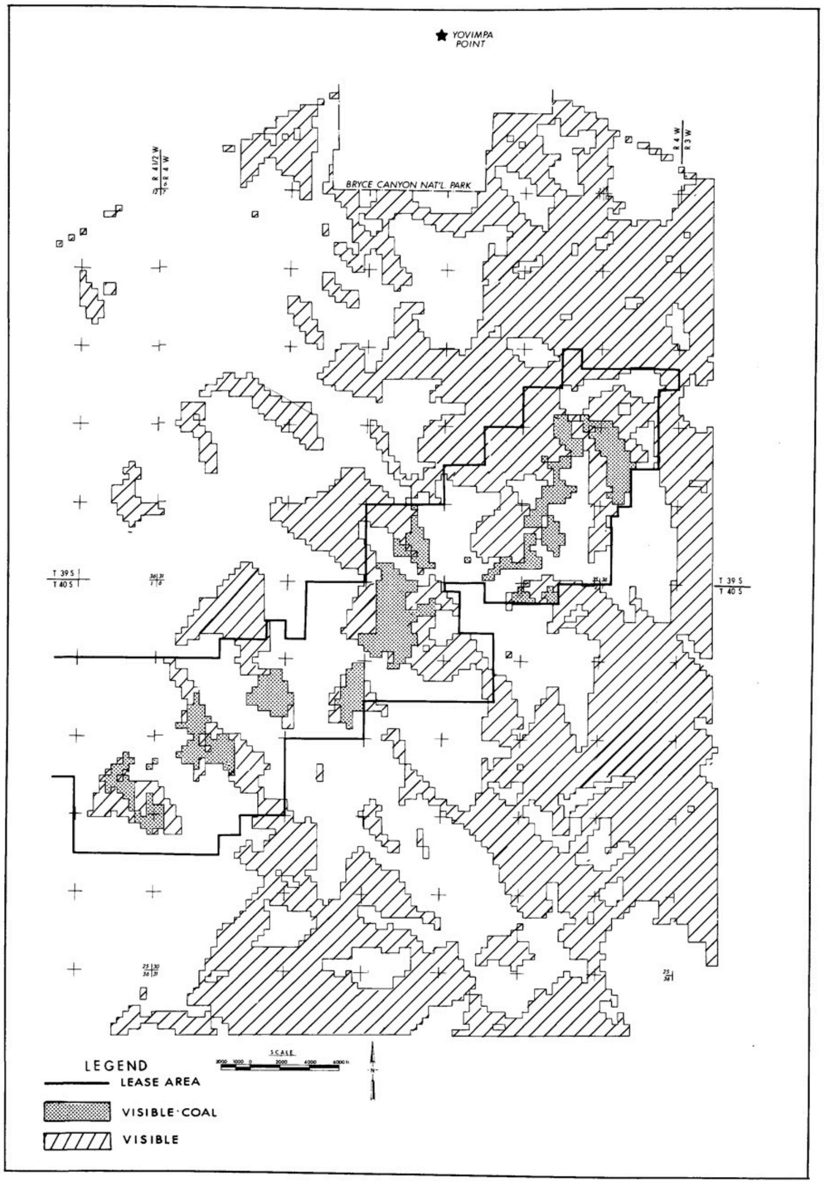


Figure 3.27 Utah International, Inc., COMARC Map Highlighting Portions of the Petition Area Visible from Yovimpa Point. In U.S. Office of Surface Mining Reclamation and Enforcement, *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4* (Washington, D.C.: U.S. Department of the Interior, 1980): p. II-4a.

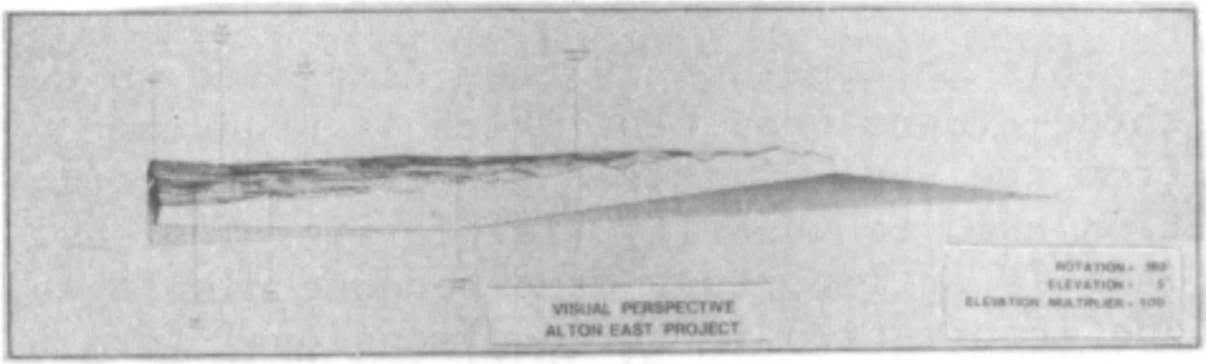
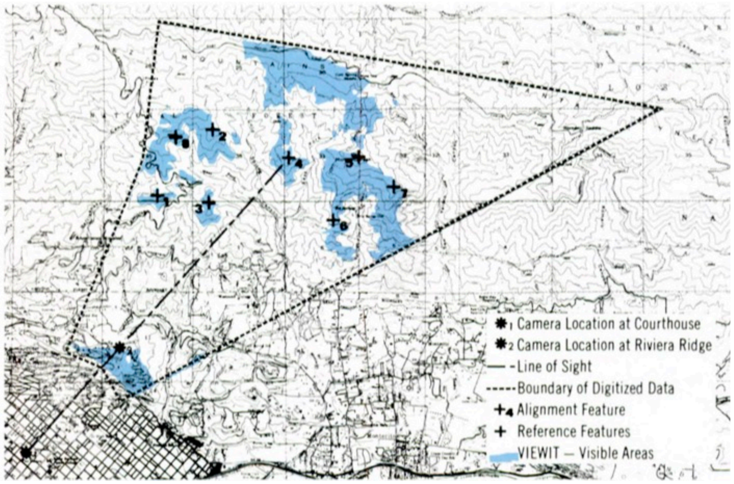
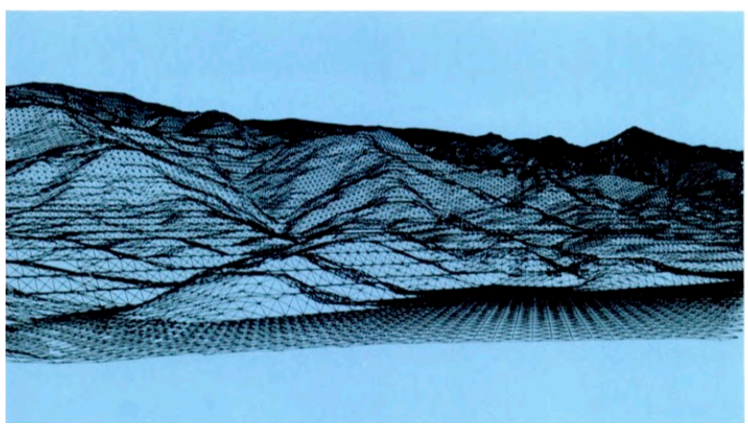


Figure 3.28 Utah International, Inc., Perspective Depicting View from Yovimpa Point. In Michael Hatfield, A. J. LeRoy Balzer, and Roger E. Nelson, "Computer-Aided Visual Assessment in Mine Planning and Design," in *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, ed. Gary H. Elsner and Richard C. Smardon, Gen. Tech. Rep. PSW-GTR-35 (Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979): p. 326.





Figures 3.29, 3.30, and 3.31 MOSAIC Technique. In *MOSAIC: A System for Displaying a Proposed Modification Before Its Impact on the Environment* (Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, 1977): pp. 7, 8.

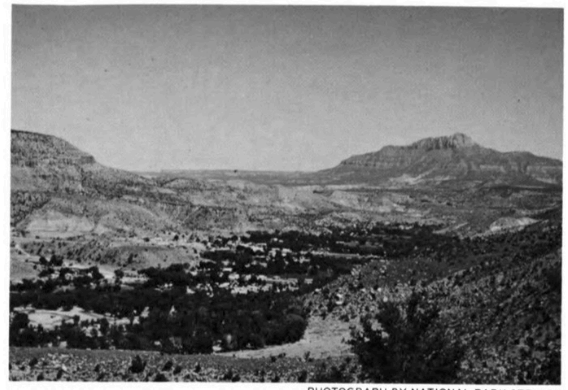
Figures 3.32 and 3.33 Existing Landscape Photograph and Hand-Retouched MOSAIC Photomontage Simulating the Presence of a Dam. In *MOSAIC: A System for Displaying a Proposed Modification Before Its Impact on the Environment* (Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, 1977): p. 9.

PHOTOGRAPH BY NATIONAL PARK SERVICE

EXISTING SITUATION

VISUAL SIMULATION BY NATIONAL PARK SERVICE

IMPACTS ON VISIBILITY
(SIMULATED PHOTOGRAPH)



PHOTOGRAPH BY NATIONAL PARK SERVICE

EXISTING SITUATION

VISUAL SIMULATION BY NATIONAL PARK SERVICE

IMPACTS ON VISIBILITY
(SIMULATED PHOTOGRAPH)

Figures 3.34 and 3.35 National Park Service, LASL Visibility System Simulations of the Visibility Effects of a Coal-Fired Power Station for Observation and Watchman Points in Zion National Park. In U.S. Bureau of Land Management, ed., *Draft Environmental Impact Statement on the Allen-Warner Valley Energy System* (Cedar City, Utah: U.S. Department of the Interior, 1980): pp. 4-17, 4-19.

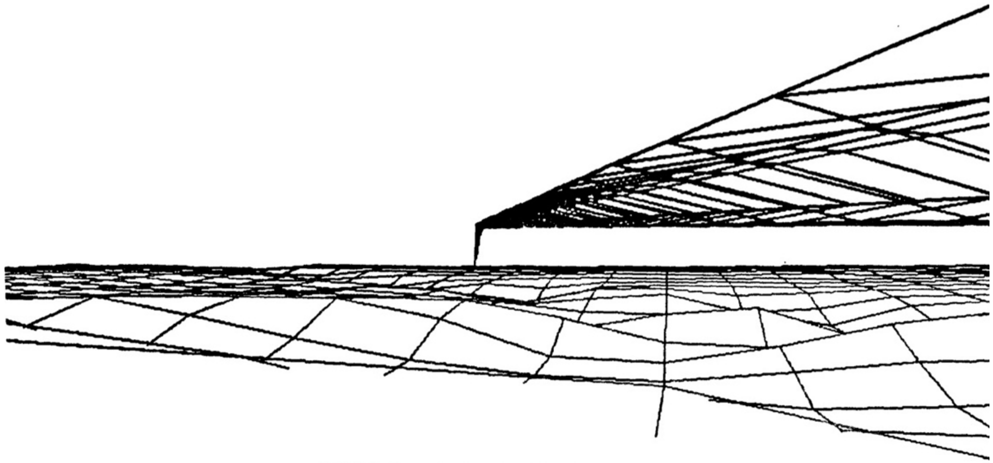


FIGURE 40. VIEW FROM LOCATION 4

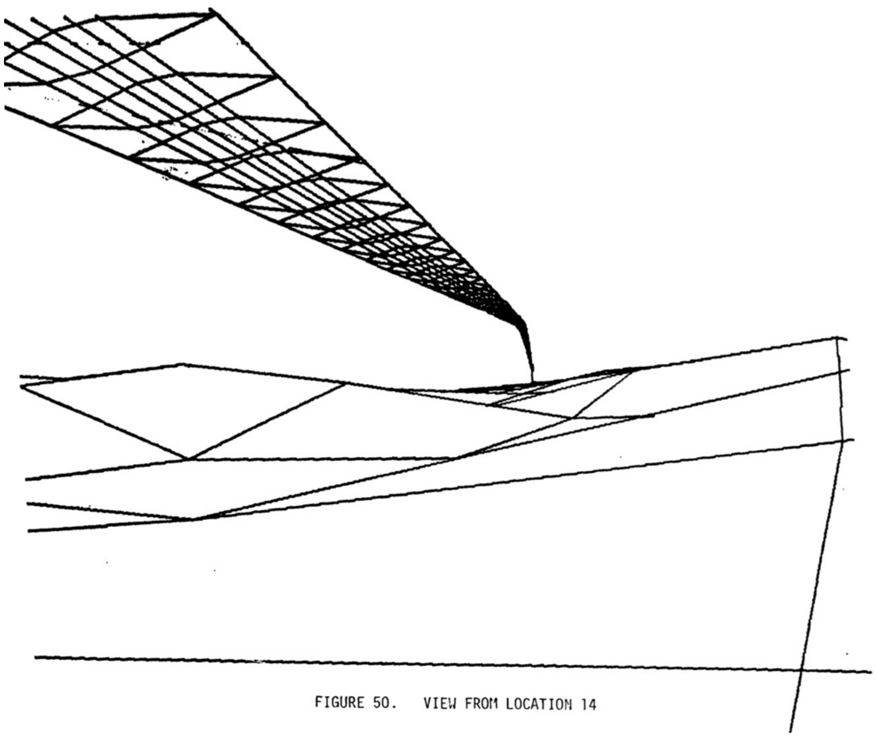


FIGURE 50. VIEW FROM LOCATION 14

Figures 3.36 and 3.37 Systems Applications, Inc., PLUVUE Visualizations of Plume Envelopes Sited in Region West of Page, Arizona. In Douglas A. Latimer et al., "The Development of Mathematical Models for the Prediction of Anthropogenic Visibility Impairment," Prepared for U.S. Environmental Protection Agency (San Rafael, CA: Systems Applications, Incorporated, 1978): pp. 117, 127.

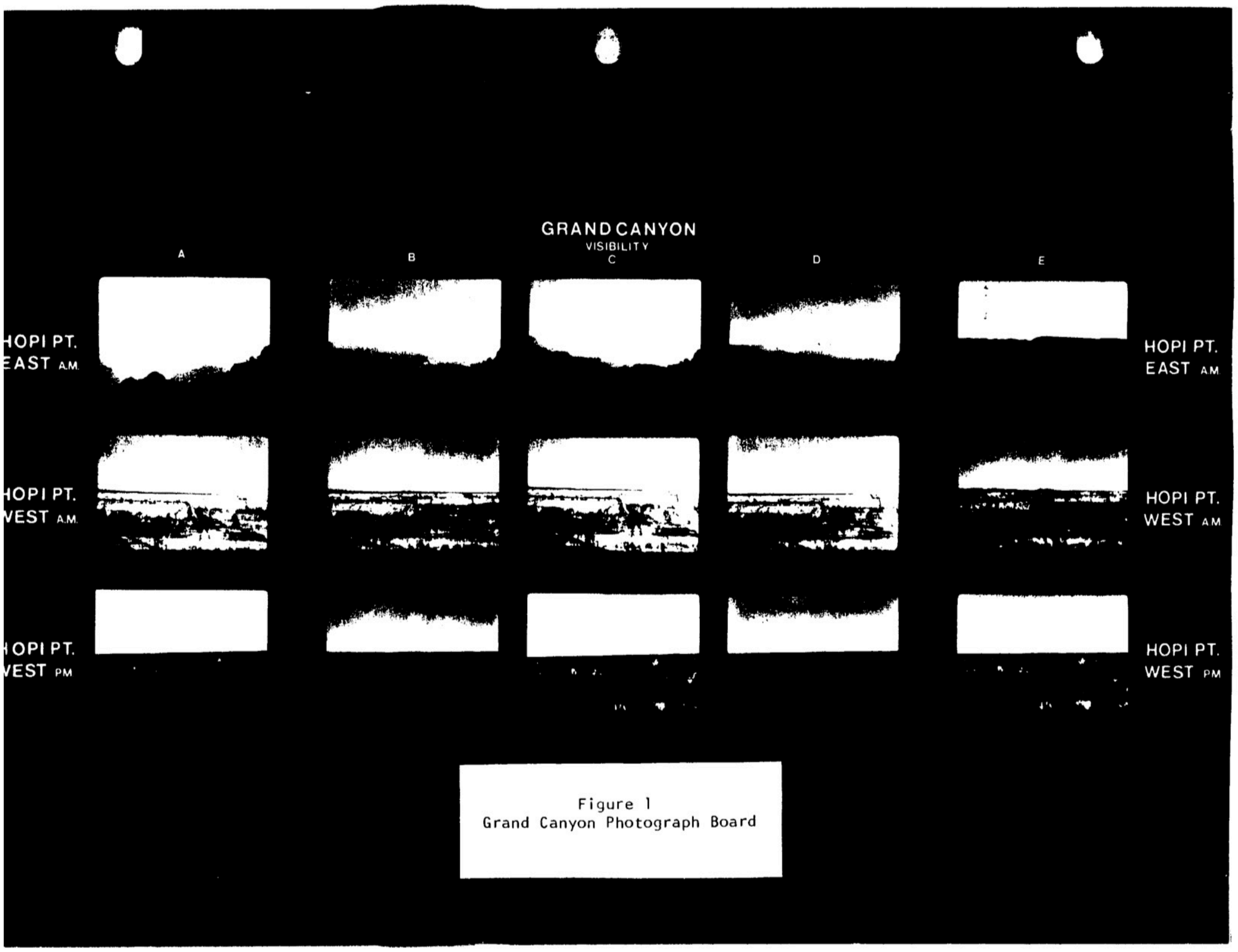


Figure 3.38 Photographs Representing Various Visibility Levels in Grand Canyon National Park Employed in Willingness-to-Pay Studies. In U.S. Environmental Protection Agency, Office of Policy Analysis, *Methods Development for Environmental Control Benefits Assessment*, vol. VIII: The Benefits of Preserving Visibility in the National Parklands of the Southwest (Washington, D.C.: U.S. Environmental Protection Agency, 1985): p. 15.

Code A-____________________

OMB 42-S80002

United States Department of the Interior

NATIONAL PARK SERVICE

Bryce Canyon National Park
Survey A - Interview

Thank you for taking part in our survey of Bryce Canyon National Park visitors. This survey should take less than 10 minutes. To begin, I would like to ask you a few questions about your entire trip. After that I would like to have you fill out a short questionnaire to tell us something about your visit at Bryce Canyon NP. All of your responses are, of course, confidential.

1. How many people are traveling in this vehicle? ________ persons.

2. From where did you start your entire trip? ____________, ____________,
City or Town, County

____________, ____________, ____________
State, Country, Zip Code

b. What is your final destination? ____________, ____________,
City or Town, County

____________, ____________, ____________
State, Country, Zip Code

((Are the zip codes in a and b of #2 the same? _____ yes _____no))

3. Did you travel by air during this trip? _____ _____
yes no

If yes: a. From where did you begin the car portion of your trip?

____________, ____________, ____________, ____________
City or Town, State, Country, Zip Code

b. What is the destination of the car portion of your trip?

____________, ____________, ____________, ____________
City or Town, State, Country, Zip Code

c. About how much did your group's airline tickets cost? $_______

((Are the zip codes in a and b of #3 the same? _____yes _____no))

Code C- ________________________

12. If a surface or strip mining operation such as that shown in photograph B were now visible from Yovimpa Point, would you change the length of your stay at Yovimpa Point?

I would have stayed:

significantly less time _____
slightly less time _____
the same amount of time _____
slightly more time _____
significantly more time _____
I would not have visited Yovimpa point at all _____

13. If a surface or strip mining operation such as that shown in photograph B were now visible from Yovimpa Point, would you change the length of your stay at the park?

I would have stayed:

significantly less time _____
slightly less time _____
the same amount of time _____
slightly more time _____
significantly more time _____
I would not have visited the park at all _____

14. If a surface mining operation such as that shown in photograph B were now visible from half of the 13 viewpoints in Bryce Canyon NP, would you change the length of your stay at the park?

I would have stayed:

significantly less time _____
slightly less time _____
the same amount of time _____
slightly more time _____
significantly more time _____
I would not have visited the park at all _____

If surface or strip mining activities similar to those in photograph B were in view from only one of the 13 viewpoints in Bryce Canyon NP, how would it have affected the length of your stay at the park?

I would have stayed:

significantly less time _____
slightly less time _____
the same amount of time _____
slightly more time _____
significantly more time _____
I would not have visited the park at all _____

Figures 3.39 and 3.40 Survey Conducted at Bryce Canyon National Park. In National Park Service, *Results of National Park Service Visitor Survey Conducted At Bryce Canyon National Park Summer 1980* (Washington, D.C.: U.S. Department of the Interior, 1980), Nina Dougherty papers, 1949-2010, Accn 2002, Box 73, Folder 5. Special Collections, J. Willard Marriott Library, The University of Utah: pp. A-3, V-16.

Bibliography

Acking, Carl-Axel, and Rikard Küller. "Presentation and Judgment of Planned Environment and the Hypothesis of Arousal." In *Environmental Design Research, Fourth International EDRA Conference*, edited by Wolfgang F.E. Preiser, 1:72–83. Stroudsburg, PA: Dowden, Hutchinson & Ross, 1973.

———. "Volymupplevelse Av Rum." Arebetsrapport 1. Lund: Lund University of Technology, Architecture Section, 1966.

Acking, Carl-Axel, Christer Ohlsson, and Ulf Sjögren. *Environmental Simulating Methods and Public Communication*. Stockholm: Statens rad för byggnadsforskning, 1976.

Adams, Maurice B. "Architectural Drawing." *Transactions of the Royal Institute of British Architects* Vol. I. New Series (1885).

Adler, Daniel. "The Formalist's Compromise: Wölfflin and Psychology." In *German Art History and Scientific Thought: Beyond Formalism*, edited by Mitchell B Frank and Daniel Adler. Farnham, Surrey: Ashgate, 2012.

Adorno, Theodor W., Else Frenkel-Brunswik, Daniel J. Levinson, and Nevitt Sanford. *The Authoritarian Personality*. New York: Harper & Brothers, 1950.

"Aesthetic Nuisance: An Emerging Cause Of Action." *New York University Law Review* 45, no. 5 (November 1970).

Aggregate Architectural History Collaborative. *Governing by Design: Architecture, Economy, and Politics in the Twentieth Century*. Pittsburgh, PA: University of Pittsburgh Press, 2012.

Agrawal, Arun. *Environmentality: Technologies of Government and the Making of Subjects*. Durham, NC: Duke University Press, 2005.

Ajzen, Icek, and Martin Fishbein. "Attitude-Behavior Relations: A Theoretical Analysis and Review of Empirical Research." *Psychological Bulletin* 84 (1977): 888–918.

Alexander, Zeynep Çelik. *Kinaesthetic Knowing: Aesthetics, Epistemology, Modern Design*. Chicago: University of Chicago Press, 2017.

Alexander, Zeynep Çelik, and John May, eds. *Design Technics: Archaeologies of Architectural Practice*. Minneapolis, MN: University of Minnesota Press, 2020.

Allen, Henry. "Senator Proxmire Against Love Research Because He Doesn't Want the Answers," April 6, 1975, sec. E.

Allen, Matthew. "Architecture Becomes Programming: Invisible Technicians, Printouts, and Situated Theories in the 1960s." In *The Figure of Knowledge: Conditioning Architectural Theory, 196X-199X*, edited by Sebastiaan Loosen, Rajesh Heynickx, and Hilde Heynen. Leuven: Leuven University Press, 2020.

———. “Prehistory of the Digital: Architecture Becomes Programming, 1935-1990.” Ph.D. Dissertation, Harvard University, 2019.

Allen, Michael Thad, and Gabrielle Hecht, eds. *Technologies of Power: Essays in Honor of Thomas Parke Hughes and Agatha Chipley Hughes*. Cambridge, MA: MIT Press, 2001.

Allen, William G. “Bass Outlines Busy Highway Program.” *The Times*. April 26, 1963.

Allport, Floyd H., and Gordon W. Allport. “Personality Traits: Their Classification and Measurement.” *The Journal of Abnormal Psychology and Social Psychology* 16, no. 1 (1921): 6–40.

Allport, Gordon W. “Concepts of Trait and Personality.” *Psychological Bulletin* 24, no. 5 (1927): 284–93.

———. *Personality: A Psychological Interpretation*. Personality: A Psychological Interpretation. Oxford, England: Holt, 1937.

Allport, Gordon W., and Henry S. Odbert. “Trait-Names: A Psycho-Lexical Study.” *Psychological Monographs* 47, no. 1 (1936): i–171.

Allport, Gordon W., and Philip E. Vernon. “The Field of Personality.” *Psychological Bulletin* 27, no. 10 (1930): 677–730.

Alpers, Svetlana, Emily Apter, Carol Armstrong, Susan Buck-Morss, Tom Conley, Jonathan Crary, Thomas Crow, et al. “Visual Culture Questionnaire.” *October* 77 (1996): 25–70.

Althusser, Louis. *On the Reproduction of Capitalism: Ideology and Ideological State Apparatuses*. London: Verso, 2014.

Altman, Irwin, and Kathleen Christensen. *Environment and Behavior Studies: Emergence of Intellectual Traditions*. Springer Science & Business Media, 2012.

Alton Coal Development, LLC. “Federal Emergency Lease within the Alton Amphitheater within Sections 18 and 19 Township 39 South, Range 5 West, SLB&M.” Cedar City, Utah: Alton Coal Development, LLC, March 2016.

American Psychological Association, American Educational Research Association, and National Council on Measurement in Education. *Standards for Educational & Psychological Tests*. Washington, D.C., 1974.

Amidon, Elliot L., and Gary H. Elsner. *Delineating Landscape View Areas... A Computer Approach*. Research Note PSW-RN-180. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, 1968.

Anderson, J.M. “A Television Aid to Design Presentation.” *Architectural Research and Training* 1, no. 2 (November 1970).

———. “Simulating Architecture.” *Architects’ Journal* 156 (December 6, 1972): 1325–29.

Anderson, Lee, Jerry Mosier, and Geoffrey Chandler. "Visual Absorption Capability." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 164–71. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

———. "Visual Management Support System." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 189–95. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Andrus, Cecil. "Secretary's Decision, Petition to Designate Certain Federal Lands In Southern Utah Unsuitable for Surface Coal Mining, OSM Reference 79-5-001." Washington, D.C.: U.S. Department of the Interior, Office of the Secretary, December 16, 1980.

———. "Statement of Reasons, Petition to Designate Certain Federal Lands In Southern Utah Unsuitable for Surface Coal Mining, OSM Reference 79-5-001." Washington, D.C.: U.S. Department of the Interior, Office of the Secretary, January 13, 1981.

Angelo, Mark. "The Use of Computer Graphics in the Visual Analysis of the Proposed Sunshine Ski Area Expansion." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 439–46. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

———. "The Use of Computers in the Visual Analysis of Landscape Alterations." *The Forestry Chronicle* 56, no. 2 (April 1980): 73–74.

Angus, Robert C., and Terry C. Daniel. "Applying Theory of Signal Detection in Marketing: Product Development and Evaluation." *American Journal of Agricultural Economics* 56, no. 3 (1974): 573–77.

Appleyard, Donald Papers, Bancroft Library, University of California, Berkeley.

Appleyard, Donald. "Periscoping Future Scenes: How to Use an Environmental Simulation Lab." Berkeley: Institute of Urban & Regional Development, University of California, 1979.

———. "Scenic Driving on the Urban Road." Report to Citizens' Advisory Committee on Recreation and Natural Beauty, December 11, 1967. BANC MSS 83/165 c, Carton 11, Folder 20. Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

———. "Toward an Imageable Structure for Residential Areas." Master's Thesis. Massachusetts Institute of Technology, 1958. BANC MSS 83/165 c, Carton 11, Folder 11. Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

———. “Understanding Professional Media.” In *Human Behavior and Environment*, edited by Irwin Altman and Joachim F. Wohlwill, 43–88. New York: Plenum Press, 1977.

———. The Berkeley Environmental Simulation Laboratory: Technical Report, May 1975. BANC MSS 83/165 c, Carton 11, Folder 12. Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

———. Traveller Perception and the Environmental Design of Highway Systems, March 1970. BANC MSS 83/165 c, Carton 8, Folder 38. Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

Appleyard, Donald, and Kenneth Craik. *Visual Simulation in Environmental Planning and Design*. Berkeley: Institute of Urban and Regional Development, University of California, 1979.

Appleyard, Donald, Kenneth Craik, Merrie Klapp, and Alcira Kreimer. “The Berkeley Environmental Simulation Laboratory: Its Use In Environmental Impact Assessment.” Working Paper No. 206. Berkeley: Institute of Urban & Regional Development, University of California, 1973.

Appleyard, Donald, R. Burton Litton, Thomas Dickert, and Hugo Blasdel. “Amenity Impacts of Nuclear and Other Power Plants: Draft Outline for an Assessment Manual.” Teknekron, Inc. and US Atomic Energy Commission, January 1972. BANC MSS 83/165 c, Carton 11, Folder 20. Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

Appleyard, Donald, Kevin Lynch, and John R. Myer. *The View from the Road*. Cambridge, MA: Joint Center for Urban Studies of the Massachusetts Institute of Technology and Harvard University, 1964.

Araki, Dwight K. “VIEWIT Uses on the Wild and Scenic Upper Missouri River.” In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 618–26. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Arnheim, Rudolf. *Art and Visual Perception: A Psychology of the Creative Eye*. London: Faber & Faber, 1954.

———. “Order and Complexity in Landscape Design.” In *Toward a Psychology of Art: Collected Essays*, 123–35. Berkeley: University of California Press, 1966.

———. “Vincent Scully and Rudolf Arnheim: Dialogue.” In *Rudolf Arnheim: Revealing Vision*, edited by Kent Kleinman and Leslie Van Duzer. Ann Arbor: University of Michigan Press, 1997.

Arnhoff, Franklyn N., and Henry V. Leon. “Psychological Aspects of Sensory Deprivation and Isolation.” *Merrill-Palmer Quarterly of Behavior and Development* 10, no. 2 (April 1, 1964): 179–94.

Atkins, J. Thomas, and William G. E. Blair. “Visual Impact of Highway Alternatives.” *Garten Und Landschaft*, no. 8 (1983): 632–35.

Austin, B.S., L.R. Chinkin, A.K. Pollack, M. Moezzi, C.S. Burton, and Douglas A. Latimer. "Characterizing Visibility Trends: A Review of Historical Approaches and Recommendations for Future Analyses." Prepared for Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. San Rafael, CA: Systems Applications, Inc., 1988.

Auzelle, Robert. *323 Citations Sur l'Urbanisme Par Robert Auzelle Avec La Collaboration de Jean Gohler et Pierre Vetter*. Paris: Vincent, Freal, 1964.

Avila, Eric. *The Folklore of the Freeway: Race and Revolt in the Modernist City*. Minneapolis: University of Minnesota Press, 2014.

Aycock, Alice. "Work (1975)." In *Individuals: Post-Movement Art in America*, edited by Alan Sondheim, 105–8. New York: E. P. Dutton, 1977.

Bacon, Warren R. "The Visual Management System of the Forest Service, USDA." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 660–65. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Bacon, Warren R., and Paul F. Hansen. *Handbook on the Visual Management System*. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region, 1972.

Bagley, Marilyn D., Cynthia A. Kroll, Kristin Clark, and Martin J. Redding. *Aesthetics in Environmental Planning*. EPA-600/5-73-009. Washington, D.C.: U.S. Environmental Protection Agency, Office of Research and Development, 1973.

Barber, Daniel A. "The Form and Climate Research Group, or Scales of Architectural History." *Avery Review*, 2016.

Barker, Roger G., and Herbert F. Wright. *Midwest and Its Children: The Psychological Ecology of an American Town*. Evanston, IL: Row, Peterson and Company, 1955.

———. *One Boy's Day: A Specimen Record of Behavior*. New York: Harper & Brothers, 1951.

Barron, Frank, and George S. Welsh. "Artistic Perception as a Possible Factor in Personality Style: Its Measurement by a Figure Preference Test." *The Journal of Psychology: Interdisciplinary and Applied* 33 (1952): 199–203.

Baudrillard, Jean. *Simulacra and Simulation* (1981). New York: Semiotext(e), 1983.

Bauman, Joe. "Utah's Coal Reserves Raise a Burning Question." *Deseret News*, January 12, 2008.

Bean, Lowell John, and Sylvia Brakke Vane. "Allen-Warner Valley Energy System: Western Transmission System: Ethnographic and Historical Resources." Report to Southern California Edison Company. Menlo Park, CA: Cultural Systems Research, Inc., December 15, 1979. Richard Stoffle Collection, University of Arizona Libraries, Special Collections.

Beardsley, John. *A Landscape for Modern Sculpture: Storm King Art Center*. New York: Abbeville Press, 1985.

Beauty for America: Proceedings of the White House Conference on Natural Beauty, May 24-25, 1965. Washington, D.C.: U.S. Government Printing Office, 1965.

Bechtel Power Corporation, Stearns-Roger, Inc., Utah International, Inc., Southern Pacific Pipe Lines, Inc. *Allen-Warner Valley Energy System: Environmental Assessment*. United States, 1975.

Bechtel, Robert B. "Human Movement and Preference." Topeka, KS: Environmental Research Foundation, 1967.

———. Method and Apparatus for Performing a Hodometer Floor Use Study. United States Patent Office 3,346,866, filed October 4, 1965, and issued 1967.

———. "The History and Promise of Environment and Behavior Research." In *Environment & Behavior: An Introduction*, 75–104. Thousand Oaks, CA: Sage Publications, 1997.

Becker, Peter, and William Clark. *Little Tools of Knowledge: Historical Essays on Academic and Bureaucratic Practices*. Ann Arbor: University of Michigan Press, 2001.

Bell, Daniel. *The Coming of Post-Industrial Society: A Venture in Social Forecasting*. New York: Basic Books, 1973.

Belting, Hans. "The Double Perspective: Arab Mathematics and Renaissance Art." *Third Text* 24, no. 5 (September 1, 2010): 521–27.

Bennett, William John. *To Reclaim a Legacy: A Report on the Humanities in Higher Education*. Washington, D.C.: National Endowment for the Humanities, 1984.

Benton, Tim. "Dreams of Machines: Futurism and l'Esprit Nouveau." *Journal of Design History* 3, no. 1 (January 1, 1990): 19–34.

Berci, George, and J. Davids. "Endoscopy and Television." *British Medical Journal* 1, no. 5292 (June 9, 1962): 1610–13.

Berlyne, Daniel E., ed. *Studies in the New Experimental Aesthetics: Steps toward an Objective Psychology of Aesthetic Appreciation*. Oxford, UK: Hemisphere, 1974.

Berry, K. L. "Critical Analysis Of The Bryce Canyon National Park Visibility Values Survey." Prepared for Utah International, August 29, 1980. in Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4.

"Beyond the Eye of the Beholder: Aesthetics and Objectivity." *Michigan Law Review* 71, no. 7 (June 1, 1973): 1438–62.

Bigelow, George, Henry Emurian, and Joseph V. Brady. "A Programmed Environment for the Experimental Analysis of Individual and Small Group Behavior." Johns Hopkins, 1975.

Bijker, Wiebe E., Thomas P. Hughes, and Trevor Pinch, eds. *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*. Cambridge, MA: MIT Press, 1987.

"Bill May End Mining Threats To Bryce." *National Parks* 64, no. 5/6 (June 1990).

Bishop, I.D., and P.N.A. Leahy. "Assessing the Visual Impact of Development Proposals: The Validity of Computer Simulations." *Landscape Journal* 8, no. 2 (1989): 92–100.

Blackwell, H. Richard. "Contrast Thresholds of the Human Eye." *Journal of the Optical Society of America* 36, no. 11 (November 1, 1946): 624–43.

Blair, William G. E. "Visual Impact Assessment in Urban Environments." In *Foundations for Visual Project Analysis*, edited by Richard C. Smardon, James F. Palmer, and John P. Felleman. New York: John Wiley & Sons, 1986.

Blair, William G. E., Peter Harvard, and Jones & Jones. *Esthetics and Visual Resource Management for Highways: Seminar Notes, 1979-1980*. Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1979.

Blake, Peter. *God's Own Junkyard: The Planned Deterioration of America's Landscape*. New York: Holt, Rinehart and Winston, Inc., 1964.

Blakeslee, Sandra. "Envisioning the Truth without the Consequences." *The New York Times*, December 11, 1983.

Block, Jack. *The Q-Sort Method in Personality Assessment and Psychiatric Research*. Springfield, Ill.: Charles C. Thomas, 1961.

Blundell-Jones, Peter, Doina Petrescu, and Jeremy Till, eds. *Architecture and Participation*. New York: Routledge, 2005.

Boring, Edwin G. *A History of Experimental Psychology*. Englewood Cliffs, NJ: Prentice-Hall, 1950.

———. *Sensation and Perception in the History of Experimental Psychology*. New York: Appleton-Century-Crofts, Inc., 1942.

Borrie, Roderick A., and Peter Suedfeld. "Restricted Environmental Stimulation Therapy in a Weight Reduction Program." *Journal of Behavioral Medicine* 3, no. 2 (1980): 147–61.

Bosselmann, Peter. *Dynamic Simulation of Urban Environments: Twenty Years of Environmental Simulation at Berkeley*. 509. Berkeley: Institute of Urban and Regional Development, University of California at Berkeley, 1990.

———. *Filmscripts: Five Films Produced at the Environmental Simulation Laboratory*. Institute of Urban and Regional Development, University of California at Berkeley, 1990.

———. "The Berkeley Environmental Simulation Laboratory: A 12 Year Anniversary." *Berkeley Planning Journal* 1, no. 1 (1984): 150–60.

Bosselmann, Peter, and Kenneth Craik. *Perceptual Simulations of Environments*. Berkeley: Institute of Urban and Regional Development, University of California, 1985.

Bouwman, M.J.A. "De Waarde Van Het Gebruik Van De Entheskoop in Relatie Tot Andere Presentatie-Technieken Voor De Gebouwde Omgeving." Ph.D., Landbouwhogeschool, 1979.

Bowlby, Rachel. *Carried Away: The Invention of Modern Shopping*. New York: Columbia University Press, 2001.

BoxOffice. "Academy Tech Awards Announced by Koch," February 27, 1978.

Bradley, Barbara. "Projections of How Tomorrow's City Might Look Help in Development Fights." *The Baltimore Sun*, November 22, 1987.

Brady, Joseph V., George Bigelow, Henry Emurian, and D. Michael Williams. "Design of a Programmed Environment for the Experimental Analysis of Social Behavior." *EDRA 5:* 6 (1974).

Broughton, Robert. "Aesthetics and Environmental Law: Decisions and Values." *Land & Water Law Review* 7, no. 2 (January 1, 1972): 451–500.

Brown, Kathi Ann. *Diversity by Design: Celebrating 75 Years of Howard, Needles, Tammen & Bergendoff, 1914–1989*. New York: Howard, Needles, Tammen & Bergendoff, 1989.

Brownfield, Charles Allen. *Isolation; Clinical and Experimental Approaches*. New York: Random House, 1965.

Brush, Robert O. "Perceived Quality of Scenic and Recreational Environments; Some Methodological Issues." In *Perceiving Environmental Quality: Research and Applications*, edited by Kenneth H. Craik and Ervin H. Zube, 47–58. Environmental Science Research. Boston: Springer, 1976.

Bryson, Norman, Michael Ann Holly, and Keith Moxey, eds. *Visual Culture: Images and Interpretations*. Hanover, N.H.: University Press of New England, 1994.

Buell, Lawrence. "Toxic Discourse." *Critical Inquiry* 24, no. 3 (1998): 639–65.

Burdge, Rabel J. "A Brief History and Major Trends in the Field of Impact Assessment." *Impact Assessment* 9, no. 4 (December 1, 1991): 93–104.

Burnham, J. B., M. H. Karr, G. L. Wilfert, W. S. Maynard, S. M. Nealey, G. Jones, I. Jones, et al. "Technique for Environmental Decision Making Using Quantified Social and Aesthetic Values." Richland, WA: Battelle Pacific Northwest Laboratories, 1974.

Caldwell, Lynton K. "Environmental Impact Analysis (EIA): Origins, Evolution, and Future Directions." *Impact Assessment* 6, no. 3–4 (December 1, 1988): 75–83.

———. *Science and the National Environmental Policy Act: Redirecting Policy through Procedural Reform*. Tuscaloosa, AL: University of Alabama Press, 1982.

Campany, David. "Precedented Photography." *Aperture*, no. 206 (2012): 46–51.

Canter, David, M. Benyon, and S. West. "Comparisons of an Hologram and a Slide of a Room Interior." *Perceptual and Motor Skills* 37, no. 2 (October 1, 1973): 635–38.

Canter, David V., and Kenneth H. Craik. "Environmental Psychology." *Journal of Environmental Psychology* 1 (1981): 1–11.

Carlson, Allen A. "On the Possibility of Quantifying Scenic Beauty." *Landscape Planning* 4 (January 1, 1977): 131–72.

Carlson, Walter. "Advertising: Using 'See America' Theme." *The New York Times*, August 9, 1965.

Carlsson, Moa. "Computing Views, Remodeling Environments." *Social Studies of Science* 52, no. 2 (April 2022): 227–52.

Carr, Edward L., H. Hogo, Mark A. Yocke, G. W. Lundberg, and B. D. Miller. "Impacts of the Proposed Alton Coal Project on the Night Sky Near Bryce Canyon National Park." San Rafael, CA: Systems Applications, Incorporated, 1989.

Carr, Edward L., Thomas S. Stocking, Mark A. Yocke, and Niki Yonkow. "Evaluation of Night Sky Model and Human Perception of Night Sky Glow." San Rafael, CA: Systems Applications, Incorporated, 1989.

Carrier, David. "Rudolf Arnheim as Art Historian." In *Rudolf Arnheim: Revealing Vision*, edited by Kent Kleinman and Leslie Van Duzer. Ann Arbor: University of Michigan Press, 1997.

Cartwright, Lisa. *Screening the Body: Tracing Medicine's Visual Culture*. Minneapolis, MN: University of Minnesota Press, 1995.

Cattell, Raymond B. "The Description of Personality: Basic Traits Resolved into Clusters." *Journal of Abnormal & Social Psychology* 38, no. 4 (January 1943): 476–506.

Chandler, Henry P. "The Attitude of the Law Toward Beauty." *American Bar Association Journal* 8, no. 8 (1922): 470–74.

Chicago Tribune. "Plays 'Guinea Pig' in Solitary for NASA," March 3, 1963.

Clawson, Marion. "Methods of Measuring Demand for and Benefits of Outdoor Recreation." Washington, D.C.: Resources for the Future, Inc., 1959.

Clawson, Marion, and Jack L. Knetsch. *Economics of Outdoor Recreation*. Baltimore, MD: Johns Hopkins Press, 1966.

Clean Air Act Amendments of 1977, 42 U.S.C. § 7470 et seq.

Coglianese, Cary. “Administrative Law in the Automated State.” *Daedalus* 150, no. 3 (July 1, 2021): 104–20.

Cohen, Roger W., Istvan Gorog, and Curtis R. Carlson. “Image Descriptors for Displays.” Prepared for Office of Naval Research. Princeton, NJ: RCA Laboratories, 1975.

Coletta, Raymond Robert. “The Case for Aesthetic Nuisance: Rethinking Traditional Judicial Attitudes.” *Ohio State Law Journal* 48, no. 141 (1987).

Coltharp, Edgar. “I-220 Environmental Report Is Prepared.” *The Time*. November 4, 1971.

———. “Route of I-220 Bypass Still Up in the Air.” *The Times*. August 1, 1971.

Costonis, John. “Law and Aesthetics: A Critique and a Reformulation of the Dilemmas.” *Michigan Law Review* 80, no. 3 (January 1, 1982): 355–461.

Coughlin, Robert E., and Karen A. Goldstein. *The Extent of Agreement among Observers on Environmental Attractiveness*. Discussion Paper No. 37. Philadelphia: Regional Science Research Institute, 1970.

Craik, Kenneth H. “A Sociopsychological Study of an Architectural Firm.” Unpublished Report. Berkeley, CA: Institute of Personality Assessment and Research, University of California, 1968.

———. “Environmental and Personality Psychology: Two Collective Narratives and Four Individual Story Lines.” In *Environment and Behavior Studies: Emergence of Intellectual Traditions*, edited by Irwin Altman and Kathleen Christensen. Springer Science & Business Media, 2012.

———. “Environmental Psychology.” In *New Directions in Psychology 4*. New York: Holt, Rinehart and Winston, Inc., 1970.

———. “Individual Variations in Landscape Description.” In *Landscape Assessment: Values, Perceptions and Resources*, edited by Ervin H. Zube, Robert O. Brush, and Julius G. Fabos, 130–50. Stroudsburg, PA: Dowden, Hutchinson & Ross, 1975.

———. “Multiple Scientific Paradigms in Environmental Psychology.” *International Journal of Psychology* 12, no. 2 (January 1, 1977): 147–57.

———. “The Comprehension of the Everyday Physical Environment.” In *Environmental Psychology: Man and His Physical Setting*. New York: Holt, Rinehart and Winston, Inc., 1970.

———. “The Environmental Dispositions of Environmental Decision-Makers.” *Annals of the American Academy of Political and Social Science* 389, no. 1 (1970): 87–94.

———. “The Personality Research Paradigm in Environmental Psychology.” In *Experiencing the Environment*, edited by Seymour Wapner, Saul B. Cohen, and Bernard Kaplan, 55–79. Boston, MA: Plenum Press, 1976.

———. “The Psychology of the Large-Scale Environment.” In *Environmental Psychology: Directions and Perspectives*, edited by Nickolaus Reinholt Feimer and E. Scott Geller, 67–105. New York: Praeger, 1983.

Craik, Kenneth H., and George E. McKechnie. “Personality and the Environment.” *Environment and Behavior* 9, no. 2 (1977): 155–68.

Craik, Kenneth H., and Ervin H. Zube. *Perceiving Environmental Quality: Research and Applications*. New York: Plenum Press, 1976.

Crary, Jonathan. *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century*. Cambridge, MA: MIT Press, 1990.

Crawford, B.H., and D.A. Palmer. “Further Investigations of Colour Rendering, and the Classifcation of Light Sources.” *Studies in Conservation* 6, no. 2/3 (August 1961).

Cronon, William. “The Trouble with Wilderness: Or, Getting Back to the Wrong Nature.” *Environmental History* 1, no. 1 (1996): 7–28.

Crosby, Alfred W. “The Past and Present of Environmental History.” *The American Historical Review* 100, no. 4 (1995): 1177–89.

Cupers, Kenny. *Use Matters: An Alternative History of Architecture*. London: Routledge, 2014.

Cushman, Philip. *Constructing the Self, Constructing America : A Cultural History of Psychotherapy*. Boston, Mass. : Addison-Wesley Pub., 1995.

Daily World. “Land Purchases for Highway Halted by Judge.” October 13, 1971.

Daniel, Terry C. “Psychological Perspectives on Air Quality and Visibility in Parks and Wilderness Areas.” In *Proceedings of the Workshop in Visibility Values, Fort Collins, Colorado, January 28-February 1, 1979*, 84–92. U.S. Department of Agriculture, Forest Service, 1979.

Daniel, Terry C., and Ron S. Boster. *Measuring Landscape Esthetics: The Scenic Beauty Estimation Method*. Res. Pap. RM-RP-167. Fort Collins, Colorado: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, 1976.

Daniel, Terry C., and Herbert Schroeder. “Scenic Beauty Estimation Model: Predicting Perceived Beauty of Forest Landscapes.” In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 514–23. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Daniel, Terry C., Lawrence Wheeler, Ron S. Boster, and Paul R. Best. “Quantitative Evaluation of Landscapes: An Application of Signal Detection Analysis to Forest Management Alternatives.” *Man–Environmental Systems* 3, no. 5 (1973): 330–44.

Danziger, Kurt. *Constructing the Subject : Historical Origins of Psychological Research*. Cambridge: Cambridge University Press, 1990.

Daston, Lorraine, and Peter Galison. "The Image of Objectivity." *Representations*, no. 40 (1992): 81–128.

David E. Nye. *American Technological Sublime.* Cambridge, MA: The MIT Press, 1996.

Davis, Robert K. "Recreation Planning as an Economic Problem." *Natural Resources Journal* 3, no. 2 (Spring 1963): 239–49.

Dawson, R. F. F. *Environmental Simulator: Progress Report*. Transport and Road Research Laboratory, Department of the Environment, TRRL Laboratory Report 659. Crowthorne, Berkshire: Environment Division, Transport Systems Department, Transport and Road Research Laboratory, 1974.

Debord, Guy. *Society of the Spectacle (1967).* Detroit: Black & Red Press, 1970.

Department of Transportation Act of 1966, 23 U.S.C. § 138 et seq.

Diffrient, Niels, Mildred S. Friedman, Joan Bardagjy, Nicholas Polites, and Walker Art Center. *Dimensions of Experience: Understanding and Measuring Human Experience in the Designed Environment*. Walker Art Center, 1975.

Dobson, Jerome E. "A Regional Screening Procedure for Land Use Suitability Analysis." *Geographical Review* 69, no. 2 (1979): 224–34.

———. "Maryland Power Plant Siting Project: An Application of the ORNL-Land Use Screening Procedure." Oak Ridge, TN: Oak Ridge National Laboratory, 1977.

Dockeray, Floyd Carlton, David Bakan, United States, Civil Aeronautics Administration, Division of Research, National Research Council (U.S.), and Committee on Aviation Psychology. *An Investigation of the Learning of Stall Perception*. Washington, D.C.: Civil Aeronautics Administration, Division of Research: National Research Council, 1948.

Dodd, Samuel. "Televising Architecture: Media, Public Engagement, and Design in America." Ph.D. Dissertation, University of Texas at Austin, 2014.

———. "Televising Architecture: Spatial Simulations and the 'Scanning Finger.'" *Art Journal* 78, no. 1 (Spring 2019): 18–29.

Dodson, Orland. "Cross Lake: To Bridge or Not to Bridge the City's Water Supply?" *The Times*. August 18, 1977.

Domike, Julie R., and Alec C. Zacaroli, eds. *The Clean Air Act Handbook*. Chicago: American Bar Association, 2016.

Downs, Roger M., and David Stea. *Image and Environment: Cognitive Mapping and Spatial Behavior*. Chicago: Aldine Publishing Company, 1973.

Doyle, Kevin. “Cross Lake Bridge Film Draws 200.” *The Times*. January 28, 1983.

Dreyfus, Daniel A., and Helen M. Ingram. “The National Environmental Policy Act: A View of Intent and Practice.” *Natural Resources Journal* 16, no. 2 (1976): 243–62.

Dubos, René J. *So Human an Animal*. New York: Scribner, 1968.

Dudley, Susan E. “Milestones in the Evolution of the Administrative State.” *Daedalus* 150, no. 3 (July 1, 2021): 33–48.

Dumont, Frank. *A History of Personality Psychology: Theory, Science, and Research from Hellenism to the Twenty-First Century*. Cambridge: Cambridge University Press, 2010.

Dunaway, Finis. “Gas Masks, Pogo, and the Ecological Indian: Earth Day and the Visual Politics of American Environmentalism.” *American Quarterly* 60, no. 1 (2008): 67–99.

———. *Natural Visions: The Power of Images in American Environmental Reform*. Chicago, IL: University of Chicago Press, 2008.

Dykstra, J. “Miniature and Mechanical Special Effects for ‘Star Wars’.” *American Cinematographer*, July 1977.

Easterling, Keller. *Extrastatecraft: The Power of Infrastructure Space*. London: Verso, 2014.

Eco, Umberto. *A Theory of Semiotics*. Bloomington, IN: Indiana University Press, 1976.

Ehrlich, Paul R. *The Population Bomb*. Ballantine Books, 1971.

Eisenman, Peter. “Notes on Conceptual Architecture IIA.” In *Environmental Design Research, Fourth International EDRA Conference*, edited by Wolfgang F.E. Preiser, 319–23. Stroudsburg, PA: Dowden, Hutchinson & Ross, 1973.

Elsner, Gary H. *Computing Visible Areas from Proposed Recreation Developments... A Case Study*. Research Note PSW-RN-246. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, 1971.

———. “New Techniques for Coordinating Timber Harvesting and Esthetic Values.” In *Forests for People: A Challenge in World Affairs: Proceedings of the Society of American Foresters 1977 National Convention*, 46–51. Washington, D.C.: Society of American Foresters, 1977.

Entzminger, Robert A. “MOSAIC/Photomontage: A New Concept to Help Reclamation Planning.” *Coal Mining & Processing* 13, no. 6 (1976).

Environmental Communications. “Urban Images Questionnaire,” ca 1971. Environmental Communications archive.

Environmental Defense Fund Archive, Special Collections and University Archives, Stony Brook University Libraries.

Environmental Research & Technology, Inc. *Kaiparowits Coal Development and Transportation Study*. Fort Collins, Colorado: Environmental Research & Technology, 1980.

Epstein, William. "Has the Time Come to Rehabilitate Gestalt Theory?" *Psychological Research* 50, no. 1 (June 1, 1988): 2–6.

Espeland, Wendy. "Legally Mediated Identity: The National Environmental Policy Act and the Bureaucratic Construction of Interests." *Law & Society Review* 28, no. 5 (1994): 1149–79.

Esperdy, Gabrielle. *American Autopia: An Intellectual History of the American Roadside at Midcentury*. Charlottesville, VA: University of Virginia Press, 2019.

———. "Ugly America." *Places Journal*, November 2014.

Facchini, François, and Mickael Melki. "The Democratic Crisis and the Knowledge Problem." *Politics & Policy* 47, no. 6 (2019): 1022–38.

Fairfax, Sally K. "Public Involvement and the Forest Service." *Journal of Forestry* 73, no. 10 (October 1, 1975): 657–59.

Farish, Matthew. "Creating Cold War Climates: The Laboratories of American Globalism." In *Environmental Histories of the Cold War*, edited by Corinna R. Unger and J. R. McNeill, 51–84. Publications of the German Historical Institute. Cambridge: Cambridge University Press, 2010.

Federal Inter-Agency River Basin Committee, Subcommittee on Benefits and Costs. "Proposed Practices for Economic Analysis of River Basin Projects." Washington, D.C.: U.S. Government Printing Office, 1950.

Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1701 et seq.

Federal Power Act of 1964, 16 U.S.C. § 803(a) et seq.

Feimer, Nickolaus R., Kenneth Craik, Richard C. Smardon, and Stephen R. J. Sheppard. "Appraising the Reliability of Visual Impact Assessment Methods." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 286–95. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Feimer, Nickolaus Reinholt. "Personality and Environmental Perception: Alternative Predictive Systems and Implications for Evaluative Judgements." Ph.D. Dissertation, University of California, Berkeley, 1979.

Filippone, Christine. *Science, Technology, and Utopias: Women Artists and Cold War America*. New York: Routledge, 2017.

Findley, Jack Davis, Bernard M. Migler, Joseph V. Brady, College Park University of Maryland, Institute for Behavioral Research, and Walter Reed Army Institute of Research. *A Long-Term*

Study of Human Performance in a Continuously Programmed Experimental Environment. College Park: University of Maryland Institute for Behavioral Research and Walter Reed Army Institute of Research by Dept. of Psychology, University of Maryland, 1963.

Fischer, John L. "Art Styles as Cultural Cognitive Maps." *American Anthropologist* 63, no. 1 (1961): 79–93.

Folkman, William Stewart. *Public Involvement in the Decision-Making Process of Natural Resource Management Agencies: With Special Reference to the Pacific Northwest*. University of Washington. Seattle: Institute of Governmental Research, University of Washington, 1973.

Forest and Rangeland Renewable Resources Planning Act of 1974, 16 U.S.C. § 1601 et seq.

Foucault, Michel. *Security, Territory, Population: Lectures at the Collège de France, 1977-1978*. Edited by Michel Senellart. New York: Picador Palgrave Macmillan, 2009.

———. "Technologies of the Self." In *Technologies of the Self: A Seminar with Michel Foucault*, edited by Luther H. Martin, Huck Gutman, and Patrick H. Hutton. Amherst, MA: University of Massachusetts Press, 1988.

Frampton, Kenneth. "America 1960-1970: Notes on Urban Images and Theory." *Casabella*, no. 359/360 (1971): 25–40.

Frederick, Edward R. *A Specialty Conference on View on Visibility--Regulatory & Scientific: November 26-27, 1979, Brown Palace Hotel, Denver, Colorado [Proceedings]*. APCA Specialty Conference Proceedings. Pittsburgh: APCA, 1979.

Galison, Peter. *Image and Logic: A Material Culture of Microphysics*. Chicago: University of Chicago Press, 1997.

Gans, Herbert J. *The Urban Villagers: Group and Class in the Life of Italian-Americans*. New York: The Free Press of Glencoe, 1962.

Gans, Herbert J. "Urban Vitality and the Fallacy of Physical Determinism." In *People and Plans; Essays on Urban Problems and Solutions*. New York: Basic Books, 1968.

Gibson, James J. *The Ecological Approach to Visual Perception*. Boston, MA: Houghton, Mifflin and Company, 1979.

Gitelman, Lisa. *Always Already New: Media, History, and the Data of Culture*. Cambridge, MA: MIT Press, 2006.

Gobright, Alex Patrick. "'Care Enough to Take Some Action': Storm King, Scenic Hudson, and the Local Citizens Who Saved a Mountain and Started a Movement, 1963-2013." *The Hudson River Valley Review* 30, no. 1 (Autumn 2013).

Gordon, Robert W. "Critical Legal Histories." *Stanford Law Review* 36, no. 1/2 (1984): 57–125.

Gottschaldt, Kurt. "Über den Einfluß der Erfahrung auf die Wahrnehmung von Figuren." *Psychologische Forschung* 8, no. 1 (December 1, 1926): 261–317.

———. "Über den Einfluß der Erfahrung auf die Wahrnehmung von Figuren." *Psychologische Forschung* 12, no. 1 (December 1, 1929): 1–87.

Gough, Harrison G. "A Creative Personality Scale for the Adjective Check List." *Journal of Personality and Social Psychology* 37, no. 8 (1979): 1398–1405.

———. "The Adjective Check List as a Personality Assessment Research Technique." *Psychological Reports* 6 (1960): 107–22.

Gould, Lewis L. *Lady Bird Johnson and the Environment*. University Press of Kansas, 2021.

Graham, James. "The Psychotechnical Architect: Perception, Vocation, and the Laboratory Cultures of Modernism, 1914-1945." Ph.D., Columbia University, 2019.

Gratzer, Miklos A., and Robert D. McDowell. "Adaptation of an Eye Movement Recorder to Esthetic Environmental Mensuration." Research Report 36. Storrs, CT: Storrs Agricultural Experiment Station, University of Connecticut, 1971.

Gray, Brian A., John Ady, and Grant R. Jones. "Evolution of a Visual Impact Model to Evaluate Nuclear Plant Siting and Design Option." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, 491–98. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Gray, Oscar S. "Section 4(f) of the Department of Transportation Act." *Maryland Law Review* 32, no. 4 (1973): 327–408.

Green, David M., and John A. Swets. *Signal Detection Theory and Psychophysics*. Oxford, England: John Wiley, 1966.

Groat, Linda. "Meaning in Post-Modern Architecture: An Examination Using the Multiple Sorting Task." *Journal of Environmental Psychology* 2, no. 1 (March 1, 1982): 3–22.

———. "The Past and Future of Research on Meaning in Architecture: The Case for Architectural Theory as a Basis for Future Research." In *EDRA 1983: Proceedings of the 14th Annual Conference of the Environmental Design Research Association*, edited by Douglas Amadeo, James Griffin, and James Potter, 29–35. Washington, D.C.: EDRA, 1983.

Groat, Linda, and David Canter. "Does Post-Modern Architecture Communicate?" *Progressive Architecture* 60, no. 12 (December 1979): 84–87.

Haffner, Jeanne. "Historicizing the View from Below: Aerial Photography and the Emergence of a Social Conception of Space." *The Proceedings of Spaces of History / Histories of Space: Emerging Approaches to the Study of the Built Environment A Conference at the University of California, Berkeley, April 30 & May 1, 2010*, September 15, 2010.

———. *The View from Above: The Science of Social Space*. Cambridge, MA: MIT Press, 2013.

Hall, Edward T. *The Hidden Dimension*. Garden City, N.Y.: Doubleday, 1966.

Hall, John F., and Richard S. Wasserstrom. "The National Forest Management Act of 1976: Out of the Courts and Back to the Forests." *Environmental Law* 8, no. 2 (1978): 523–38.

Halprin, Lawrence. *Freeways*. New York: Reinhold Publishing Company, 1966.

———. "Motation." *Progressive Architecture* 46, no. 7 (1965): 126–33.

Hammitt, William Edgar. "Visual and User Preference for a Bog Environment." Ph.D. Dissertation, University of Michigan, 1978.

Hart, Stuart L., Gordon A. Enk, and William F. Hornick, eds. *Improving Impact Assessment: Increasing the Relevance and Utilization of Scientific and Technical Information*. Boulder, CO: Westview Press, 1984.

Hartshorne, Hugh, Mark A. May, and Frank K. Shuttleworth. *Studies in the Nature of Character: III. Studies in the Organization of Character*. New York: The Macmillan Company, 1930.

Hartung, Martin. "Collection Building: Making Architecture Public in the Art Market." *OASE*, no. 99: The Architecture Museum Effect (2017): 56–65.

Hatfield, Michael, A. J. LeRoy Balzer, and Roger E. Nelson. "Computer-Aided Visual Assessment in Mine Planning and Design." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 323–27. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Hauck, Forrest Richard. *Cultural Resources Evaluation of South-Central Utah, 1977-1978*. Cultural Resource Series No. 4. Salt Lake City: U.S. Department of the Interior, Bureau of Land Management, Utah, 1979.

Hayek, Friedrich A. "The Use of Knowledge in Society." *The American Economic Review* 35, no. 4 (1945): 519–30.

Hayes, Stanley R. "A Technique for Plume Visualization in Power Plant Siting." *Journal of the Air Pollution Control Association* 29, no. 8 (August 1979): 840–43.

Hays, Samuel P., and Barbara D. Hays. *Beauty, Health, and Permanence: Environmental Politics in the United States, 1955-1985*. Cambridge: Cambridge University Press, 1987.

Hearne, Sarah. "Other Things Visible on Paper: Architectural Writing and Imaging Craftsmanship 1960-87." Ph.D. Dissertation, University of California, Los Angeles, 2020.

Hebb, Donald O., Woodburn Heron, and W.H. Bexton. "The Effect of Isolation Upon Attitude, Motivation, and Thought." In *Fourth Symposium, Military Medicine I*, 163–67. Ottawa: Defence Research Board, 1952.

Hebert, J.A., R. Shikiar, and R.W. Perry. "Valuing the Environment via Bidding Games: A Psychological Perspective." Prepared for the U.S. Nuclear Regulatory Commission. Richland, WA: Pacific Northwest Laboratory, August 1980.

Heffley, Divya Rao. "Vision in Motion: Architectural Space Time Notation and Urban Design, 1950-1970." Ph.D. Dissertation, Brown University, 2011.

Hendee, John C., William R. Catton, Larry D. Marlow, and C. Frank Brockman. *Wilderness Users in the Pacific Northwest: Their Characteristics, Values, and Management Preferences*. USDA Forest Service Research Paper PNW-61. Portland, OR: Pacific Northwest Forest and Range Experiment Station, 1968.

Henle, Mary. "Some New Gestalt Psychologies." *Psychological Research* 51 (1989): 81–85.

Henry, Ronald C. "Psychophysics and Visibility Values." In *Proceedings of the Workshop in Visibility Values, Fort Collins, Colorado, January 28-February 1, 1979*, 74–81. U.S. Department of Agriculture, Forest Service, 1979.

———. "The Application of the Linear System Theory of Visual Acuity to Visibility Reduction by Aerosols." *Atmospheric Environment* 11, no. 8 (1977): 697–701.

———. "The Human Observer and Visibility - Modern Psychophysics Applied to Visibility Degradation." In *A Specialty Conference on View of Visibility - Regulatory and Scientific (November 26-28, Denver, CO)*, 27–35. Air Pollution Control Association, 1979.

Hepburn, Ronald. "Contemporary Aesthetics and the Neglect of Natural Beauty." In *British Analytical Philosophy*, edited by Bernard Williams and Alan Montefiore, 285–310. London: Routledge & Kegan Paul, 1966.

Herman, Ellen. *The Romance of American Psychology: Political Culture in the Age of Experts*. Berkeley: University of California Press, 1995.

Heron, W., W.H. Bexton, and D.O. Hebb. "Cognitive Effects of a Decreased Variation in the Sensory Environment." *American Psychologist* 8 (1953).

Herrnstein, Richard J., and Edwin G. Boring, eds. *A Source Book in the History of Psychology*. Cambridge, MA: Harvard University Press, 1965.

Hertz, Marguerite R. "The 'Popular' Response Factor in the Rorschach Scoring." *The Journal of Psychology* 6, no. 1 (July 1, 1938): 3–31.

Herzog, Thomas R., Stephen Kaplan, and Rachel Kaplan. "The Prediction of Preference for Familiar Urban Places." *Environment and Behavior* 8, no. 4 (1976): 627–45.

Highway Beautification Act of 1965, 23 U.S.C. § 131 et seq.

Hirsch, A. Adler. "Any Bridge at All Is an Intrusion." *The Times*. February 13, 1983.

Hiscock, John W. "Protecting National Park System Buffer Zones: Existing, Proposed, and Suggested Authority." *Journal of Energy Law and Policy* 7, no. 1 (1986).

Hofstadter, Richard. *Anti-Intellectualism in American Life*. New York: Vintage Books, 1963.

Holden, Constance. "Social Science at NSF Needs Pruning, Says Proxmire." *Science* 185, no. 4151 (August 16, 1974): 597.

Holmes, Ronald. "A Study of Vertical and Horizontal Scales for Highway Design Models." Master's Thesis, Kansas State University, 1972.

Homer, William Innes. "Visual Culture: A New Paradigm." *American Art* 12, no. 1 (1998): 6–9.

Hopkins, George. *Proceedings of the National Urban Forestry Conference: November 13-16, 1978, Washington, D.C.* College of Environmental Science and Forestry. Syracuse: State University of New York, College of Environmental Science and Forestry, 1980.

Horkheimer, Max, and Theodor Adorno. "The Culture Industry: Enlightenment as Mass Deception (1947)." In *Dialectic of Enlightenment*. New York: Herder and Herder, 1972.

Houston, Kerr. *The Place of the Viewer: The Embodied Beholder in the History of Art, 1764-1968*. Leiden: Brill, 2019.

Howard, Needles, Tammen & Bergendoff. *Howard, Needles, Tammen & Bergendoff: Consulting Engineers.* New York: Howard, Needles, Tammen & Bergendoff, 1963.

———. *Shreveport Metropolitan Plan and Transportation Study*. Kansas City, 1968.

Hunt, Morton M. "Users and Misusers of Psychology." In *The Story of Psychology*, 599–633. New York: Anchor Books, 1993.

Huntington, David C. "Frederic Edwin Church, 1826-1900: Painter of the Adamic New World Myth." Ph.D. Dissertation, Yale University, 1960.

Hyde, Timothy. "Striking and Imposing Beauty": On the Evidence of Aesthetic Valuation." In *Writing Architectural History: Evidence and Narrative in the Twenty-First Century*, edited by Aggregate Architectural History Collective. Pittsburgh: University of Pittsburgh Press, 2021.

———. *Ugliness and Judgment: On Architecture in the Public Eye*. Princeton, NJ: Princeton University Press, 2019.

Indiana University School of Public and Environmental Affairs and National Science Foundation. *A Study of Ways to Improve the Scientific Content and Methodology of Environmental Impact Analysis: Final Report to the National Science Foundation*. Advanced Studies in Science, Technology and Public Policy. Bloomington, IN: School of Public and Environmental Affairs, Indiana University, 1982.

"Interior Able To Protect Fully National Parks Without Integral Vista Concept, Hodel Says." Department of the Interior News Release, October 25, 1985.

International Co-ordinating Council of the Programme on Man and the Biosphere, ed. *Expert Panel on Project 13: Perception of Environmental Quality, Final Report*. MAB Report, no. 9. Paris: UNESCO, 1973.

Isenstadt, Sandy. "Contested Contexts." In *Site+Matters: Design Concepts, Histories, and Strategies*, edited by Carol J. Burns and Andrea Kahn. New York: Routledge, 2005.

Ittelson, William H., Harold M. Proshansky, Leanne G. Rivlin, and Gary H. Winkel, eds. *An Introduction to Environmental Psychology*. New York: Holt, Rinehart and Winston, Inc., 1974.

Iverson, Wayne D. "And That's About the Size of It: Visual Magnitude as a Measurement of the Physical Landscape." *Landscape Journal* 4, no. 1 (Spring 1985): 14–22.

Ivory, Lee. "Bridge Film to Be Shown Today." *The Times*. January 27, 1983.

Jackson, J.B. *Landscapes: Selected Writings of J. B. Jackson*. Edited by Ervin H. Zube. Amherst: University of Massachusetts Press, 1970.

Jacobs, Jane. *The Death and Life of Great American Cities*. New York: Random House, 1961.

———. "The Miniature Boom." *Architectural Forum* 108 (May 1958).

Jacobs, Peter, and Douglas Way. *Visual Analysis of Landscape Development*. Cambridge, MA: Harvard University, Graduate School of Design, Department of Landscape Architecture, 1968.

Jameson, Fredric. "Postmodernism, or The Cultural Logic of Late Capitalism." *New Left Review*, no. I/146 (August 1, 1984): 53–92.

Janke, Rolf. *Architekturmodelle*. Stuttgart: Hatje Cantz, 1962.

Janssens, Jan, and Rikard Küller. "Utilizing an Environmental Simulation Laboratory in Sweden." In *Foundations for Visual Project Analysis*, edited by Richard C. Smardon, James F. Palmer, and John P. Felleman. New York: John Wiley & Sons, 1986.

Jarzombek, Mark. *The Psychologizing of Modernity: Art, Architecture and History*. Cambridge, UK: Cambridge University Press, 1999.

Johnson, Christine G. *Mineral King Visual Analysis*. San Francisco, CA: U.S. Department of Agriculture, Forest Service, 1974.

Johnson, Clark D., Douglas A. Latimer, Robert W. Bergstrom, and Henry Hogo. "User's Manual for the Plume Visibility Model (PLUVUE)." Prepared for Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. San Rafael, CA: Systems Applications, Inc., November 1980.

Johnson, Katherine M. "Captain Blake versus the Highwaymen: Or, How San Francisco Won the Freeway Revolt." *Journal of Planning History* 8, no. 1 (February 1, 2009): 56–83.

Johnson, Lady Bird. *A White House Diary*. New York: Holt, Rinehart and Winston, Inc., 1970.

Jones & Jones. *I-220: Cross Lake Visual Impact Assessment*, 1983.

———. *Visual Impact Assessment for Highway Projects*. Edited by American Society of Landscape Architects and Federal Highway Administration. Washington, D.C.: Federal Highway Administration, 1981.

Jones & Jones, Grant R. Jones, Brian Gray, John Ady, Battelle Pacific Northwest Laboratory, and U.S. Nuclear Regulatory Commission. *Visual Impact Study: Statement of Findings, Alternative Closed Cycle Cooling Systems, Indian Point Nuclear Generating Plant*. Seattle: Jones & Jones, 1975.

Jones, Grant R. *Design as Ecogram*. Seattle: University of Washington, College of Architecture and Urban Planning, 1975.

Jones, Grant R., Ilze Jones, Brian A. Gray, Bud Parker, Jon C. Coe, John B. Burnham, and Neil M. Geitner. "A Method for the Quantification of Aesthetic Values for Environmental Decision Making." *Nuclear Technology* 25, no. 4 (April 1, 1975): 682–713.

Joseph, David. "Summary of Air Quality and Visibility Impact Analyses for the Proposed Alton Surface Coal Mine." Denver, CO: Environmental Protection Agency, Region VIII, Air Programs Branch, 1980.

Kahneman, Daniel, Paul Slovic, and Amos Tversky. *Judgment under Uncertainty: Heuristics and Biases*. Cambridge: Cambridge University Press, 1982.

Kamnitzer, Peter. *An Urban UCLA Laboratory*. Los Angeles: School of Architecture and Urban Planning, University of California, Los Angeles, 1966.

———. *Computers and Urban Problems*. Los Angeles: School of Architecture and Urban Planning, University of California, Los Angeles, 1977.

Kaplan, Rachel. "A Methodology for Simultaneously Obtaining and Sharing Information." In *Assessing Amenity Resource Values*, 58–66. USDA Forest Service General Technical Report RM-68, 1979.

———. "A Strategy for Dimensional Analyses." In *Man-Environment Interactions: Evaluation and Applications. Proceedings of the Environmental Design Research Association Conference No.5*, edited by Daniel H. Carson, 66–68. Stroudsburg, PA: Dowden, Hutchinson and Ross, 1975.

———. "Dominant and Variant Values in Environmental Preference." In *Environmental Preference and Landscape*, edited by Ann S. Devlin and Sally L. Taylor. New London, CT: Connecticut College, 1984.

———. "Down by the Riverside: Informational Factors in Waterscape Preference." In *Proceedings: River Recreation Management and Research Symposium (January 24-27, 1977, Minneapolis, Minnesota)*, 285–89. USDA Forest Service General Technical Report NC-28. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station, 1977.

———. "Physical Models in Decision Making for Design: Theoretical and Methodological Issues." edited by Robert W. Marans and Daniel Stokols. New York: Plenum Press, 1993.

———. "Some Methods and Strategies in the Prediction of Preference." Stroudsburg, PA: Dowden, Hutchinson and Ross, 1975.

———. "The Dimensions of the Visual Environment: Methodological Considerations." In *Environmental Design: Research and Practice*, edited by William J. Mitchell. Washington, D.C.: Environmental Design Research Association, 1972.

———. "Visual Resources and the Public: An Empirical Approach." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 209–16. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Kaplan, Rachel, and Eugene J. Herbert. "Cultural and Sub-Cultural Comparisons in Preferences for Natural Settings." *Landscape and Urban Planning* 14 (January 1, 1987): 281–93.

Kaplan, Rachel, and Stephen Kaplan. *The Experience of Nature: A Psychological Perspective*. Cambridge; New York: Cambridge University Press, 1989.

Kaplan, Rachel, and Janet Frey Talbot. "Ethnicity and Preference for Natural Settings: A Review and Recent Findings." *Landscape and Urban Planning* 15, no. 1 (June 1, 1988): 107–17.

Kaplan, Stephen. "Adaptation, Structure and Knowledge." In *Environmental Knowing: Theories, Perspectives and Methods*, edited by Gary T. Moore and Reginald G. Golledge, 32–45. Stroudsburg, PA: Dowden, Hutchinson and Ross, 1976.

———. "Adaptation, Structure, and Knowledge: A Biological Perspective." In *Environmental Design: Research and Practice*, edited by William J. Mitchell. Washington, D.C.: Environmental Design Research Association, 1972.

———. "Cognitive Maps, Human Needs and the Designed Environment." In *Environmental Design Research*, edited by Wolfgang F.E. Preiser. Stroudsburg, PA: Dowden, Hutchinson and Ross, 1973.

———. "Perception and Landscape: Conceptions and Misconceptions." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 241–48. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Kaplan, Stephen, and Rachel Kaplan. *Cognition and Environment: Functioning in an Uncertain World*. New York: Praeger, 1983.

———. *Humanscape: Environments for People*. North Scituate, MA: Duxbury Press, 1978.

———. "The Visual Environment: Public Participation in Design and Planning." *Journal of Social Issues* 45, no. 1 (1989): 59–86.

Kaplan, Stephen, Rachel Kaplan, and John S. Wendt. "Rated Preference and Complexity for Natural and Urban Visual Material." *Perception & Psychophysics* 12, no. 4 (1972): 354–56.

Kaplan, Stephen, and John S. Wendt. "Preference and the Visual Environment: Complexity and Some Alternatives." In *Environmental Design: Research and Practice*, edited by William J. Mitchell. Stroudsburg, PA: Dowden, Hutchinson and Ross, 1972.

Kapp, Ernst. *Elements of a Philosophy of Technology: On the Evolutionary History of Culture*. Edited by Jeffrey West Kirkwood and Leif Weatherby. Translated by Lauren K. Wolfe. Minneapolis, MN: University of Minnesota Press, 2018.

Kauffman, Jordan. "Architecture in the Art Market: The Max Protetch Gallery." *Journal of Architectural Education* 70, no. 2 (July 2, 2016): 257–68.

———. *Drawing on Architecture: The Object of Lines, 1970–1990*. Cambridge, MA: MIT Press, 2019.

Kent, Brian, B. Bruce Bare, Richard C. Field, and Gordon A. Bradley. "Natural Resource Land Management Planning Using Large-Scale Linear Programs: The USDA Forest Service Experience with FORPLAN." *Operations Research* 39, no. 1 (February 1991): 13–27.

Kenworthy, N. Paul. "The Kenworthy Snorkel Camera System Today." *American Cinematographer* 54, no. 8 (August 1973).

———. "The Development Of Kenworthy's Snorkel Camera System." *Back Stage*, May 6, 1988.

———. "The Techniques of Filming with the Snorkel Camera." *American Cinematographer*, September 1967.

Kenworthy, Norman Paul, and William R. Latady. Motion Picture Camera System. US3437748 A, filed November 24, 1967, and issued April 8, 1969.

Kesner, Ladislav. "Warburg/Arnheim Effect: Linking the Cultural/Social and Perceptual Psychology of Art." *Journal of Art Historiography* 11, no. 2 (2014).

Kihss, Peter. "New York Power Agency Drops Nuclear-Energy Project Upstate." *The New York Times*, April 6, 1979.

Kimura Sōhachi, and Suzuki Yoshikazu. *銀座界隈 / アルバム・銀座八丁 (Ginza Kaiwai / Arubamu Ginza Hatchō)*. Tōkyō: Tōhō Shobō, 1954.

Kjaer, Bodil. "Progress Towards an American Full Scale Environmental Design Simulation Laboratory." In *Proceedings of the 1st European Full-Scale Workshop Conference, Copenhagen (Denmark) 15-16 January 1987*, edited by Peder Duelund Mortensen and Karen Zahle, 45–51. Copenhagen: Boliglaboratoriets Forlag, 1987.

Kling, Vincent. “The Architect as Film Maker.” *AIA Journal*, February 1971.

Knoblauch, Joy. *The Architecture of Good Behavior: Psychology and Modern Institutional Design in Postwar America*. University of Pittsburgh Press, 2020.

Kotler, Philip. “Atmospherics as a Marketing Tool.” *Journal of Retailing* 49, no. 4 (Winter 1973): 48–64.

Krutilla, John V., and Otto Eckstein. *Multiple Purpose River Development; Studies in Applied Economic Analysis*. Baltimore, MD: Johns Hopkins Press, 1958.

Küller, Rikard. “Rumsperception.” Arebetsrapport 1. Lund: Lund University of Technology, Architecture Section, 1971.

Kuraya Mika, and Ueseki Sen, eds. *路上 (Rojō) / On the Road*. Tōkyō: Tōkyō Kokuritsu Kindai Bijutsukan, 2011.

Lamm, W. Thomas, and Philip H. Lewis. *The 360⁰ Theatre: An Environmental Planning Communications Tool*. Madison, WI: Environmental Awareness Center, University of Wisconsin-Madison, 1977.

Lampland, Martha, and Susan Leigh Star, eds. *Standards and Their Stories: How Quantifying, Classifying, and Formalizing Practices Shape Everyday Life*. Ithaca, NY: Cornell University Press, 2009.

Larsen, Otto N. *Milestones and Millstones: Social Science at the National Science Foundation, 1945-1991*. Transaction Publishers, n.d.

Latimer, Douglas A., Robert W. Bergstrom, Stanley R. Hayes, Mei-Kao Liu, John H. Seinfeld, Gary Z. Whitten, Michael A. Wojcik, and Martin J. Hillyer. “The Development of Mathematical Models for the Prediction of Anthropogenic Visibility Impairment.” Prepared for U.S. Environmental Protection Agency. San Rafael, CA: Systems Applications, Incorporated, 1978.

Latimer, Douglas A., and Terry C. Daniel. “Preliminary Results of a Study of Human Judgment of Visual Air Quality.” In *A Specialty Conference on View of Visibility - Regulatory and Scientific (November 26-28, Denver, CO)*, 11–26. Air Pollution Control Association, 1979.

Latimer, Douglas A., Stanley R. Hayes, and Clark D. Johnson. “Visual Impacts of Particulate Emissions From the Proposed Alton Coal Project.” Prepared for U.S. Environmental Protection Agency, Region VIII, Air Programs Branch. San Rafael, CA: Systems Applications, Incorporated, September 23, 1980.

Latimer, Douglas A., and Robert G. Ireson. “Workbook for Estimating Visibility Impairment.” Prepared for Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. San Rafael, CA: Systems Applications, Inc., November 1980.

Lattanzio, Richard K. *Clean Air Act: A Summary of the Act and Its Major Requirements*. Washington, D.C.: Congressional Research Service, 2022.

Lavin, Sylvia. “A Cloudburst of Happiness, or Modernism by Other Means.” In *Architecture Itself and Other Postmodernization Effects*. Montreal: Canadian Centre for Architecture, 2020.

———. “A Report on Little Tools of Knowledge.” In *Architecture Itself and Other Postmodernization Effects*. Montreal: Canadian Centre for Architecture, 2020.

———. *Architecture Itself and Other Postmodernization Effects*. Montreal: Canadian Centre for Architecture, 2020.

Lavin, Sylvia, and UCLA Curatorial Project. *The New Creativity: Man and Machines*. Exhibition at MAK Center for Art and Architecture, Los Angeles, CA, June 11–August 16, 2015.

Lawrence, Roderick J. “A ‘Living-Laboratory’ for Home Design.” *Batiment International, Building Research and Practice* 10, no. 3 (January 1, 1982): 152–152.

———. “Laypeople as Architectural Designers.” *Leonardo* 16, no. 3 (1983): 232–36.

Leeuwen, Hendrik van, and Wim van Ingen. “Ontwikkeling En Gebruik van de Entheskoop.” Wageningen, Netherlands: Afdeling Wonen, Landbouwhogeschool, 1965.

———. “Ontwikkeling En Gebruik van de Entheskoop.” Wageningen, Netherlands: Vakgroep Wonen, Landbouwhogeschool, 1968.

Leighty, Leighton L. “Aesthetics as a Legal Basis for Environmental Control.” *Wayne Law Review* 17, no. 5 (1971): 1347–96.

Leith, Emmett N., and Juris Upatnieks. “Photography by Laser.” *Scientific American* 212, no. 6 (1965): 24–35.

Lemkow, Daniel Zwi. “Development of a Digital Terrain Simulator for Short-Term Forest Resource Planning.” University of British Columbia, 1977.

Leonard, Jerry D., ed. *Legal Studies as Cultural Studies: A Reader in (Post)Modern Critical Theory*. Albany, NY: State University of New York Press, 1995.

Leopold, Luna B. “Landscape Esthetics.” *Ekistics* 29, no. 173 (1970): 271–77.

———. “Landscape Esthetics: How to Quantify the Scenics of a River Valley.” *Natural History*, October 1969, 37–45.

———. *Quantitative Comparison of Some Aesthetic Factors Among Rivers*. Washington, D.C.: U.S. Geological Survey, 1969.

Leopold, Luna B., and Maura O’Brien Marchand. “On the Quantitative Inventory of the Riverscape.” *Water Resources Research* 4, no. 4 (1968): 709–17.

Levin, David R. *Scenic Byways*. Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1988.

———. "The 1966 Scenic Roads Proposal." Report to Citizens' Advisory Committee on Recreation and Natural Beauty. Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, December 12, 1967. BANC MSS 83/165 c, Carton 8, Folder 49. Donald Appleyard Papers, Bancroft Library, University of California, Berkeley.

Lewin, Kurt. *A Dynamic Theory Of Personality*. New York: McGraw-Hill Book Company, Inc., 1935.

———. *Field Theory in Social Science: Selected Theoretical Papers*. Edited by Dorwin Cartwright. New York: Harper and Row, 1951.

Lewis, Tom. *Divided Highways: Building the Interstate Highways, Transforming American Life*. Ithaca: Cornell University Press, 2013.

Library of Congress, and Genevieve Johanna Knezo. *The Psychological and Social Sciences Research Support Programs of the National Science Foundation: A Background Report*. House Committee on Science and Technology, No. 95-I. Washington, D.C.: U.S. Government Printing Office, 1977.

Likert, Rensis. "A Technique for the Measurement of Attitudes." *Archives of Psychology* 22, no. 140 (1932): 5–55.

"Lilliputian's-Eye Viewer Puts You Inside Tiny Model." *Popular Science* 185, no. 2 (August 1964): 85.

Lilly, John C. *The Deep Self: Profound Relaxation and the Tank Isolation Technique*. New York: Simon and Schuster, 1977.

Litton, R. Burton. "Descriptive Approaches to Landscape Analysis." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 77–87. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

———. *Forest Landscape Description and Inventories - A Basis for Land Planning and Design*. Res. Paper PSW-RP-049. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1968.

———. *Landscape Control Points: A Procedure for Predicting and Monitoring Visual Impacts*. USDA Forest Service Research Paper PSW 91. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1973.

———. "Visual Vulnerability of Forest Landscapes." In *Outdoor Recreation Research: Applying the Results. Papers from a Workshop Held by the USDA Forest Service at Marquette, Michigan, June 19-21, 1973*, 87–91. USDA Forest Service General Technical Report NC-9. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station, 1974.

———. *Visual Vulnerability of the Landscape: Control of Visual Quality*. Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1984.

Litton, R. Burton, and Kenneth H. Craik. "Aesthetic Dimensions of the Landscape." Berkeley, CA: Department of Landscape Architecture, University of California, 1969.

Litton, R. Burton, and Robert H. Twiss. "The Forest Landscape: Some Elements of Visual Analysis." In *Proceedings of the Society of American Foresters Meeting: Resources, Foresters, and Policies for Progress*. Washington, D.C.: Society of American Foresters, 1967.

Locasso, Richard M. "The Influence of a Beautiful vs. an Ugly Interior Environment on Selected Behavioral Measures." Ph.D. Dissertation, Pennsylvania State University, 1976.

Louisiana Department of Highways. *Draft Environmental Impact Statement: I-220, Shreveport Bypass, Caddo/Bossier Parishes*. Baton Rouge, Louisiana, 1971.

Louisiana Environmental Soc., Inc. v. Brinegar 407 F. Supp. 1309 (W.D. La. 1976).

Louisiana Environmental Soc., Inc. v. Brinegar, 513 F. Supp. 179 (W.D. La. 1981).

Louisiana Environmental Soc., Inc. v. Coleman 524 F. 2d 930 (5th Cir. 1975).

Louisiana Environmental Soc., Inc. v. Dole, 707 F. 2d 116 (5th Cir. 1983).

Lowenthal, David. *Finding Valued Landscapes*. Environmental Perception Research, Working Paper No. 4. Toronto: University of Toronto, 1978.

Lowenthal, David, and Marquita Riel. *Milieu and Observer Differences in Environmental Associations*. New York: American Geographical Society, 1972.

Loyer, François. "Pour Bien Lire Une Maquette d'Architecture: Le Relatoscope." *Communication & Langages* 23, no. 1 (1974): 56–75.

Lugli, Emanuele. *The Making of Measure and the Promise of Sameness*. University of Chicago Press, 2019.

Lynch, Kevin. *The Image of the City*. Cambridge, MA: The MIT Press, 1960.

Lyotard, Jean-François. *The Postmodern Condition: A Report on Knowledge*. Manchester: Manchester University Press, 1979.

MacKinnon, Donald W. "The Structure of Personality." In *Personality and the Behavior Disorders: A Handbook Based on Experimental and Clinical Research*, edited by Joseph McVicker Hunt, 1:3–48. New York: The Ronald Press Company, 1944.

Maffly, Brian. "Judge Taps Brakes on Utah Coal Mine Expansion, Orders Climate Change Analysis." *The Salt Lake Tribune*, March 27, 2021.

Malm, William C. *Introduction to Visibility*. Fort Collins, Colorado: National Park Service, Air and Water Quality Division, Air Research Branch, 1983.

Malm, William C., Karen K. Leiker, and John V. Molenar. "Human Perception of Visual Air Quality." In *A Specialty Conference on View of Visibility - Regulatory and Scientific (November 26-28, Denver, CO)*, 36–69. Air Pollution Control Association, 1979.

Manning, Robert E. "Coming of Age: History and Trends in Outdoor Recreation Research." In *Trends in Outdoor Recreation, Leisure and Tourism*, edited by William C. Gartner and David W. Lime, 121–30. Wallingford, UK: CABI Publishing, 2000.

Marcus, Clare Cooper. *Easter Hill Village: Some Social Implications of Design*. New York: Free Press, 1975.

Markelin, Antero. "Erfahrungen Bei Der Anwendung Sensorischer Simulation Im Städtebau." *Bauwelt* 25 (July 1977): 872–78.

Markelin, Antero, and Bernd Fahle. *Umweltsimulation: sensorische Simulation im Städtebau*. Stuttgart: Krämer, 1979.

Martin, Reinhold. "Environment, c. 1973." *Grey Room*, no. 14 (2004): 79–101.

Marx, Leo. *The Machine in the Garden: Technology and the Pastoral Ideal in America.* Oxford: Oxford University Press, 1964.

Maslow, Abraham H., and Norbett L. Mintz. "Effects of Esthetic Surroundings: I. Initial Effects of Three Esthetic Conditions Upon Perceiving 'Energy' and 'Well-Being' in Faces." *The Journal of Psychology* 41 (April 1, 1956): 247–54.

Massey, Jonathan. "Review of Vincent Scully, Modern Architecture and Other Essays, Ed. Neil Levine." *Caa.Reviews*, July 8, 2004. http://www.caareviews.org/reviews/660.

Masuda, Yoneji. *The Information Society as Post-Industrial Society*. Tokyo: Institute for the Information Society, 1980.

Max, Fourestier, Gladu Amedee Joseph, and Vulmiere Jacques Claude. Endoscope. US2699770 A, filed May 9, 1952, and issued January 18, 1955.

Mazuzan, George T. "'Good Science Gets Funded…' The Historical Evolution of Grant Making at the National Science Foundation." *Knowledge* 14, no. 1 (September 1, 1992): 63–90.

———. *The National Science Foundation: A Brief History*. Washington, D.C.: National Science Foundation, 1988.

McAdams, Dan P. "A Conceptual History of Personality Psychology." In *Handbook of Personality Psychology*, edited by R. Hogan, J. Johnson, and S. Briggs, 3–39. San Diego, CA: Academic Press, 1997.

McCloskey, Michael. "Litigation and Landscape Esthetics." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 674–75. Gen.

Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

McDaniel, James B., ed. *Environmental Law and Transportation*. Selected Studies in Transportation Law, Volume 3. Washington, D.C.: Transportation Research Board of the National Academies, 2010.

McGaughey, Robert J., and Roger H. Twito. *VISUAL and SLOPE: Perspective and Quantitative Representation of Digital Terrain Models*. General Technical Report PNW- GTR-214. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 1988.

McGinley, Patrick. "The Surface Mining Control and Reclamation Act: Ten Years of Promise and Problems for the National Parks." In *Our Common Lands: Defending The National Parks*, edited by David J. Simon, 465–98. Washington, D.C.: Island Press, 1988.

McKean, Roland N. *Efficiency in Government Through Systems Analysis: With Emphasis on Water Resources Development*. New York: Wiley, 1958.

McKechnie, George. "Simulation Techniques in Environmental Psychology." In *Perspectives on Environment and Behavior: Theory, Research, and Applications*, edited by Daniel Stokols. New York: Plenum Press, 1976.

McKechnie, George E. *ERI Manual: Environmental Response Inventory*. Palo Alto, CA: Consulting Psychologists Press, 1974.

———. *Leisure Activities Blank*. Palo Alto, CA: Consulting Psychologists Press, 1975.

———. "Measuring Environmental Dispositions with the Environmental Response Inventory." In *EDRA 2: Proceedings of the Second Annual Environmental Design Research Association Conference*, edited by John Archea and Charles M. Eastman, 320–26. Stroudsburg, PA: Dowden, Hutchinson & Ross, 1970.

———. "The Psychological Structure of Leisure: Past Behavior." *Journal of Leisure Research* 6, no. 1 (January 1, 1974): 27–45.

McKenna, Christopher D. "Creating the Contractor State: Consultants in the American Federal Government." In *The World's Newest Profession: Management Consulting in the Twentieth Century*, 80–110. New York: Cambridge University Press, 2006.

———. "The Origins of Modern Management Consulting." *Business and Economic History* 24, no. 1 (1995): 51–58.

McLuhan, Marshall. *Understanding Media*. New York: McGraw-Hill, 1964.

McMahon, Catherine F. "Predictive Machines: Data, Computer Maps, and Simulation." In *A Second Modernism: MIT, Architecture, and the "Techno-Social" Moment*, edited by Arindam Dutta. Cambridge, MA: MIT Press, 2013.

McNeill, J.R. "Observations on the Nature and Culture of Environmental History." *History and Theory* 42, no. 4 (2003): 5–43.

Meehl, Paul E. "The Dynamics of 'Structured' Personality Tests." *Journal of Clinical Psychology* 1, no. 4 (1945): 296–303.

Meskimmon, Marsha. "Visuality: The New, New Art History?" *Art History* 20 (June 1997).

Mills, C. Wright. *The Power Elite*. New York: Oxford University Press, 1956.

Mintz, Norbett L. "Effects of Esthetic Surroundings: II. Prolonged and Repeated Experience in a 'Beautiful' and an 'Ugly' Room." *The Journal of Psychology* 41 (1956): 459–66.

Mitchell, W.J.T. "Showing Seeing: A Critique of Visual Culture." *Journal of Visual Culture* 1, no. 2 (2002).

———. "What Is Visual Culture?" In *Meaning in the Visual Arts: Views from the Outside; A Centennial Commemoration of Erwin Panofsky (1892-1968)*, edited by Irving Lavin. Princeton, NJ: Princeton University Press, 1995.

Mohl, Raymond A. "Stop the Road: Freeway Revolts in American Cities." *Journal of Urban History* 30, no. 5 (July 1, 2004): 674–706.

———. "The Interstates and the Cities: Highways, Housing, and the Freeway Revolt." Civil Rights Research. Washington, D.C.: Poverty & Race Research Action Council, 2002.

Monchaux, Nicholas de. "Rebel Plans: Apple, Star Wars, and Architecture at Bay." Research Project, 2018.

Montgomery, Jim. "Texas and the Cross Lake Bridge." *The Times*. June 4, 1978.

———. "The Bridge Joke." *The Times*. January 30, 1983.

Moore, Gary T., and Reginald G. Golledge, eds. *Environmental Knowing: Theories, Research and Methods*. Stroudsburg, PA: Dowden, Hutchinson and Ross, 1976.

Morse, Kathryn. "There Will Be Birds: Images of Oil Disasters in the Nineteenth and Twentieth Centuries." *Journal of American History* 99, no. 1 (June 1, 2012): 124–34.

MOSAIC: A System for Displaying a Proposed Modification Before Its Impact on the Environment. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, 1977.

Moulton, D.G., A. Turk, and J.W. Johnston. *Methods In Olfactory Research*. London: Academic Press, 1975.

Multiple-Use Sustained-Yield Act of 1960, 16 U.S.C. § 528 et seq.

Murray, Henry A. *Explorations in Personality*. Oxford: Oxford University Press, 1938.

Museum of Modern Art. "Roads, New Exhibition at Museum of Modern Art." Press Release, 1961.

Muzaffar, M. Ijlal. "Fuzzy Images: The Problem of Third World Development and the New Ethics of Open-Ended Planning at the MIT-Harvard Joint Center for Urban Studies." In *A Second Modernism: MIT, Architecture, and the "Techno-Social" Moment*, edited by Arindam Dutta. Cambridge, MA: MIT Press, 2013.

Myklestad, Erik, and J. Alan Wagar. *PREVIEW: Computer Assistance for Visual Management of Forested Landscapes*. USDA Forest Service Research Paper NE-555. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, 1976.

National Cartographic Information Center. *Digital Terrain Tapes*. U.S. Department of the Interior, Geological Survey, 1977.

National Environmental Policy Act of 1969, 42 U.S.C. § 4331 et seq.

National Forest Management Act of 1976, 16 U.S.C. § 1600 et seq.

"National Forest System Land and Resource Management Planning: Proposed Rules." In *Federal Register*, Vol. 44, no. 88, 1979.

National Park Service. *Air Quality in the National Parks: A Summary of Findings from the National Park Service Air Quality Research and Monitoring Program*. U.S. Department of the Interior, National Park Service, Air Quality Division, 1988.

———. "Identification of Integral Vistas Associated With Federal Class I Areas; Guideline Availability and Preliminary List." *Federal Register* 46, no. 10 (January 15, 1981).

———. "Results of National Park Service Visitor Survey Conducted At Bryce Canyon National Park Summer 1980." Washington, D.C.: U.S. Department of the Interior, 1980. Nina Dougherty papers, 1949-2010, Accn 2002, Box 73, Folder 5. Special Collections, J. Willard Marriott Library, The University of Utah.

———. *Statement for Management: Bryce Canyon National Park*. Washington, D.C.: U.S. Department of the Interior, 1983.

National Research Council, Commission on Natural Resources, Planning Committee on Environmental Indices. *Planning for Environmental Indices*. Washington, D.C.: National Academy of Sciences and National Academy of Engineering, 1975.

National Science Foundation. *Grants for Scientific Research*. Washington, D.C.: National Science Foundation, 1963.

———. *Grants for Scientific Research*. NSF 78–41. Washington, D.C.: National Science Foundation, 1978.

———. *National Science Foundation Grants and Awards for Fiscal Year 1972*. Washington, D.C.: U.S. Government Printing Office, 1973.

———. *Summary of Awards in Energy-Related General Research*. Washington, D.C.: National Science Foundation, 1974.

New York Times. "Judge Rebuffs Interior Secretary on Bryce Canyon Mining Request," January 19, 1982, sec. A.

Newhall, Beaumont. *Airborne Camera; the World from the Air and Outer Space*. New York: Hastings House, 1969.

Newman, Oscar. *Defensible Space; Crime Prevention Through Urban Design*. New York: Macmillan Publishing, 1973.

Nicholas, Lynn H. *The Rape of Europa: The Fate of Europe's Treasures in the Third Reich and the Second World War*. New York: Alfred A. Knopf, 1994.

Nickerson, Devon B. *Perspective Plot: An Interactive Analytical Technique for the Visual Modelling of Land Management Activities*. Portland, OR: U.S. Department of Agriculture, Forest Service, Division of Timber Management, 1980.

———. "SIGHTLINE, PERSPECTIVE PLOT, SCOPE: Three Desktop Computer Programs for Forest Landscape Design." *Journal of Forestry* 77, no. 1 (January 1, 1979): 14–17.

No More Tall Stories. Color Video. New York: Channel One, 1986.

Omang, Joanne. "Bryce Canyon Coal Mining Compromised." *Washington Post*, December 17, 1980.

———. "Watt Is Rebuffed In Bid to Alter Mining Decision." *Washington Post*, January 19, 1982.

Omuka, Toshiharu. "Futurism in Japan, 1909–1920." In *International Futurism in Arts and Literature*, edited by Günter Berghaus, 244–70. Berlin: Walter de Gruyter, 2000.

Organic Act of 1897, 16 U.S.C. § 473 et seq.

Ostrov, Jerome. "Visibility Protection Under the Clean Air Act: Preserving Scenic and Parkland Areas in the Southwest." *Ecology Law Quarterly* 10, no. 3 (1982): 397–454.

Ott, Wayne R. *Water Quality Indices: A Survey of Indices Used in the United States*. U.S. Environmental Protection Agency, Office of Research and Development, Office of Monitoring and Technical Support, 1978.

Park, David W., and Jefferson Pooley. *The History of Media and Communication Research: Contested Memories*. New York: Peter Lang, 2008.

Parreno, Christian. "A Laboratory for Boredom." *Journal of Architectural Education* 73, no. 1 (January 2, 2019): 107–9.

Patton, Vickie, and Bruce Polkowsky. "The EPA's Regional Haze Proposal: Protecting Visibility in National Parks and Wilderness Areas." *Tulane Environmental Law Journal* 11, no. 2 (1998): 299–330.

Peelle, Elizabeth. "Socioeconomic Impact Assessment and Nuclear Power Plant Licensing, Greene County, New York," 30. The Institute on Man and Science, Rensselaerville, New York, 1980.

Peterson, Cass. "National Parks Not Always A Breath Of Fresh Air." *Washington Post*, July 8, 1987.

Petrich, Carl H. "Aesthetic Impact of a Proposed Power Plant on an Historic Wilderness Landscape." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 477–84. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

———. "Assessing Aesthetic Impacts in Siting a Nuclear Power Plant: The Case of Greene County, New York." *Environmental Impact Assessment Review* 3, no. 4 (1982): 311–32.

———. "EIA Scoping for Aesthetics: Hindsight from the Greene County Nuclear Power Plant EIS." In *Improving Impact Assessment: Increasing the Relevance and Utilization of Scientific and Technical Information*, edited by Stuart L. Hart, Gordon A. Enk, and William F. Hornick. Boulder, CO: Westview Press, 1984.

———. "Science and the Inherently Subjective: The Evolution of Aesthetic Assessment Since NEPA." In *Environmental Analysis: The NEPA Experience*, edited by Stephen G. Hildebrand and J. B. Cannon. Boca Raton, FL: Lewis Publishers, 1993.

Pitt, David G., and Ervin H. Zube. "The Q-Sort Method: Use in Landscape Assessment Research and Landscape Planning." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 227–34. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Porteous, J. Douglas. *Environmental Aesthetics: Ideas, Politics and Planning*. London: Routledge, 1996.

Porter, Theodore M. *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton, NJ: Princeton University Press, 1995.

Porter, Tom. *The Architect's Eye: Visualization and Depiction of Space in Architecture*. London: E & FN Spon, 1997.

Powell, Dana E. *Landscapes of Power: Politics of Energy in the Navajo Nation*. Durham, NC: Duke University Press, 2018.

Prochnau, Bill, and Valarie Thomas. "The Watt Controversy." *Washington Post*, June 30, 1981.

Proshansky, Harold M., William H. Ittelson, and Leanne G. Rivlin. *Environmental Psychology: Man and His Physical Setting*. New York: Holt, Rinehart and Winston, Inc., 1970.

Proshansky, Harold M., and Timothy O'Hanlon. "Environmental Psychology: Origins and Development." In *Perspectives on Environment and Behavior: Theory, Research, and Applications*, edited by Daniel Stokols, 101–29. Boston, MA: Springer US, 1977.

Pulsa. "The City as an Artwork." In *Arts of the Environment*, edited by György Kepes. New York: George Braziller, 1972.

Quade, E.S. "A History of Cost-Effectiveness." Santa Monica, CA: Rand Corporation, 1971.

Quintavalle, Arturo Carlo, and Robert Julian. "Arnheim and the History of Art." *Salmagundi*, no. 78/79 (1988): 62–69.

Rabinowitz, Carla B., and Robert E. Coughlin. *Analysis of Landscape Characteristics Relevant to Preference*. Discussion Paper No. 38. Philadelphia: Regional Science Research Institute, 1970.

Rancière, Jacques. *Dissensus: On Politics and Aesthetics*. Translated by Steven Corcoran. London: Bloomsbury Academic, 2015.

———. *The Politics of Aesthetics: The Distribution of the Sensible*. London: Continuum, 2004.

Randall, Alan. "The Economic Value of Atmospheric Visibility." In *Proceedings of the Workshop in Visibility Values, Fort Collins, Colorado, January 28-February 1, 1979*, edited by Douglas Fox, Ross J. Loomis, and Thomas C. Greene, 124–29. Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1979.

Rapoport, Amos, and Robert E. Kantor. "Complexity and Ambiguity in Environmental Design." *Journal of the American Institute of Planners* 33, no. 4 (July 1, 1967): 210–21.

Raynsford, Anthony. "Simulating Spatial Experience in the People's Berkeley." *Design and Culture* 6, no. 1 (March 1, 2014): 45–63.

———. "Spectacle of the Hyper-Real: Environmental Simulation, Cybernetic Subjects, and Urban Design." Boston, Massachusetts, 2012.

Raz, Mical. "Alone Again: John Zubek and the Troubled History of Sensory Deprivation Research." *Journal of the History of the Behavioral Sciences* 49, no. 4 (2013): 379–95.

———. *What's Wrong with the Poor?: Psychiatry, Race, and the War on Poverty*. Chapel Hill, NC: University of North Carolina, 2013.

Reif, Frederick. "Educational Challenges for the University." *Science* 184, no. 4136 (May 3, 1974): 537–42.

Report to the President and the President's Response: White House Conference on Natural Beauty. Washington, D.C.: U.S. Government Printing Office, 1965.

Rice, Genie. "The Story of Paul Newman and East Side Zoning." *CIVITAS Newsletter*, 2008.

Roberts, Jennifer L. *Mirror-Travels: Robert Smithson and History*. New Haven: Yale University Press, 2004.

Robertson, Lynn C. "From Gestalt to Neo-Gestalt." In *Approaches to Cognition: Contrasts and Controversies*, edited by Terry J. Knapp and Lynn C. Robertson. New York: Routledge, 1986.

Rock, Irvin, and Stephen Palmer. "The Legacy of Gestalt Psychology." *Scientific American* 263, no. 6 (December 1990): 84–90.

Rome, Adam. "What Really Matters in History: Environmental Perspectives in Modern America." *Environmental History* 7, no. 2 (2002): 303–18.

Rorschach, Hermann. "The Application of the Interpretation of Form to Psychoanalysis." *Journal of Nervous and Mental Disease* 60, no. 3 (1924): 225–48, 359–79.

Rose, Mark H. *Interstate: Express Highway Politics, 1939-1989*. Knoxville, TN: University of Tennessee Press, 1990.

Rosman, P. F. *A Simulation Approach to Evaluating the Environmental Effects of Roads and Traffic.* Transport and Road Research Laboratory, Department of the Environment, TRRL Laboratory Report 826. Crowthorne, Berkshire: Environment Division, Transport Systems Department, Transport and Road Research Laboratory, 1978.

Ross, Robert W. "The Bureau of Land Management and Visual Resource Management—An Overview." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 666–70. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Roth, Curtis. "Software Epigenetics and Architectures of Life." *E-Flux*, February 2019.

Rotter, Julian B. "Generalized Expectancies for Internal versus External Control of Reinforcement." *Psychological Monographs: General and Applied* 80, no. 1 (1966): 1–28.

Rudolph, Ronald L. "Visibility Protection: A Historical Perspective with Suggestions for Policy Implementation." In *Proceedings of the Workshop in Visibility Values, Fort Collins, Colorado, January 28-February 1, 1979*, 26–31. U.S. Department of Agriculture, Forest Service, 1979.

Ruscha, Edward. *Every Building on the Sunset Strip*. Los Angeles: Ed Ruscha, 1966.

Rutherford, Paul. "'The Entry of Life into History.'" In *Discourses of the Environment*, edited by Éric Darier. Oxford: Blackwell Publishers, 1999.

Sachs, Avigail. "Architects, Users, and the Social Sciences in Postwar America." In *Use Matters: An Alternative History of Architecture*, edited by Kenny Cupers, 70–84. London: Routledge, 2014.

———. *Environmental Design: Architecture, Politics, and Science in Postwar America.* Charlottesville, VA: University of Virginia Press, 2018.

Saliba, George. *Islamic Science and the Making of the European Renaissance*. MIT Press, 2007.

San Francisco Chronicle. "Dr. Harrison G. Gough," May 25, 2014, sec. C4.

Sanoff, Henry. *Visual Research Methods in Design*. Van Nostrand Reinhold, 1991.

Sarah E. Igo. *The Averaged American: Surveys, Citizens, and the Making of a Mass Public*. Cambridge, MA: Harvard University Press, 2007.

Scenic Hudson Preservation Conference v. Federal Power Commission, 354 F.2d 608 (2d Cir. 1965).

School for Environment and Sustainability (University of Michigan) records 1903–2012, Bentley Historical Library, University of Michigan.

Schulz van Treeck, Martin. "Möglichkeiten Der Darstellung Und Abklärung Architektonischer Projekte." *Detail*, no. 4 (August 1974): 636, 642.

———. "Reale Modellphotographie Als Neue Darstellungsmethode in Der Architekturplanung." *Bauen + Wohnen*, 1957.

Schuyler, David. *Embattled River: The Hudson and Modern American Environmentalism*. Ithaca: Cornell University Press, 2018.

———. "Saving Olana." *The Hudson River Valley Review* 32, no. 2 (Spring 2016).

Scott Brown, Denise. "Learning from Pop." *Casabella*, no. 359/360 (1971): 15–23.

Scott, Felicity D. *Outlaw Territories: Environments of Insecurity/Architecture of Counterinsurgency*. Princeton, NJ: Princeton University Press, 2016.

Scully, Vincent. "Palace of the Past." *Progressive Architecture* 46, no. 5 (May 1965): 184–89.

———. *Pueblo: Mountain, Village, Dance*. New York: Viking Press, 1975.

———. *The Earth, the Temple, and the Gods: Greek Sacred Architecture*. New Haven, CT: Yale University Press, 1962.

Sent, Esther-Mirjam. "Behavioral Economics: How Psychology Made Its (Limited) Way Back Into Economics." *History of Political Economy* 36, no. 4 (2004): 735–60.

Serraino, Pierluigi. *The Creative Architect: Inside the Great Midcentury Personality Study*. New York: The Monacelli Press, 2016.

Sert, José Luis. *Can Our Cities Survive?: An ABC of Urban Problems, Their Analysis, Their Solutions*. Harvard University Press, 1942.

Sessions, Sterling D., and Gene A. Sessions. *A History of Utah International: From Construction to Mining*. Salt Lake City: University of Utah Press, 2005.

Shabecoff, Philip. "Plan For Vista Outside National Parks Is Rejected." *The New York Times*, October 27, 1985, sec. 1.

———. "Watt Acts to End Ban on Utah Mine." *The New York Times*, September 22, 1981.

———. "Watt May Lift Ban on Mining Near Park." *New York Times*, September 3, 1981, sec. A.

Shafer, Elwood L. "Perception of Natural Environments." *Environment and Behavior* 1 (1969): 71–82.

Shafer, Elwood L., and Robert O. Brush. "How to Measure Preferences for Photographs of Natural Landscapes." *Landscape Planning* 4 (January 1, 1977): 237–56.

Shafer, Elwood L., John F. Hamilton, and Elizabeth A. Schmidt. "Natural Landscape Preferences: A Predictive Model." *Journal of Leisure Research* 1, no. 1 (January 1, 1969): 1–19.

———. "Natural Landscape Preferences: A Predictive Model." *Ekistics* 29, no. 173 (1970): 278–83.

Shafer, Elwood L., and James Mietz. *It Seems Possible to Quantify Scenic Beauty in Photographs*. Forest Service Research Paper, NE-162. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, 1970.

Shaffer, Marguerite. *See America First: Tourism and National Identity, 1880-1940*. Washington, D.C.: Smithsonian Institution, 2001.

———. "See America First: Tourism and National Identity, 1905-1930." Ph.D. Dissertation, Harvard University, 1994.

Shah, Jyoti. "Endoscopy through the Ages." *BJU International* 89, no. 7 (May 2002): 645–52.

Shapin, Steven, and Simon Schaffer. *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*. Princeton, NJ: Princeton University Press, 1985.

Shaw, Nancy. "Siting the Banal: The Expanded Landscapes of the N.E. Thing Co." In *You Are Now in the Middle of a N.E. Thing Co. Landscape*. Vancouver: UBC Fine Arts Gallery, 1993.

Sheppard, Stephen R. J. "Landscape Portrayals: Their Use, Accuracy, and Validity in Simulating Proposed Landscape Changes." Ph.D., University of California, Berkeley, 1982.

———. *Visual Simulation*. New York: Van Nostrand Reinhold, 1989.

Sheppard, Stephen R. J., and Tim Tetherow. "Visual Assessment of Surface Mining in the Alton Coal Field." *Garten Und Landschaft*, no. 8 (1983): 624–28.

Sheridan, Thomas B. "Citizen Feedback: New Technology for Social Choice." *MIT Technology Review* 73, no. 3 (January 1971): 47–51.

Shreveport Metropolitan Planning Commission. "The Shreveport Plan: A Long-Range Guide for the Future Development of Metropolitan Shreveport." Shreveport, Louisiana, 1956.

Siegert, Bernhard. "Cultural Techniques: Or the End of the Intellectual Postwar Era in German Media Theory." *Theory, Culture & Society* 30, no. 6 (2013): 48–65.

Simon, Herbert A. "A Behavioral Model of Rational Choice." *Quarterly Journal of Economics* 69, no. 1 (1955): 99–118.

———. "Theories of Decision-Making in Economics and Behavioral Science." *American Economic Review* 49, no. 3 (1959): 253–83.

Simondon, Gilbert. *On the Mode of Existence of Technical Objects*. Translated by Cécile Malaspina and John Rogove. Minneapolis, MN: Univocal Publishing, 2017.

"Site Photography and Production of Drawings: Obtaining the Stereo Photographs." *The Architects' Journal* 171, no. 5 (January 30, 1980): 252–53.

Sive, David. "Securing, Examining, and Cross-Examining Expert Witnesses in Environmental Cases." *Michigan Law Review* 68, no. 6 (May 1, 1970): 1175–99.

Skillen, James R. *This Land Is My Land: Rebellion in the West*. New York, NY: Oxford University Press, 2020.

Smardon, Richard C. "An Organizational Analysis of Federal Agency Visual Resource Management Systems." Ph.D. Dissertation, University of California, Berkeley, 1982.

———. "Law and Aesthetics, or Where Is the Pig in the Parlor? A Legal/Policy Overview of Legal Factors' Influence on Visual Landscape Policy." Berkeley: Department of Landscape Architecture, University of California, Berkeley, 1978.

———. "The Interface of Legal and Esthetic Considerations." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 676–85. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

———. "When Is the Pig in the Parlor?: The Interface of Legal and Aesthetic Considerations." *Environmental Review: ER* 8, no. 2 (1984): 147–61.

Smardon, Richard C., and James Karp. *The Legal Landscape*. New York: Van Nostrand Reinhold, 1993.

Smith, Sara G. "Utah International, Inc. v. Watt: Adjudicative or Legislative Hearing." *Kentucky Law Journal* 72, no. 1 (1983).

Smithson, Alison. *As in DS: An Eye on the Road (1983)*. Baden: Lars Müller, 2001.

Smithson, Robert. "The Monuments of Passaic." *Artforum* 7, no. 4 (December 1967): 48–51.

Snow, C. P. *The Two Cultures and the Scientific Revolution*. New York: Cambridge University Press, 1959.

Solovey, Mark. "Senator Fred Harris's National Social Science Foundation Proposal: Reconsidering Federal Science Policy, Natural Science–Social Science Relations, and American Liberalism during the 1960s." *Isis* 103, no. 1 (2012): 54–82.

Solovey, Mark, and Jefferson Pooley. "The Price of Success: Sociologist Harry Alpert, the NSF's First Social Science Policy Architect." *Annals of Science*, 2010.

Sommer, Robert. *Personal Space; the Behavioral Basis of Design*. Englewood Cliffs, N.J.: Prentice-Hall, 1969.

———. "Studies in Personal Space." *Sociometry* 22, no. 3 (September 1, 1959): 247–60.

Spencer, Theo. "The Fight to Stop a Strip Mine Near Bryce Canyon: A History." *Natural Resources Defense Council* (blog), June 5, 2017. https://www.nrdc.org/experts/timeline-alton.

Spigel, Lynn. *Make Room for TV: Television and the Family Ideal in Postwar America*. Chicago: University of Chicago Press, 1992.

Stafford, Barbara Maria. *Good Looking: Essays on the Virtue of Images*. Cambridge, MA: MIT Press, 1996.

Stagner, Ross. *Psychology of Personality*. New York: McGraw-Hill, 1937.

State of Louisiana Department of Highways. *Louisiana North-South Expressway: Draft Environmental Impact Statement*. Vol. 1, 1976.

Stephenson, William. *The Study of Behavior: Q-Technique and Its Methodology*. Chicago: University of Chicago Press, 1953.

Stevenson, A. E., J. A. Conley, and J. B. Carey. "A Computerized System for Portrayal of Landscape Alterations." In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 151–56. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Stoffle, Richard W., Cheryl A. Last, and Michael J. Evans. "Reservation-Based Tourism: Implications of Tourist Attitudes for Native American Economic Development." *Human Organization* 38, no. 3 (1979): 300–306.

Stone, Christopher D. "Should Trees Have Standing? -- Toward Legal Rights for Natural Objects." *Southern California Law Review* 45 (1972): 450–501.

Stone, Edward H. *Visual Resource Management*. Landscape Architecture Technical Information Series. Washington, D.C.: American Society of Landscape Architects, 1978.

Storm King Art Center. "Mark Di Suvero: 25 Years of Sculpture and Drawings," 1985. Storm King Art Center Archives.

Suedfeld, Peter. "Attitude Manipulation In Restricted Environments I: Conceptual Structure And Response To Propaganda." *Journal of Abnormal Psychology* 68 (1964): 242–47.

———. *Conceptual And Environmental Complexity As Factors In Attitude Change*. Ph.D. Dissertation, Princeton University, 1963.

———. "Sensory Deprivation Used In the Reduction of Cigarette Smoking: Attitude Change Experiments In an Applied Context." *Journal of Applied Social Psychology* 3, no. 1 (March 1, 1973): 30–38.

———. "The Benefits of Boredom: Sensory Deprivation Reconsidered: The Effects of a Monotonous Environment Are Not Always Negative; Sometimes Sensory Deprivation Has High Utility." *American Scientist* 63, no. 1 (1975): 60–69.

———. "The Clinical Relevance of Reduced Sensory Stimulation." *Canadian Psychological Review* 16, no. 2 (1975): 88–103.

Suedfeld, Peter, and Elena Buchanan. "Sensory Deprivation and Autocontrolled Aversive Stimulation in the Reduction of Snake Avoidance." *Canadian Journal of Behavioural Science* 6, no. 2 (1974): 105–11.

Suedfeld, Peter, and Robert D. Hare. "Sensory Deprivation in the Treatment of Snake Phobia: Behavioral, Self-Report, and Physiological Effects." *Behavior Therapy* 8, no. 2 (1977): 240–50.

Suedfeld, Peter, and Frederick F. Ikard. "Attitude Manipulation in Restricted Environments: IV. Psychologically Addicted Smokers Treated in Sensory Deprivation." *British Journal of Addiction to Alcohol & Other Drugs* 68, no. 2 (1973): 170–76.

Suedfeld, Peter, P. Bruce Landon, and Elizabeth J. Ballard. "Effects of Reduced Stimulation on Divergent and Convergent Thinking." *Environment and Behavior* 15, no. 6 (November 1, 1983): 727–38.

Suedfeld, Peter, P. Bruce Landon, Richard Pargament, and Yakov M. Epstein. "An Experimental Attack on Smoking (Attitude Manipulation in Restricted Environments, III)." *Substance Use & Misuse* 7, no. 4 (1972): 721–33.

Suedfeld, Peter, and Chunilal Roy. "Using Social Isolation to Change the Behavior of Disruptive Inmates." *International Journal of Offender Therapy and Comparative Criminology* 19, no. 1 (1975): 90–99.

Suedfeld, Peter, James A. Russell, and Environmental Design Research Association, eds. *The Behavioral Basis of Design: Proceedings of the Seventh International Conference of the Environmental Design Research Association, Vancouver, British Columbia, Canada*. Stroudsburg, PA: Dowden, Hutchinson & Ross, 1976.

Suedfeld, Peter and Jack Vernon. "Attitude Manipulation in Restricted Environments. II. Conceptual Structure and the Internalization of Propaganda Received as a Reward for Compliance." *Journal of Personality and Social Psychology* 3, no. 5 (1966): 586–89.

Suedfeld, Peter, Jack Vernon, John T. Stubbs, and Marvin Karlins. "The Effects of Repeated Confinement on Cognitive Performance." *The American Journal of Psychology* 78, no. 3 (1965): 493–95.

Sunstein, Cass R. "Some Costs & Benefits of Cost-Benefit Analysis." *Daedalus* 150, no. 3 (July 1, 2021): 208–19.

Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. § 1201 et seq.

Sutter, Paul S. "The World with Us: The State of American Environmental History." *Journal of American History* 100, no. 1 (June 1, 2013): 94–119.

Suttles, Gerald D. *The Social Construction of Communities*. University of Chicago Press, 1972.

Taketomo, Kristian. "'Town Meetings by Television': Regional Plan Association's 'CHOICES for '76'." *The Gotham Center for New York City History*, October 4, 2018. https://www.gothamcenter.org/blog/town-meetings-by-television-regional-plan-associations-choices-for-76.

Talbot, Janet Frey, and Rachel Kaplan. "Needs and Fears: The Response to Trees and Nature in the Inner City." *Journal of Arboriculture* 10, no. 8 (1984): 222–28.

Terranova, Charissa N. *Automotive Prosthetic: Technological Mediation and the Car in Conceptual Art*. Austin, TX: University of Texas Press, 2014.

Tetlock, Philip E, and Peter Suedfeld. "Inducing Belief Instability without a Persuasive Message: The Roles of Attitude Centrality, Individual Cognitive Differences, and Sensory Deprivation." *Canadian Journal of Behavioural Science* 8, no. 4 (1976): 324–33.

The Harvard Crimson. "Arnheim Will Teach 'Psychology of Art,'" September 29, 1967.

The New York Times. "The View From Yovimpa Point," October 8, 1981, sec. Opinion.

———. "Upstate Area Divided by Atomic Project," April 14, 1974.

The Times (Shreveport). "63 File Suit Opposing I-220 Cross Lake Bypass Bridge." March 24, 1965.

———. "Architect Is Appointed for Master Plan." May 23, 1953.

———. "Court Orders Trial of Suit over Bridge." April 29, 1965.

———. "Cross Lake Bridge Film to Be Shown." January 26, 1983.

———. "Drought and Floods Taught City Need of Steady Water Supplies." June 28, 1935.

———. "Firm Works into Night on Bridge." October 11, 1984.

———. "Group Forms to Halt Cross Lake Bridge." July 9, 1971.

———. "Interior Report Highly Critical of I-220 Bridge." September 23, 1971.

———. “Master Plan Authors Are Challenged.” May 30, 1956.

———. “Span Across Cross 25 Years in the Making.” April 9, 1989.

———. “U.S. Highways Officials’ View of I-220 Span Asked.” October 19, 1976.

Thiel, Philip. “Notes on the Description, Scaling, Notation, and Scoring of Some Perceptual and Cognitive Attributes of the Physical Environment.” In *Environmental Psychology: Man and His Physical Setting*, edited by Harold M. Proshansky, William H. Ittelson, and Leanne G. Rivlin. New York: Holt, Rinehart and Winston, Inc., 1970.

Thom, Gary C., and Wayne R. Ott. *Air Pollution Indices: A Compendium and Assessment of Indices Used in the United States and Canada*. Washington, D.C.: The Council on Environmental Quality and the U.S. Environmental Protection Agency, 1975.

Thurstone, Louis Leon. “A Law of Comparative Judgment.” *Psychological Review* 34 (1927): 273–86.

———. “Attitudes Can Be Measured.” *American Journal of Sociology* 33, no. 4 (January 1928): 529–54.

Thurstone, Louis Leon, and Ernest J. Chave. *The Measurement of Attitude*. Chicago: University of Chicago Press, 1929.

Time. “The Legacy of James Watt,” October 24, 1983.

Tiner, Stanley. “State I-220 Report Under Federal Study.” *The Times* (Shreveport). June 27, 1971.

Tlusty, Wayne. “The Use of VIEWIT and Perspective Plot to Assist in Determining the Landscape’s Visual Absorption Capability.” In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, edited by Gary H. Elsner and Richard C. Smardon, 201–8. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Tolman, Edward C. “Cognitive Maps in Rats and Men.” *Psychological Review* 55, no. 4 (1948): 189–208.

Travis, Michael R., Gary H. Elsner, Wayne D. Iverson, and Christine G. Johnson. *VIEWIT: Computation of Seen Areas, Slope, and Aspect for Land-Use Planning*. General Technical Report PSW-GTR-11. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station, 1975.

Treiman, Evelyn F., David B. Champion, Mona J. Wecksung, Glenn H. Moore, Andrew Ford, and Michael D. Williams. “Simulation of the Visual Effects of Power Plant Plumes.” In *Proceedings of Our National Landscape: A Conference on Applied Techniques for Analysis and Management of the Visual Resource (Incline Village, Nevada, April 23-25, 1979)*, 485–90. Gen. Tech. Rep. PSW-GTR-35. Berkeley, CA: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, 1979.

Trenholm, Richard. "'Star Wars' Pioneer John Dykstra on How Those Visual Effects Came to Be." CNET, May 4, 2017. https://www.cnet.com/news/john-dykstra-star-wars-anniversary-industrial-light-and-magic-special-effects/.

Tressel, George. "Science on the Air: NSF's Role." *Physics Today* 43, no. 11 (January 11, 2008): 24–32.

Trice, Andrew H., and Samuel E. Wood. "Measurement of Recreation Benefits." *Land Economics* 34, no. 3 (August 1958): 195–207.

Tsuda, Kenta. "Making Bureaucracies Think Distributively: Reforming the Administrative State with Action-Forcing Distributional Review." *Michigan Journal of Environmental & Administrative Law* 7, no. 1 (November 1, 2017): 131–78.

Tuan, Yi-Fu. "Environmental Psychology: A Review." *Geographical Review* 62, no. 2 (1972): 245–56.

Tuholske, Jack. "A Question of Balance: The National Forest Management Act and Draft Forest Plans in the Northern Region." *Public Land and Resources Law Review* 6 (1985).

Tunstall, Daniel B. "Developing Indicators of Environmental Quality: The Experience of the Council on Environmental Quality." *Social Indicators Research* 6, no. 3 (1979): 301–47.

Tushnet, Mark, ed. "The Administrative State in the Twenty-First Century: Deconstruction and/or Reconstruction." *Daedalus* 150, no. 3 (Summer 2021).

Twito, Roger H. *Plotting Landscape Perspectives of Clearcut Units*. General Technical Report PNW-GTR-071. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, 1978.

Twito, Roger H., Stephen E. Reutebuch, Robert J. McGaughey, and Charles N. Mann. *Preliminary Logging Analysis System (PLANS): Overview*. General Technical Report PNW-GTR-199. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 1987.

U. S. Atomic Energy Commission Directorate of Regulatory Standards. *General Site Suitability Criteria for Nuclear Power Stations (Draft)*. Regulatory Guide 4.7. U.S. Atomic Energy Commission, 1974.

———. *Preparation of Environmental Reports for Nuclear Power Plants*. Regulatory Guide 4.2. U.S. Atomic Energy Commission, 1973.

Ulrich, Roger S. "Natural Versus Urban Scenes: Some Psychophysiological Effects." *Environment and Behavior* 13, no. 5 (September 1, 1981): 523–56.

United States Commission on Civil Rights Louisiana Advisory Committee. *Fair Housing in America: Community Development in Louisiana*. Washington, D.C.: United States Commission on Civil Rights, 1981.

United States Congress House Committee on Government Operations Environment, Energy, and Natural Resources Subcommittee. *Secretary Watt's Refusal to Cooperate with Congress: Hearing Before a Subcommittee of the Committee on Government Operations, House of Representatives, Ninety-Seventh Congress, Second Session*. Washington, D.C.: U.S. Government Printing Office, 1982.

United States Department of Commerce. *A Proposed Program for Scenic Roads and Parkways*. Washington, D.C.: U.S. Government Printing Office, 1966.

United States Department of Commerce, Bureau of the Census. *1970 Census of Population and Housing: Census Tracts. Shreveport, Louisiana, Standard Metropolitan Statistical Area*. Final Report PHC(1)-197. Washington, D.C.: U.S. Government Printing Office, 1972.

———. *1990 Census of Population and Housing: Population and Housing Characteristics for Census Tracts and Block Numbering Areas. Shreveport, Louisiana, Metropolitan Statistical Area*. Washington, D.C.: U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census, 1993.

United States Environmental Protection Agency. *Developing Long-Term Strategies for Regional Haze: Findings and Recommendations of the Visibility Task Force*. Research Triangle Park, NC: U.S. Environmental Protection Agency, 1984.

United States Environmental Protection Agency, Office of Air Quality Planning and Standards. *Protecting Visibility: An EPA Report to Congress*. Washington, D.C.: U.S. Environmental Protection Agency, 1979.

United States Environmental Protection Agency, Office of Air Quality Planning and Standards, Benefit Analysis Program. *Visibility Benefits Assessment Guidebook*. Research Triangle Park, NC: U.S. Environmental Protection Agency, 1981.

United States Environmental Protection Agency, Office of Policy Analysis. *Methods Development for Environmental Control Benefits Assessment*. Vol. VIII: The Benefits of Preserving Visibility in the National Parklands of the Southwest. Washington, D.C.: U.S. Environmental Protection Agency, 1985.

United States Federal Highway Administration. *An Assessment of the Feasibility of Developing a National Scenic Highway System: Report to Congress*. Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 1974.

United States Geological Survey. *Development of Coal Resources in Southern Utah: Regional Analysis*. Vol. 1. Washington, D.C.: U.S. Department of the Interior, 1979.

———. *Development of Coal Resources in Southern Utah: Site Specific Analysis*. Vol. 2. Washington, D.C.: U.S. Department of the Interior, 1979.

United States Office of Management and Budget, Statistical Policy Division. *Social Indicators, 1973*. Washington, D.C.: U.S. Department of Commerce, Social and Economic Statistics Administration, 1973.

United States Outdoor Recreation Resources Review Commission. *Outdoor Recreation for America: A Report to the President and to the Congress*. Washington, D.C.: U.S. Government Printing Office, 1962.

U.S. Bureau of Land Management, ed. *Draft Environmental Impact Statement on the Allen-Warner Valley Energy System*. Cedar City, Utah: U.S. Department of the Interior, 1980.

———. *Final Environmental Impact Statement on the Allen-Warner Valley Energy System*. Cedar City, Utah: U.S. Department of the Interior, 1980.

———. *Final Environmental Impact Statement: Proposed Kaiparowits Project*. Washington, D.C.: U.S. Department of the Interior, 1976.

———. *Visual Resource Contrast Rating*. Manual Handbook 8431-1. Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986.

———. *Visual Resource Inventory*. Manual Handbook 8410-1. Washington, D.C.: Department of the Interior, Bureau of Land Management, 1986.

———. *Visual Resource Management*. Manual Handbook 8400. Washington, D.C.: Department of the Interior, Bureau of Land Management, 1984.

———. *Visual Resource Management Program*. Washington, D.C.: Department of the Interior, Bureau of Land Management, Division of Recreation and Cultural Resources, 1980.

U.S. Department of Agriculture, Forest Service. *Forest Service Manual 2380: Recreation Management*. Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1977.

———. *Landscape Aesthetics: A Handbook For Scenery Management*. Agriculture Handbook 701. Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1995.

———. *National Forest Landscape Management, Vol. 1*. Agriculture Handbook 434. Washington, D.C.: U.S. Department of Agriculture, 1973.

———. *National Forest Landscape Management, Vol. 2, Ch. 1: The Visual Management System*. Agriculture Handbook 462. Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1974.

———. *National Forest Landscape Management, Vol. 2, Ch. 5: Timber*. Agriculture Handbook 559. Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1977.

———. *National Forest Landscape Management, Vol. 2, Ch. 7: Ski Areas*. Agriculture Handbook 617. Washington, D.C.: U.S. Department of Agriculture, Forest Service, 1984.

U.S. Department of Transportation Federal Highway Administration. "Guidelines for the Visual Impact Assessment of Highway Projects." FHWA-HEP-15-029. Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 2015.

U.S. Environmental Protection Agency, Office of Policy Analysis, Economic Studies Branch. *EPA's Use of Benefit-Cost Analysis: 1981-1986*. Washington, D.C.: U.S. Environmental Protection Agency, 1987.

U.S. General Accounting Office. "Cost-Benefit Analysis Can Be Useful in Assessing Environmental Regulations, Despite Limitations." Report to the Congress of the United States. Washington, D.C.: U.S. General Accounting Office, April 6, 1984.

U.S. Nuclear Regulatory Commission. *Environmental Standard Review Plans for the Environmental Review of Construction Permit Applications for Nuclear Power Plants*. NUREG-0555. Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979.

———, ed. *Final Environmental Statement by the U.S. Nuclear Regulatory Commission for Greene County Nuclear Power Plant Proposed by Power Authority of the State of New York, Docket No. 50-549*. Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979.

———. *Final Environmental Statement for Selection of the Preferred Closed Cycle Cooling System at Indian Point Unit No. 3, Docket No. 50-286*. Washington, D.C.; Springfield, VA: Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation; National Technical Information Service, 1979.

U.S. Office of Surface Mining Reclamation and Enforcement. *Southern Utah Petition Evaluation Document: Final 522 SMCRA Evaluation and Environmental Statement OSM-EIS-4*. Washington, D.C.: U.S. Department of the Interior, 1980.

U.S. Office of Technology Assessment. *An Assessment of Development and Production Potential of Federal Coal Leases*. Washington, D.C.: United States Congress, 1981.

Valentine, Charles W. *The Experimental Psychology of Beauty*. London: Methuen & Co., Ltd., 1962.

Valfer, Ernst, Stephen Laner, and Daina Dravnieks. "Public Involvement Processes and Methodologies: An Analysis." Berkeley, CA: U.S. Department of Agriculture, Forest Service, Management Sciences Staff, 1977.

Variety. "Pictures: Academy's Technicals," February 22, 1978.

Vermeule, Adrian. "Local and Global Knowledge in the Administrative State." In *Law, Liberty and State: Oakeshott, Hayek and Schmitt on the Rule of Law*, edited by David Dyzenhaus and Thomas Poole, 295–327. Cambridge: Cambridge University Press, 2015.

Vidler, Anthony. "Agoraphobia: Spatial Estrangement in Georg Simmel and Siegfried Kracauer." *New German Critique*, no. 54 (October 1, 1991): 31–45.

———. "Photourbanism: Planning the City from Above and from Below." In *A Companion to the City*, edited by Gary Bridge and Sophie Watson. Malden, MA: Blackwell Publishing, 2000.

Vigier, François C. "An Experimental Approach to Urban Design." *Journal of the American Institute of Planners* 31, no. 1 (February 1, 1965): 21–31.

Wagstaff, Samuel. "Talking with Tony Smith." *Artforum* 5, no. 4 (December 1966).

Waldo, Dwight. *The Administrative State: A Study of the Political Theory of American Public Administration*. New York: The Ronald Press Company, 1948.

Waltenspül, Sarine. "'Qu'importe Qui Regarde?' Zu Der Rolle Und Den Konsequenzen Des 'Point-of-View' in Architektonischen Modellsimulationen Zwischen 1939 Und 1990." In *Artefakte Des Entwerfens: Skizzieren, Zeichnen, Skripten, Modellieren: 2., Aktualisierte Auflage*, edited by Lyngsø Christensen Rikke, Drach Ekkerhard, Gasperoni Lidia, Hallama Doris, Anna Hougaard, and Liptau Ralf. Berlin: Universitätsverlag der TU Berlin, 2022.

Washington Post. "N.Y. Scraps Huge Nuclear Power Plant," April 6, 1979.

Weart, Spencer R. *Nuclear Fear: A History of Images*. Cambridge, MA: Harvard University Press, 1988.

Weingroff, Richard F. "History of Scenic Road Programs." Highway History. Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 2017.

———. "Lady Bird Johnson's I-95 Landscape-Landmark Tour." Highway History. Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, 2017.

———. "The Battle of Its Life." *Public Roads* 69, no. 6 (June 2006): 26–38.

Weinstein, Neil David. "The Statistical Prediction of Environmental Preferences: Problems of Validity and Application." *Environment and Behavior* 8, no. 4 (December 1, 1976): 611–26.

Weisenfeld, Gennifer. *MAVO: Japanese Artists and the Avant-Garde, 1905-1931*. University of California Press, 2002.

Weiss, Robert Stuart, and Serge Boutourline. *Fairs, Pavilions, Exhibits, and Their Audiences*, 1962.

Wennergren, E. Boyd, and Warren E. Johnston. "Economic Concepts Relevant to the Study of Outdoor Recreation." In *Outdoor Recreation: Advances in Application of Economics*, edited by Jay M. Hughes and R. Duane Lloyd. General Technical Report WO-2. U.S. Department of Agriculture, Forest Service, 1977.

"Western Coal Fields Declared Unsuitable for Mining Amidst Legal Challenges to §522 of the Surface Mining Act." *Environmental Law Reporter* 11, no. 2 (February 1981).

Wexler, Donald, Jack Mendelson, P. Herbert Leiderman, and Philip Solomon. "Sensory Deprivation: A Technique for Studying Psychiatric Aspects of Stress." *A.M.A. Archives of Neurology and Psychiatry* 79, no. 2 (February 1958): 225–33.

Weybrew, Benjamin, and James Parker. "Bibliography of Sensory Deprivation, Isolation, and Confinement." *United States Armed Forces Medical Journal* 11 (August 1960): 903–11.

Williams, Gerald W. *The USDA Forest Service—The First Century*. Washington, D.C.: U.S. Department of Agriculture, Forest Service, 2005.

Williams, Michael D., Lo Yin Chan, and Renate Lewis. *Validation and Sensitivity of a Simulated Photograph Technique for Visibility Monitoring*. Submitted to Symposium on Plumes and Visibility: Measurements and Model Components, Grand Canyon, AZ, November 10-14, 1980 (LA-UR-80-2604). Los Alamos, NM: Los Alamos Scientific Laboratory, 1980.

Williams, Michael D., Evelyn F. Treiman, and Mona J. Wecksung. *Plume Blight Visibility Modeling with a Simulated Photograph Technique*. Submitted to Air Pollution Control Association Conference on Visibility, Denver, CO, November 1979 (LA-UR-79-3250). Los Alamos, NM: Los Alamos Scientific Laboratory, 1979.

———. "Plume Blight Visibility Modeling with A Simulated Photograph Technique." *Journal of the Air Pollution Control Association* 30, no. 2 (February 1, 1980): 131–34.

Wilson, Alexander. "The View from the Road: Recreation and Tourism." In *The Culture of Nature: North American Landscape from Disney to the Exxon Valdez*, 19–51. Toronto: Between The Lines, 1991.

Wilson, Edward O. *Biophilia*. Cambridge, MA: Harvard University Press, 1984.

Winkel, Gary H., Roger Malek, and Philip Thiel. "Community Response to the Design Features of Roads: A Technique for Measurement." *Highway Research Record*, no. 305: Socioeconomic Considerations in Transportation Planning (1970): 133–45.

Winkel, Gary H., and Robert Sasanoff. *An Approach to an Objective Analysis of Behavior in Architectural Space*. Seattle: College of Architecture and Urban Planning, University of Washington, 1966.

Winner, Langdon. "Do Artifacts Have Politics?" *Daedalus* 109, no. 1 (1980): 121–36.

Wise, M. Norton. "Making Visible." *Isis* 97, no. 1 (2006): 75–82.

Wohlwill, Joachim F. "The Emerging Discipline of Environmental Psychology." *American Psychologist* 25 (1970): 303–12.

———. "The Environment Is Not in the Head!" In *Environmental Design Research*, 2:166–81. Stroudsburg, PA: Dowden, Hutchinson, & Ross, Inc., 1973.

———. "What Belongs Where: Research on Fittingness of Man-Made Structures in Natural Settings." In *Assessing Amenity Resource Values*, edited by T. C. Daniel and Ervin H. Zube. Fort Collins, Colorado: US Department of Agriculture, Rocky Mountain Forest and Range Experiment Station, 1979.

Yamada, Mizuki, and Takeshi Goto. "Human Response to Tall Building Motion." In *Human Response to Tall Buildings*, edited by Donald J. Conway, 58–71. Stroudsburg, PA: Dowden, Hutchinson & Ross, Inc., 1977.

Yang, Byoung-e, and Rachel Kaplan. "The Perception of Landscape Style: A Cross-Cultural Comparison." *Landscape and Urban Planning* 19, no. 3 (June 1, 1990): 251–62.

Zeller, Thomas. "Aiming for Control, Haunted by Its Failure: Towards an Envirotechnical Understanding of Infrastructures." *Global Environment* 10, no. 1 (2017): 202–28.

———. *Driving Germany: The Landscape of the German Autobahn, 1930-1970*. Berghahn Books, 2007.

Zimring, Carl A. "'Neon, Junk, and Ruined Landscape': Competing Visions of America's Roadsides and the Highway Beautification Act of 1965." In *The World Beyond the Windshield: Roads and Landscapes in the United States and Europe*, edited by Christof Mauch and Thomas Zeller. Athens, OH: Ohio University Press, 2008.

Zube, Ervin H. "Rating Everyday Rural Landscapes of the Northeastern U.S." *Landscape Architecture* 63, no. 4 (July 1973): 370–75.

———. "Themes in Landscape Assessment Theory." *Landscape Journal* 3, no. 2 (1984): 104–10.

Zube, Ervin H., David G. Pitt, and Thomas W. Anderson. "Perception and Measurement of Scenic Resources in the Southern Connecticut River Valley." Amherst, MA: Institute for Man and His Environment, University of Massachusetts, 1974.

Zube, Ervin H., James L. Sell, and Jonathan G. Taylor. "Landscape Perception: Research, Application and Theory." *Landscape Planning* 9 (1982): 1–33.

Zube, Ervin H., David E. Simcox, and Charles S. Law. "Perceptual Landscape Simulations: History and Prospect." *Landscape Journal* 6, no. 1 (1987): 62–80.

Zubek, John P. *Sensory Deprivation: Fifteen Years of Research*. New York: Appleton-Century-Crofts, 1969.