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ENVIRONMENTAL PSYCHOLOGY

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At a time when environmentalists and economists are proclaiming that "small is beautiful" (383, 398), the research literature on human behavior in relation to its environmental settings continues to expand at a staggering rate. The rapid expansion of environmental psychology can be gauged by the diversity and sheer quantity of publications that have appeared since Kenneth Craik's 1973 review of this area in the present series (92). During the past 5 years (from early 1972 through early 1977), no fewer than ten text books (13, 72, 151, 194, 214, 271, 306, 307a, 344, 372) and six edited readers (160, 210, 320, 352, 360, 400) were published, all of which pertain to the interface between human behavior and the sociophysical environment. In addition, two multiple volume series designed to communicate significant theoretical and methodological advances in the field (15, 16, 41) were established, while more than 30 "state of the art" monographs and edited volumes on specific topics within the environment-and-behavior area appeared (5, 18, 33, 39, 42, 82, 89, 96, 102, 115, 116, 135, 157, 172, 176, 179, 212, 259, 264, 276, 304, 305, 307, 315, 318, 324, 388, 389, 408, 415, 426, 433, 443, 453, 490, 494). Also during the same period, numerous reviews and programmatic analyses of environmental psychology were published in existing psychological, sociological, and geographical journals (11, 12, 38, 69, 95, 180, 234, 277, 349, 375, 407, 432, 437), as well as in several textbooks on social psychology (36, 158, 330, 390, 423).

Environmental psychologists have maintained a vigorous level of professional and interdisciplinary contact as evidenced by the published proceedings of recent Environmental Design Research Association (EDRA) meetings (74, 204, 346, 347, 420, 445) and International Architectural Psychology Conferences (71, 258). As a fur-

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ther indication of the vitality of the field, the existing journal of *Environment and Behavior* (470), and newsletters on *Man-Environment Systems* (133) and *Architectural Psychology* (270) were supplemented by the founding of a new journal entitled *Environmental Psychology and Nonverbal Behavior* (269). Moreover, the American Psychological Association (APA) established a Task Force on Environment and Behavior in 1974, which compiled an inventory of environment-behavioral researchers[2] and prepared a comprehensive report on curriculum and research developments in the environment-and-behavior field (455). The graduate curriculum chapter of this report, as of January 1977, listed more than 60 universities within Canada, the United States, and Great Britain which provide either formal or informal graduate training programs in various subspecialities of human-environment studies (137). And as further testimony to the growing interest among psychologists in environmental research, APA now incorporates a formal division (Division 34) of "Population and Environmental Psychology." This group currently publishes a newsletter (144), and in March 1977 established a journal entitled *Population: Behavioral, Social, and Environmental Issues* (428), which will provide a new outlet for research on population and environmental psychology.

Though it is a simple matter to chart the quantitative growth of environmental psychology over the past 5 years, an assessment of the scientific quality and coherence of this area is considerably more difficult. A major complexity in this regard is that the boundaries of the field are not easily delimited. The study of human behavior in relation to the environment, broadly speaking, would seem to encompass all areas within psychology, let alone most of the behavioral sciences. To what extent then does environmental psychology comprise a unique domain of scientific inquiry?

The present review assumes that the substantive concerns of environmental psychology are distinguishable from those of other areas of psychological research in some important respects, and can be framed within a broad interdisciplinary context. First, in contrast to most subareas of psychology, environmental psychology (and in particular, ecological psychology) brings an ecological perspective to the study of environment and behavior. Accordingly, the environment is construed in multidimensional, molar terms, and the focus of analysis generally is on the interrelations among people and their sociophysical milieu (11, 30, 212, 233, 350) rather than on the linkages between discrete stimuli and behavioral responses (167, 402, 446). It should be noted, though, that much of the research in this field has attempted to isolate physical dimensions (e.g. noise, temperature, space) of the broader milieu in order to assess their specific effects on behavior.

Second, environmental psychology places greater emphasis on the utilization of scientific strategies in developing solutions to community-environmental problems than do most other areas within psychology.[3] This fusion of "basic" and "applied"

[2]See also the directory of behavior and design researchers published by the Association for the Study of Man-Environment Relations (47).

[3]Community psychology (196, 237, 240) is explicitly concerned with the development and evaluation of community intervention strategies, but the emphasis of this field is on the prevention or reduction of psychological and behavioral disorders at the community level, rather than on the more general assessment of environment-behavioral relationships.

perspectives, in the Lewinian tradition (278), is reflected in research on topics such as social impact assessment (480), perceived environmental quality (96), and urban stress (168). And third, owing to the complexity of the large-scale, sociophysical environment and the necessity of approaching it from different levels of analysis, much of the research in environmental psychology is interdisciplinary in both its scope and implementation.

In view of the above considerations, the research concerns and strategies subsumed under the rubric of "environmental psychology" (see outline of topical areas presented below) can perhaps be best represented as parts of an emerging interdisciplinary field of environment and behavior, or "human-environment relations" (21, 95, 131). This field encompasses several diverse perspectives on environment and behavior such as human ecology (331, 360, 438), environmental and urban sociology (76, 151, 307, 479, 490), architecture (375), planning (19), natural resources management (100, 494), and behavioral geography (172, 216, 433, 453). While closely related to these areas, environmental psychology diverges from them by placing relatively greater emphasis on basic psychological processes (e.g. cognition, development, personality, learning) and on individual and group (vs societal) levels of analysis.

The present discussion emphasizes the study of environment and behavior from a psychological perspective. Thus areas such as human ecology, environmental sociology, and behavioral geography are not given systematic coverage in the ensuing discussion.

ORIGINS AND DIRECTIONS OF ENVIRONMENTAL PSYCHOLOGY

Among psychologists, scientific interest in the effects of the ecological or "geographical" environment on people was expressed several decades ago by Koffka (246), Murray (321), Brunswik (61), Tolman (430), and Chein (80). Yet prior to the emergence of environmental psychology during the late 1960s and early seventies (352, 353), the only systematic attempt among psychologists to chart the ecological environment and its impact on human behavior was undertaken by Roger Barker and his colleagues (30, 32, 34)[4,5] Most other "environmentally oriented" psychologists directed their attention away from the molar physical environment and toward either Lewin's (278) "life space"—the psychological situation as perceived by the individual (148, 192, 235, 368, 427)—or the microenvironmental "stimuli" of perceptual and operant psychology (167, 402).

During the past decade, the "doomsday" predictions of demographers (128, 303), the shrinkage of natural resources (including funding opportunities), and the dete-

[4]Additional historical treatments of environmental psychology are provided by Altman (11), Canter & Stringer (72), Smith (404), Stokols (415), and Willems (464).

[5]The development of an ecological perspective within sociology was signaled by the establishment of human ecology during the mid-1920s by Park & Burgess (331). Although human ecology and ecological psychology are based on similar theoretical assumptions, these areas have essentially developed in isolation from each other.

rioration of environmental quality prompted widespread concern about the constraints of the ecological environment. Suddenly psychologists "rediscovered" the large-scale physical environmental and, in collaboration with architects and planners, became increasingly involved in studying its impact on behavior.

As psychologists turned their attention to the study of behavior in relation to the built and natural environment, they encountered several engaging conceptual and methodological issues that had been left unresolved by the mainstream of behavioral science. Some of the more crucial of these issues or "gaps" were (*a*) the lack of an adequate taxonomy of environments (385) which made it difficult to assess the comparability of behavioral observations gathered in different situations and to gauge the ecological validity (62) of both laboratory and field studies; (*b*) the lack of alternative theoretical perspectives from which to approach the complex, dynamic transactions between people and their everyday settings (save for Barker's ecological psychology); and (*c*) the restricted range of methodologies available for observing the behavior of individuals and groups within naturally occurring settings (465). Ongoing attempts by psychologists, design practitioners, and other researchers to confront these issues largely account for the current vitality and directions of environmental psychology (though environmentalist and societal concerns continue to play a role in shaping the course of research in this field).

At present, several trends can be discerned within environmental psychology and within the environment-and-behavior field at large. First, the interdisciplinary and problem-oriented nature of the field has fostered a high degree of methodological eclecticism (307, 334). A creative blend of observational, self-report, math-modeling, and simulation strategies has been employed in studying such issues as environmental cognition (115, 212, 315), environmental assessment (96, 302, 490, 494), and human response to environmental stressors (169, 369).

Second, environment-behavioral research reflects an increasing emphasis on the assessment of ecological validity, or the extent to which phenomena studied in one situation are representative of those occurring in other settings (62, 464). Recent studies of human crowding, for example, have been conducted within diverse laboratory and naturalistic settings and have emphasized the situation-specific nature of human reactions to high density (5, 13, 39, 42, 157, 414, 422).

Third, in their efforts to integrate diverse theoretical perspectives, researchers in the environment-and-behavior field have increasingly combined existing psychological theories of cognitive development, personality, interpersonal processes, and human learning with the assumptions of systems theory (129, 440). Altman's (12) "social-unit" approach to the study of environment and behavior, for instance, provides a synthesis of social psychological theory and the concepts of equilibrium, adaptation, stress, and coping. Other theorists (55, 212, 227, 238, 265a, 266, 291, 339, 429, 444) have called for the development of dynamic, "transactional" models which emphasize the bidirectional relationship between environment and behavior.

Fourth, increasing attention has been paid to the importance of psychological or "perceived" control over the environment and behavioral freedom as determinants of human well-being (23, 168, 227, 263, 272, 388, 485). A growing number of laboratory and naturalistic studies (84, 252, 361, 381, 393) suggests the existence

of a pervasive human need for environmental control which plays a crucial role in determining the quality and intensity of people's reactions to their milieu. But the relative importance of different dimensions of control (e.g. perceived vs actual control, over physical vs social features of the environment), as well as cross-cultural variations in the salience of these dimensions, remains to be examined in future research.

Fifth, the concept of "behavior-environment congruence" (220, 307a, 456) is becoming increasingly important as a theoretical and environmental design tool (255, 259, 305, 394, 415). To the extent that personal and cultural mediators of human response to the environment can be identified, it may be possible to develop criteria for designing environments that are maximally supportive of users' goals and activities.

While the eclectic nature of environmental research has, in many instances, promoted a creative synthesis of approaches, it also has resulted in widespread confusion and controversy over what should be the major concerns (e.g. "applied" vs "basic" issues) and theoretical orientation of the field. Environmental psychology has been racked by repeated arguments among architects, urban planners, and behavioral scientists as to whether design-oriented or theoretically focused approaches should be emphasized (11, 21, 95, 354, 419). And among proponents of the latter approach, heated debates have ensued over whether the environment should be construed in objective (30, 88, 99, 178, 475) or subjective terms (115, 214, 227, 315, 355), and whether the occupants of behavior settings should be viewed as passive objects or active modifiers of environmental forces (213, 474).

Currently, environmental psychology is comprised of several diverse research areas which vary widely in their respective positions along the theoretical vs applied continuum, their conceptualizations of the environment, and their emphases on alternative modes of human-environment interchange. The rather formidable task of the ensuing discussion is to assess the independent status of these research areas, as well as their present or potential linkages.

TOPICAL AREAS WITHIN ENVIRONMENTAL PSYCHOLOGY

There are a number of possible approaches that might be adopted in attempting to represent the diverse areas within environmental psychology. At one extreme, these areas could be viewed simply as an aggregation of unrelated and loosely defined research concerns whose only commonality is their joint relevance to the issue of human-environment relations. At the other extreme, they might be construed as integrated parts of an over-arching theory of environment and behavior—a scientific paradigm (257) characterized by a high degree of professional consensus regarding terminology, theory, methodology, and research priorities.

Environmental psychology at the present time appears to be more than an assortment of loosely defined problem areas but less than a comprehensive, coherent paradigm. Craik (95), for example, has characterized environmental psychology as an array of multiple scientific paradigms, each of which is organized around a set of exemplary achievements and an agreed-upon agenda of worthwhile puzzles for

future research. Areas such as environmental cognition, environmental assessment, and ecological psychology are viewed as highly coherent domains by virtue of either their firm grounding in the traditional paradigms of psychological research (e.g. cognition, development, personality) or their exemplary and novel contributions (e. g. Barker's analysis of behavior settings). As for the interrelations among these areas, Craik's analysis suggests that opportunities for "paradigm-merging" exist, but that the prospects of developing a comprehensive paradigm of human-environment relations are remote.

The present review, building upon Craik's (95), will emphasize those areas within environmental psychology that have achieved a considerable degree of progress and agreement regarding definitional, theoretical, and methodological matters. As indicated below, the relative coherence of the areas varies, and not all research in the field is area-specific. Nonetheless, an emphasis on the more active and focused research components should provide a reasonably representative view of the field's development and current concerns.

At the same time, an attempt will be made to identify certain conceptual continuities or common themes that are beginning to emerge across areas. These themes suggest several questions for future research whose eventual resolution may provide the basis for developing a more integrative perspective on environment and behavior than presently exists.

MODES OF HUMAN-ENVIRONMENT TRANSACTION

One theme which appears to underlie much of the research in environmental psychology is that of *human-environment optimization* (415). The concept of environmental optimization is based on a cyclical, feedback model of human cognition and behavior (60, 227, 310, 323) and pertains broadly to human transactions with the sociophysical environment. The optimization notion assumes that people ideally strive to achieve "optimal environments," or those that maximize the fulfillment of their needs and the accomplishment of their goals and plans. In actuality, people are often forced by situational constraints to accept undesirable environmental conditions, or at best to "satisfice" (399)—i.e. to achieve less than optimal improvements in their surroundings. Although environmental optimization is never realized in its ideal form, the concept is heuristically useful in emphasizing the goal-directed and cyclical nature of human-environment transactions, and in suggesting certain processes by which these transactions occur.[6]

[6]A distinction can be drawn between adaptation (117) and optimization. Adaptation refers to people's attempts (behavioral, cognitive, physiological) to cope with existing environmental conditions. Optimization involves a more planful and cyclical process whereby individuals not only adapt to the existing situation, but also opt to maintain or modify their milieu in accord with specified goals. Optimization subsumes adaptation but places an equal emphasis on man's reciprocal control over the environment. See also Wohlwill's (474) discussion of adaptation and adjustment.

Specifically, the optimization theme suggests that people *orient* to the environment in terms of existing information, goals, and expectations; they *operate* on the environment in an effort to achieve their goals and maintain desired levels of satisfaction; they *are directly affected* by environmental forces (e.g. situational supports, constraints); and they *evaluate* the quality of the environment as a context for future activity and goal attainment. These processes presumably occur within individuals, groups, and communities. This discussion places greatest emphasis on person-environment transactions, but also suggests the relevance of optimization processes to analyses of group- and community-environment transactions.

The above processes can be characterized in terms of two basic dimensions: 1. *cognitive* (or symbolic) vs *behavioral* (or physical) *forms* of transaction; and 2. *active* vs *reactive phases* of transaction. These dimensions essentially concern the extent to which cognitive representations (e.g. beliefs, attitudes, cognitive maps) or physical and social features of the environment (e.g. material objects, other people, rules) either influence or are themselves modified by the individual. Taken together, these dimensions yield four *modes* of human-environment transaction: 1. *interpretive* (active-cognitive); 2. *evaluative* (reactive-cognitive); 3. *operative* (active-behavioral); and 4. *responsive* (reactive-behavioral). The first mode involves the individual's cognitive representation or construction of the environment; the second, his evaluation of the situation against predefined standards of quality; the third, his movement through or direct impact on the environment; and fourth, the environment's effects on the individual's behavior and well-being.

In the ensuing discussion, the various modes of human-environment transaction will be used as a basis for representing some of the major areas of environmental psychology in terms of their respective emphases. For instance, ecological psy-

Table 1 Modes of human-environment transaction and related areas of research

		FORM OF TRANSACTION	
		Cognitive[a]	*Behavioral*
PHASE OF TRANSACTION	*Active*	*Interpretive* Cognitive representation of the spatial environment Personality and the environment	*Operative* Experimental analysis of ecologically relevant behavior Human spatial behavior (Proxemics)
	Reactive	*Evaluative* Environmental attitudes Environmental assessment	*Responsive* Impact of the physical environment Ecological psychology

[a] In the present schema, the term "cognitive" refers to both informational and affective processes.

chology which emphasizes the impact of behavior-setting forces on people focuses most heavily on the responsive mode of human-environment interchange, whereas research on cognitive mapping places much greater emphasis on the interpretive mode (see Table 1).

One implication of the proposed representation of the field is that most research areas typically have focused on a single mode (in some cases two or three, but rarely all four) of human-environment interchange.[7] Consequently, most theoretical orientations tend to overemphasize particular aspects of this interchange while ignoring or downplaying the possibility that the form and directionality of human-environment relations shift over time in a dynamic and cyclical pattern. Thus some important directions for future research are to link, conceptually and empirically, the various modes of human-environment transaction and to describe their patterns of occurrence both within and across different kinds of settings.

The proposed categorization of transactional modes is presented simply as a preliminary, descriptive schema rather than a predictive model. No assumptions are made about the sequence in which the different modes occur (at times two or more modes may occur simultaneously) or their relative duration in different situations. Also, it is recognized that the boundaries between the various modes are not always clear and distinct (hence the use of dotted rather than solid lines to separate the cells of the matrix in Table 1). For example, although attitudes toward the environment reflect judgments of environmental quality, they also mediate more active cognitive and behavioral processes. Thus the proposed categorization of research areas is somewhat arbitrary and at best representative of certain major emphases within each area.

With these qualifications stated, the following areas of human-environment research will be considered: (*a*) cognitive representation of the spatial environment and (*b*) personality and the environment (interpretive mode); (*c*) environmental attitudes and (*d*) environmental assessment (evaluative mode); (*e*) experimental analysis of ecologically relevant behavior and (*f*) human spatial behavior (operative mode); (*g*) impact of the physical environment and (*h*) ecological psychology (responsive mode). In reviewing each of these areas, an attempt is made to highlight theoretical and empirical trends, as well as priorities for future research.

Interpretive Mode

COGNITIVE REPRESENTATION OF THE SPATIAL ENVIRONMENT Perhaps spurred on by the so-called "cognitive revolution" in psychology (107), geography (172, 432), and other fields, research on human comprehension of the molar environment has become one of the most active areas within environmental psychology. Recent work in this area reflects substantial progress in confronting definitional

[7]Certain research areas within the environment-and-behavior field, such as those represented by the literature on family planning (145, 326), case studies of the urban planning process (18, 19, 89), and research on the evaluation of social and environmental programs (66, 68, 487) would seem to encompass all four modes of human-environment transaction as they are explicitly concerned with successive cycles of environmental optimization.

issues and in establishing a theoretical context for research. Basic distinctions have been drawn between *environmental cognition,* the perceptual, cognitive, and affective processes by which people come to know the sociophysical environment, and *cognitive mapping* (or spatial cognition), a more restrictive category involving those processes by which people acquire, code, store, recall, and decode information about the locations and attributes of phenomena within the spatial environment (115, 315). Also, *fundamental spatial cognition* (the perception of objects in space) has been distinguished from *macro-spatial cognition* (cognitive representation of the molar environment) (186, 212); and the hypothetical construct "cognitive map" (mental image of the spatial environment) has been differentiated from more encompassing "cognitive schemata" (e.g. goals, beliefs, and attitudes) (323, 432),[8] and from externalized products or probes of cognitive representations (e.g. sketch maps, repertory grids, verbal way-finding tasks) (115, 315).

Research on spatial cognition over the past 5 years has become increasingly anchored in psychological theories of cognitive development and functioning. Hart & Moore (186) and Siegel & White (397) provided comprehensive analyses of the development of spatial cognition based on the theories of Piaget (342) and Werner (452), while S. Kaplan (227) presented a conceptualization of cognitive mapping involving an integration of Darwinian assumptions and Hebb's (190) neural-net theory. And in line with the constructivist theories of Bruner (60), Kelly (236), and Neisser (323), an increasing emphasis has been placed on the interdependencies among perceptual and cognitive processes of environmental comprehension (212, 274, 314).

At a methodological level, several important developments can be noted. First, use of the sketch map as a probe of cognitive processes has been refined in several respects: (*a*) techniques for the measurement of relational and locational distortions in handdrawn maps have been devised (45, 367, 410, 435), though the relative validity and reliability of these techniques remain to be assessed; (*b*) control measures pertaining to graphic ability and spatial aptitude have been added to the analysis of sketch maps (367); (*c*) Lynch's (289) taxonomy of environmental elements has been elaborated upon as exemplified by recent analyses of landmarks in terms of their visual and functional salience (2, 110, 146, 201, 225, 309); and (*d*) progress has been made toward the development of a cartographic mapping language (483) and the assessment of its effects on the graphic organization of spatial knowledge (45). At the same time, the use of sketch maps to assess spatial knowledge has been supplemented by a wide range of additional techniques including toy modeling (54, 410), photographic recognition (309), verbal wayfinding tasks (314), multidimensional and psychophysical scaling of subjective distance estimates, environmental ratings and activity patterns (58, 65, 70, 162, 171, 184, 251, 327), and factor analysis of repertory grid and semantic differential responses (185, 205, 418).

[8]Although affective processes clearly play a role in spatial cognition, research specifically pertaining to evaluative dimensions of environmental cognition (e.g. attitudes, preferences) is reviewed in a subsequent section concerning the "Evaluative Mode" of human-environment transactions.

The current literature on spatial cognition reflects a number of substantive emphases and some emerging trends. First, the notion that spatial cognition develops ontogenetically from egocentric to coordinated-reference systems of orientation (186, 342) has received empirical support in recent studies (2, 146). Second, the microgenetic, or short-term development of spatial cognition has received increasing research attention, with several studies indicating that heightened familiarity with an area is associated with more detailed and hierarchically organized sketch maps (45, 110, 314, 435). An intriguing study by Wofsey, Rierdan & Wapner (472), however, emphasizes that the microgenesis of cognitive mapping and the form of successive sketch maps are strongly influenced by significant changes in the individual's orientation to the environment (e.g. plans to move to a new area). Third, a variety of personal and cultural variables (sex, socioeconomic level, nationality, ethnic identity) appear to play an important role in the development and expression of cognitive mapping abilities (18, 154, 224, 298, 367, 410), but the possibility remains that these relationships can be accounted for by underlying covariates such as mobility patterns (18, 489) and relative proximity to various areas of the environment (90, 174, 175, 287, 372). And fourth, several studies have combined verbal, graphic, and behavioral assessments of spatial orientation and generally have found substantial overlap between these measures (70, 202, 208, 224, 327, 358).

Priorities for future research include the further assessment of: (*a*) sociocultural factors in spatial cognition (165, 356); (*b*) the effects of environmental surrogates and simulation techniques on the development of spatial cognition and behavior (115, 224, 435); (*c*) the validity and reliability of verbal, graphic, and behavioral assessments of environmental orientation (170, 207, 285); and (*d*) the cognitive and behavioral "spillover effects" (e.g. on creativity, mood, empathy, altruism) of environmental simulations and other exercises designed to broaden cognitive mapping abilities (115). The latter priority suggests the potential design and planning implications of research on spatial cognition which only recently have been subjected to empirical assessment (18). Also, the further extension of psychological research on various aspects of fundamental spatial cognition, including picture memory (293) and selective attention (51), to the study of macrospatial cognition remains as a promising avenue for future research.

PERSONALITY AND THE ENVIRONMENT Whereas the study of spatial cognition emphasizes the processes by which people in general construe the environment, research on personality and the environment focuses on the unique organization and expression of these processes within specific individuals. In recent reviews, Craik (92, 94, 95) noted at least two major thrusts of personality research in environmental psychology: (*a*) the conceptualization and measurement of environmental dispositions (personal styles of relating to the everyday physical environment); and (*b*) the utilization of established personality inventories to predict people's use and modification of the physical environment, as well as its reciprocal impact on them.

Several self-report inventories have been developed in recent years to assess environmental dispositions such as "pastoralism" and "urbanism" (301), "privacy preference" (296), "thing-person orientation" (282), "sensation-seeking" (496) and

"arousal-seeking" (304, 305) tendencies, and sensitivity to noise (449). In addition, behavioral and projective measures of "close vs far personal space" have been employed (6, 91, 114, 118). Some of the findings associated with this research are that high-arousal seekers react more pleasurably to complex situations than do low-arousal seekers (305), and that persons who characteristically maintain greater distance between themselves and others are more likely to experience physiological stress under conditions of high density (6) and to exhibit task-performance deficits following exposure to high-density situations (114), than are those who maintain close distances. While some measures of environmental dispositions have undergone considerably psychometric evaluation and refinement (296, 301), all of them must be tested in a wider variety of situations before their predictive and construct validity can be established.

In attempting to forecast individual behavior and experiences with regard to the environment, environmental psychologists have also utilized more established theories and measures of personality. For instance, the dimension of internal vs external (I-E) locus of control (368) has been found to be significantly related to individuals' engagement in ecologically relevant behavior. Specifically, internals were more likely to participate in antipollution activities (275, 431) and to implement birth control methods (3, 290), although at least one recent study failed to find a relationship between I-E and contraceptive success (386). And in a prospective study of Planned Parenthood clinic participants, a measure of future-time perspective (411) was found to be predictive of individuals' freedom from unwanted pregnancies (312).

With regard to the effects of the environment on individual experiences, several studies indicate that the dimensions of I-E and coronary-prone (Type A) behavior (497) may mediate the intensity of individuals' reactions to stressful situations (169, 273), but the reported relationships are highly complex and seem to depend on the situational context in which they are observed. In short-term laboratory situations, for example, external individuals as compared to internals required greater interpersonal distance between themselves and strangers (118) and were more susceptible to the experience of "learned helplessness" (388) following exposure to uncontrollable environmental events (86, 200). However, within longer-term residential situations, particularly where living conditions were perceived as cramped or constraining, internals manifested greater interpersonal distance requirements (37) and lower levels of adjustment and life satisfaction (147) than did externals. In regard to the coronary-prone behavior pattern, preliminary evidence (169, 252) suggests that Type A (impatient, job-involved, hard-driving) individuals strive harder to avoid loss of control over the environment, but under conditions of extreme or prolonged uncontrollability, they tend to relinquish their efforts to reassert control more readily than their Type B counterparts.

On the whole, the above findings reflect certain gaps in the existing literature and suggest priorities for future research. First, previous research on personality and the environment has been guided almost exclusively by trait models of human behavior, and consequently has failed to consider the situational modifiers of person-environment relationships (467). A shift of emphasis from trait-centered analyses toward

"interactionist" models (55, 130, 291, 313), in which situational and personal antecedents of behavior are equally emphasized, might provide the basis for a more adequate understanding of the cross-situational variability in personality-environment linkages. The crucial dimensions of situations must be identified, however, before person-by-situation interactions can be adequately assessed. The tasks of dimensionalizing and codifying situations point toward the possible utility of linking personality-based analyses with other areas of environmental research, such as ecological psychology, in which attempts have been made to categorize situations in terms of their behaviorally relevant dimensions (33, 317, 348). In an initial attempt to link personality and ecological approaches, Eddy & Sinnett (124) studied the relationship between assessments of college students' introversion-extroversion and their participation in campus behavior settings. Results indicated that students' selection of settings and preferred activities varied in relation to personal orientations, with extroverts spending more time in settings offering opportunities for social contact.

Another priority for future research is the consideration of temporal and developmental mediators of personal orientation toward the environment. The importance of these factors is suggested by recent evidence that individual preference for environmental stimulation (477) and susceptibility to learned helplessness and depression (241) are related to the complexity and controllability of previously experienced environments; that hospitalization rates among certain clinical groups may be affected by the "supportiveness" of their home neighborhood (403); and that elderly persons are more likely to exhibit patterns of "environmental disengagement" (466) and preferences for lower levels of environmental stimulation (111) than younger individuals. Further elucidation of the situational and developmental determinants of personal orientations toward the environment may yield criteria for designing environments that are congruent with the goals and activities of diverse user groups (94, 284).

Evaluative Mode

ENVIRONMENTAL ATTITUDES Evaluation processes, or the ways in which people judge the quality of their surroundings, have been examined most directly in research on environmental attitudes and assessment. Like studies of cognitive mapping and personality, those pertaining to environmental attitudes and assessment have investigated people's internal (cognitive/affective) representations of the environment. But the latter studies have been more explicitly concerned with the evaluative and informational content of environmental perceptions, and with the role that these perceptions play in prompting behavioral attempts to improve the environment.

Research on environmental attitudes (i.e. tendencies to respond favorably or unfavorably to one's milieu) has focused on two major issues: (*a*) public attitudes and knowledge regarding environmental problems (e.g. pollution, depletion of resources); and (*b*) the degree of consistency among individuals' attitudes, beliefs, and behavior relevant to the improvement of environmental conditions. Investigations of the first issue generally have employed survey research methods to assess public

opinion about the environment and to identify the socioeconomic and demographic correlates of environmental concern. Maloney, Ward & Braucht (292), for example, developed and refined a 45-item questionnaire to measure individuals' ecological attitudes and knowledge. Other investigators, utilizing data from national opinion polls, have documented the upsurge of public concern about environmental problems (especially in the United States) during the mid-1960s (132, 281), and more recently, the increased resistance to environmental reforms voiced by certain segments of the population (9, 120, 398). The findings from both national and regional surveys conducted in the United States further suggest that environmental concern is most pronounced among people who are liberal and activist in their political orientation (119, 245), highly educated, and affluent (281, 311). Affluent individuals with vested interests in pollution-causing industries, however, are more likely to oppose rather than support proenvironmental reforms (10, 281).

During acute energy crises and resource shortages, expressions of environmental concern have been accompanied by increased conservationist behavior (98, 281). Nonetheless, most individuals (even those concerned about environmental quality) have expressed a general unwillingness to maintain reduced levels of resource conservation on a permanent basis (98, 281, 329). The discrepancy between environmental concern and individuals' reluctance to curb their consumption of resources has been attributed by some researchers either to mistaken beliefs or to insufficient knowledge about environmental problems. Donohue, Olien & Tichenor (113) found that people are overly optimistic about the ability of government and industry to solve current environmental problems. And a survey of ecological knowledge conducted in Britain, Hungary, and Yugoslavia (254) revealed that most respondents were unaware of the causes and health-related effects of atmospheric pollutants. Also, research conducted by Heberlein (191) suggests that people are more likely to engage in ecologically responsible behavior when they are knowledgeable about the human consequences of pollution.

The degree of consistency among environmental attitudes, beliefs, and behavior has been examined in both correlational and experimental studies, many of which have been based on social psychological theories of attitude change. For instance, Crawford (97) and Davidson & Jaccard (103) examined the relationships between contraceptive attitudes, beliefs, and behavior in terms of Rosenberg's (363) affective-cognitive consistency theory and Fishbein's (153) model of behavioral intentions, respectively. Generally these studies found that the perceived consequences or beliefs about birth control were significantly correlated with attitudes toward contraception, intentions to engage in contraceptive behavior, and reported contraceptive use. A number of quasi-experimental studies also have been conducted in recent years (22a, 209, 447). In one such study, individuals' attitudes toward the Sierra Club were predictive of their willingness to join or support the club five months later (447). In other investigations, workers' attitudes toward recycling were predictive of their behavioral compliance with an experimental waste-paper sorting program sponsored by their company (209); and an environmental education program was found to promote conservation behavior among fifth-graders over a 2-year period (22a).

The future development of research in this area is likely to be facilitated by its integration with other paradigms and perspectives in environmental psychology. Attitudinal research has been widely utilized in the contexts of environmental design and assessment (see next section), but the potential linkages of this research with other approaches, including ecological psychology and operant analyses of proenvironmental behavior (see relevant sections below), have not been explored. For example, the combination of behavior-setting (29) and attitudinal surveys would yield a more comprehensive assessment of the interplay between environmental attitudes and behavior than would the use of either approach by itself. Also, informational and persuasive appeals might be effectively combined with reinforcement strategies to promote ecologically responsible behavior among community members (87). In the context of transportation planning, "market segmentation" techniques based on attitudinal surveys have been used to identify automobile commuters who would be most responsive to incentives for joining car pools (206) or for riding buses (357). These studies point toward the development of informational and incentive programs to promote ecological well-being that would be tailored to the needs, abilities, and preferences of specific community groups. Additional directions for research include the further analysis of attitude-behavioral consistency in relation to environmental issues (63, 447), and the development of transactional theories (238) which emphasize the reciprocal relationship between environmental attitudes and behavior.

ENVIRONMENTAL ASSESSMENT Research on environmental assessment is concerned not only with people's attitudes toward their present surroundings, but also with their preferences regarding the shape of future environments. A basic assumption of this research is that people judge the adequacy of existing or potential settings in terms of predefined standards of environmental quality (96, 415, 427). To the extent that these standards are made explicit, the design of behaviorally supportive environments can be facilitated.

The expansion of assessment research in recent years coincides with increased public concern over environmental deterioration (see preceding section) and with the passage of legislation in various countries (e.g. the 1969 National Environmental Policy Act in the United States and the 1971 Town and Country Planning Act in Britain) requiring the evaluation of proposed environmental changes in terms of their potential community impact. The major thrusts of assessment research can be grouped according to their respective emphases on physical, social, or sociophysical dimensions of the environment. Physical assessments, for example, have focused on the perceived quality of buildings (1, 199), landscapes (17, 100, 222, 493, 494), and of air, water and noise (49, 77, 96). Social assessments have focused on the interpersonal "climate" within organizational and institutional settings (163, 166, 211, 217, 317, 318). And sociophysical assessments have involved appraisals of neighborhood and housing quality (64, 89, 294, 307a, 328, 403, 491), as well as forecasting community impacts resulting from technological and social interventions (52, 75, 478, 480).

In addition to categorizing and selecting environmental dimensions for study, assessment researchers have developed and compared various means of presenting environmental displays (e.g. simulations) and of measuring observers' evaluative responses. Also, investigators have begun to examine the complex, interactive effects of setting properties, measurement techniques, and observer attributes on judgments of environmental quality (20, 93, 96). Substantial progress has been made in the area of environmental simulation. McKechnie (302) developed a useful typology of simulations distinguishing among those that are static (e.g. photograph) vs dynamic (e.g. movie), and concrete (e.g. scale model) vs abstract (e.g. computer modeling of environmental impacts). Much of the research on assessment of buildings and landscapes has utilized static simulations, such as color photographs, and suggests that observers' responses to such displays are moderately predictive of their on-site reactions (100, 199, 392, 495).

Concurrently, dynamic simulations have been developed to study people's reactions to urban and rural landscapes (1, 20, 26, 228, 435). One such project (20) is equipped with a computer-guided video camera which provides simulated tours (via TV monitor and videotape) through a scale-model neighborhood. Preliminary data from this project indicate a high degree of correspondence between observers' evaluations of the simulated and actual tours (93, 302). Another study utilized 16 mm films of beach areas in conjunction with tape recordings of ambient sounds to simulate an oceanfront setting (26).

The development of dynamic simulation procedures has been accompanied by additional methodological innovations. First, semantic differential measures of perceived environmental quality (1, 199) have been supplemented by a wide array of behavioral and perceptual techniques, including Q-sort and paired comparison tasks for the assessment of scenic quality (198, 495), and psychophysical scaling procedures for the judgment of noise, temperature, air quality, and landscape value (26, 49, 77). Also, behavioral-mapping procedures (215) have been used to assess occupants' reactions to residential environments (44, 203, 491), playgrounds (189) and specialized work settings (197, 488).

A second methodological trend reflected in recent research is the systematic sampling of different respondent groups. The data from this research suggest, for example, that inhabitants tend to rate their surroundings more favorably than visitors (1); that environmental design specialists and nonexpert groups of comparable income and social status are quite similar in their appraisals of landscape quality (495); and that adolescents and young adults are more critical in their evaluations of urban beach areas than middle-age people (26).

At present, there appear to be at least two major gaps in environmental assessment research. First, the work in this area has been predominantly atheoretical. As Weinstein (450) and Wohlwill (473) have noted, there has been an overemphasis on the construction of empirically derived models of preference (i.e. factor analyses, multiple regression procedures) and too little attention paid to the development of theory. Exceptions to this trend include Wohlwill's (473) extension of Berlyne's (50) theory of aesthetics to the realm of environmental assessment, and S. Kaplan's (225)

model for the prediction of landscape preference. These theories are useful in that they suggest critical determinants of environmental preference (e.g. complexity, coherence, mystery) and may help to explain the observed relationship between perceived environmental quality and variables such as naturalism (229, 494), land-use compatibility (198), familiarity, and spaciousness (222). To predict the generalizability of these relationships across different settings, however, it will be necessary to extend current models through the development of a theoretically based taxonomy of environments.

A second major gap in assessment research is the lack of data concerning the relative validity of different simulation and measurement procedures (99). Obtaining validity data will require the incorporation of multiple forms of measurement in assessment studies (334) and the systematic comparison of alternative displays, respondents, and response criteria (96, 450, 473). Along these lines, a recent experiment (150) found that observers' perceptions of room size and crowding varied significantly under three different modes of environmental display (actual room, video tape, scale model).

As these problems are resolved, environmental assessment strategies should become increasingly important in the context of community planning. Potential applications of research in this area include: (*a*) the incorporation of Perceived Environmental Quality Indices (PEQIs) as a standard component of environmental impact analyses (96, 478, 480); (*b*) the use of social climate scales to gauge the psychological impact of architectural interventions (203, 461); and (*c*) the use of environmental simulation procedures in predicting users' response to alternative future environments (20, 302). Finally, the unexplored relationships between cognitive mapping processes, personality variables, and environmental preference suggest several opportunities for "cross-paradigm" research.

Operative Mode

EXPERIMENTAL ANALYSIS OF ECOLOGICALLY RELEVANT BEHAVIOR

While the above areas of research emphasize interpretive and evaluative processes in human-environment transactions, the four remaining sections focus on the ways in which people physically modify or respond to their surroundings. Until recently, environmental psychologists had given very little attention to the consequences of human activity in the environment (e.g. litter, pollution, resource scarcities) or to those behaviors that produce or eliminate such products (88, 434). The relative lack of "product-oriented" studies (88) has been in marked contrast to what some observers (99) view as an overabundance of research focusing on the role of psychological processes in mediating environment-behavior relationships. Within the past few years, efforts to redress this imbalance have yielded one of the newest areas within environmental psychology, namely, the behavioral analysis of environmental/ecological problems. The conceptual and methodological underpinnings of this area are derived primarily from Skinnerian (402) learning theory and the techniques of applied behavioral analysis (24), but also reflect the concerns of environmental assessment research. Further integration of these perspectives may eventually lead to significant extensions of the operant paradigm in psychology. As a step in that

direction, Willems's (462) critique of behavioral technology from an ecological point of view highlights the pitfalls (e.g. unintended side effects) of behavioral interventions that are too narrowly conceived and illustrates the advantages of linking operant perspectives with those of ecological psychology and environmental assessment.

Comprehensive reviews of empirical work in this area have been provided by Cone & Hayes (88) and Tuso & Geller (434). As these authors note, a combination of within- and between-subjects experimental designs has been used to assess the behavioral dimensions of two major community problems: environmental degradation and resource management. Overall, the findings from this research clearly indicate that environmental problems can be reduced through behavioral modification strategies. Littering, for example, has been decreased in various settings through antilitter prompts [e.g. printed messages on disposable materials (164)] and by providing rewards for the proper disposal of trash (81, 188, 247, 345). Also, prompting and reward strategies have been implemented to promote newspaper recycling (288, 359), the use of public transportation systems (141–143), and energy conservation in private households (187, 248, 468, 469).

As for the relative impact of alternative interventions, the provision of cash rewards or special privileges on a response-contingent basis appears to be the most potent means of encouraging proenvironmental behavior (141, 187), whereas the mere dissemination of information (e.g. energy conservation manuals) has been the least effective strategy (187, 248). Moreover, in the absence of material contingencies, social praise (384) and the provision of verbal or written feedback to families about their rate of electricity usage (187, 248, 387, 468, 469) have been moderately effective in reducing levels of energy consumption. The independent effects of reward and feedback on patterns of energy use have been demonstrated both within self-selected (volunteer) and randomly chosen households (187).

If these and related experimental findings are to be implemented at a community level, then several practical and theoretical issues must be addressed in future research. First, unlike short-term demonstration studies, community interventions must be cost-effective. Possible strategies for developing economically feasible programs are suggested by (*a*) the proven impact of social reinforcement and feedback on conservation behavior; (*b*) evidence that intermittent levels of reinforcement may be as effective as continuous schedules in promoting proenvironmental behavior (108, 247); (*c*) successful development of automated and remote reinforcement systems (345); and (*d*) current efforts to pretest community interventions via simulation procedures (143).

Second, criteria for defining acceptable levels of environmental quality and energy consumption must be derived largely from nonbehavioral or "reactive" studies (88) incorporating attitudinal, perceptual, and physiological measures. Also, preintervention assessment of perceived environmental quality (96) might make proposed programs more congruent with citizens' needs and ultimately more acceptable to them. Third, the extension of an ecosystems perspective (419, 462) to the design of behavioral interventions might help to avoid certain desirable outcomes such as the reinforcement of trash production (78) or the promotion of bus ridership among

pedestrians rather than automobile drivers (142). Finally, the effectiveness of small-scale experimental interventions in promoting environmental quality and resource conservation suggests the value of approaching other environmental problems, such as overpopulation (492), from an applied behavioral perspective.

HUMAN SPATIAL BEHAVIOR The central concern of *proxemics* (181, 406) is the manner in which people use space as a means of regulating social interaction. This issue has been examined in relation to at least four basic phenomena: (*a*) *privacy,* the control of others' access to oneself; (*b*) *personal space,* the maintenance of an intrusion-resistant zone around oneself; (*c*) *territoriality,* the personalization, ownership, and defense of areas and objects; and (*d*) *crowding,* the desire for reduced contact with others arising from spatial and/or social interferences.[9]

The quantitative growth of proxemic research is reflected in recent literature reviews, one of which (13) cites over 200 empirical studies of personal space as of 1975, while another (422) reviews nearly 100 studies of human crowding, most of which were completed during 1974–76. This prodigious research effort has been accompanied by several conceptual developments. First, attempts have been made to refine existing proxemic concepts, to develop new ones, and to examine their interrelationships. For example, the differences between personal space and territory, and between animal and human territoriality, have been considered (13, 126); physical density has been distinguished from the experience of crowding (13, 109, 134, 413, 436); and the concept of "group space," an analogue of personal space, has been developed (243, 244). At the same time, the conceptual linkages between privacy, territoriality, personal space, and crowding have been emphasized (13, 139, 336). Altman's (13) model of proxemic behavior, for example, views personal space and territoriality as "boundary-regulation" mechanisms designed to maintain a balance between desired and achieved levels of privacy, and crowding as an experience in which desired privacy exceeds achieved privacy.

Second, recent analyses (13, 39, 126, 336, 424) place greater emphasis on the cognitive, psychological, and social underpinnings of human spatial behavior than did earlier biologically oriented theories (181). The dimension of "perceived control" over the environment (23, 168, 272, 388), for instance, has become a central unifying concept in contemporary formulations of spatial behavior (295, 361, 362, 393, 394, 396, 414).

Additional conceptual and methodological developments include greater attention to the situation-specificity of proxemic phenomena (230, 336, 414, 481), increased methodological eclecticism in studying these phenomena (13, 39), and preliminary tests of the design implications of spatial research (42, 104, 109, 136,

[9]The conceptualization of crowding as a stressful experience suggests that this area of research might have been reviewed more appropriately in the section on environmental stressors (see below). The discussion of crowding in the context of proxemics, however, reflects the shift in emphasis in recent research from the behavioral effects of high density per se to the development of a comprehensive model of human spatial behavior in which individuals' attempts to regulate privacy and personal space are of central importance.

325, 377, 394, 408, 417). Specific developments pertaining to privacy, personal space, territoriality, and crowding are briefly noted below. More thorough discussions of these trends can be found in the review articles cited under each topic.

Privacy Three major conceptualizations of privacy have been proposed (13, 239, 261). Kelvin's (239) model defines privacy as the perceived limitation of others' power over oneself. This is distinguished from isolation, the lack of social relations imposed upon, rather than chosen by, the individual. The analysis developed by Laufer, Proshansky & Wolfe (261) emphasizes the psychological functions of privacy as they emerge throughout the life cycle and are affected by situational factors. Research derived from this model indicates age-related shifts in people's ability to define privacy (482) and the impact of institutionalization on children's privacy experiences (481). Altman's (13) boundary-regulation model focuses on behavioral strategies used to maintain desired levels of privacy. The relationship between privacy-regulation capabilities and the well-being of institutionalized elderly persons has been examined by Pastalan (333), while individual differences in preferences for privacy have been assessed by Marshall (296). Additional developments in this area are reviewed by Margulis (295).

Territoriality Recent analyses have emphasized the cognitive and social-organizational functions of human territoriality rather than its biological (reproductive and survival-related) aspects (13, 126, 324, 425). A classification of territories based on their association with primary, secondary, and reference group functions was developed (13). Empirical findings indicate a positive correlation between occupants' use of territorial markers and their degree of attachment to an area (125, 183), reduced fear of crime (335), and respect of proprietary rights by outsiders (46). Other studies have examined the situationally determined relationship between social dominance and territorial behavior (106, 424). Design principles have been derived from theories of territoriality (13, 325) but have received only preliminary empirical assessment (104, 324). [See (13, 126) for detailed reviews.]

Personal space According to Argyle & Dean's (22) equilibrium theory, desired levels of involvement with others are maintained through a delicate interplay of verbal and nonverbal behaviors. Given a comfortable level of intimacy, changes in one behavioral component (e.g. eye contact) will prompt compensatory changes along other dimensions (e.g. interpersonal distance). While some studies have found evidence of compensation (337, 382), others have observed either reciprocal (57) or equivocal relationships (4, 73, 371) between eye contact and distance. Recently Patterson (336) proposed that the behavioral consequences of increased intimacy are mediated by arousal and emotional labeling. Thus the occurrence of either compensatory or reciprocal responses may depend on the perceived meaning of the approacher's behavior. "Inappropriate" proximity with strangers, for example, has been found to induce both physiological (308) and self-reported (127) arousal.

Hall's (181) theory of spatial zones and his emphasis on cultural antecedents of personal space have received substantial empirical support (14, 182). Ethnicity,

however, has been found to interact with such variables as age, gender, and family income in predicting spatial behavior (218). A variety of other individual, interpersonal, and situational determinants of personal space (e.g. physical attractiveness, degree of acquaintance, standing vs sitting) have been examined (14), but the influence of architectural factors on personal space (376) has received little empirical attention. [See (140, 280, 339, 424) for additional reviews.]

Crowding Substantial progress has been made in refining terminology and in developing preliminary theoretical analyses of crowding. The distinction between physical density and the experience of crowding, mentioned above, as well as analyses of density in terms of its spatial, social, and perceptual components (25, 37, 40, 54a, 161, 283, 355, 373, 378, 439) exemplify definitional refinements. Recent theoretical analyses reflect both physicalistic and psychological conceptions of crowding. According to the "density-intensity" model (157), density serves merely to intensify the prevailing quality of social situations. Alternatively, psychological theories posit that high density can at times independently impair the quality of situations by promoting behavioral constraints (351, 380, 412, 421), stimulation overload (42, 109, 134, 373), reduced privacy (13), overmanning (457, 458), and negatively labelled arousal resulting from personal space violation (138, 336, 484). The assumption that crowding involves a reduction of personal control over the environment is central in psychological analyses (361, 362, 393, 414), but the conditions under which reduced spatial or social control are most salient have not been identified. A recent typology suggests that crowding experiences will be most intense and difficult to resolve in primary (psychologically important) vs secondary environments and in the context of perceived threat to personal security (413, 414). The predictive utility and design implications of the above theories, however, remain to be established empirically.

Significant empirical developments include the findings that short-term exposure to high density (with group size held constant) can heighten physiological arousal (6, 7, 138, 308) and can induce both immediate and delayed task-performance deficits (114, 138, 195, 338, 374, 393, 484). Negative effects of prolonged residential density on health and behavior have also been observed, particularly among confined or low-status groups (8, 37, 42, 54a, 101, 105, 299, 361). In addition, recent studies suggest that sex differences in reactions to crowding may be mediated by temporal and social factors, with females responding more positively to proximity with strangers in short-term situations (159, 364, 416) and more negatively under conditions of prolonged residential density (8), though normative factors may be more critical than duration of exposure in mediating these differences (231). Also, the relationship between personality and crowding sensitivity appears to be time-dependent (37). [See (39, 84, 152, 262, 380, 422) for additional reviews.]

Responsive Mode

HUMAN RESPONSE TO THE PHYSICAL ENVIRONMENT Research in this area has focused on the behavioral and health consequences of (*a*) environmental stressors (e.g. noise, heat, pollution, high density), (*b*) the built environment (e.g.

housing, urban design), and (*c*) the natural environment (e.g. climate, topography). Theoretical and empirical work on stress has been most extensive and therefore receives greatest emphasis in this section.

Environmental stressors Environmental conditions operate as stressors to the extent that they tax or exceed the individual's adaptive resources (265, 389). Several studies have documented the direct effects of stressors such as noise (84, 168), extreme temperature (35, 177, 369), air pollution (319, 340, 370, 441), and high density (see preceding section) on human physiology and behavior. Noise, for example, has been found to be associated with elevated blood pressure (219), adrenalin secretion (155), skin conductance (59, 168, 256), and impaired task performance (168, 396, 448).

The major thrust of recent research has been to identify cognitive and psychological factors that mediate the impact of stressors on people. The research of Glass & Singer (168) has been particularly important in identifying the role of predictability and perceived control as determinants of response to stressors. Specifically, their research indicates that although people are able to adapt (physiologically and behaviorally) to high-intensity noise in the short run, they frequently exhibit post-noise "aftereffects" such as decreased tolerance for frustration and impaired task performance. Furthermore, when noise is predictable (periodic) or perceived as controllable, its negative aftereffects are reduced.

The differential effects of controllable and uncontrollable stressors have been documented in numerous laboratory and field investigations (23, 84, 272, 388). In lab settings, uncontrollable noise has been found to produce greater aggression (112), less helping behavior (395), and lower tolerance for frustration (168, 396) than controllable noise. Similarly, exposure to high density resulted in fewer negative aftereffects when subjects believed that they were free (vs not free) to leave a crowded room if they so desired (393). Also, the detrimental impact of prolonged exposure to environmental stressors has been demonstrated in field investigations of the relationship between highway noise and reading ability in children (85), railroad commuting and physiological stress among urban workers (401), and the controllability of individuals' life events and their susceptibility to coronary heart disease (169).

Several theories have been proposed to account for the relationship between perceived control and response to stressors (23, 83, 168, 297, 388, 396). Cohen's (83) theory of attentional overload assumes that individuals' capacity for attention is limited (see also 221) and that uncontrollable or unpredictable stimuli require more extensive monitoring (due to their novelty, complexity) than controllable events. The former stimuli are, therefore, more likely to deplete attentional resources and to result in impaired task performance and interpersonal relations. Consistent with this theory, Wohlwill & Heft (476) found children from noisy homes to be less proficient on a selective attention task and less sensitive to auditory distraction than children from quieter homes. And in two related studies, pedestrians in noisy areas were observed to be less helpful to strangers than those in quieter areas (250, 297). These findings, while subject to arousal-based (122) as well as cognitive interpreta-

tions, are at least consistent with the notion that excessive environmental inputs result in decreased attentiveness to others' needs.

Seligman's (388) theory of learned helplessness provides an alternative explanation for the beneficial effects of perceived control. Helplessness involves a syndrome of cognitive, motivational, and emotional disturbances stemming from repeated encounters with uncontrollable events. Through exposure to such events, the individual comes to believe that personal outcomes are independent of his behavior and consequently reduces his attempts to influence the environment. Experimental studies indicate that personal expectancies for control (200, 485) and the extent to which one attributes lack of control to either task difficulty or insufficient effort (121, 241, 486) are crucial determinants of susceptibility to learned helplessness. Moreover, the amount of exposure to uncontrollable events (252, 361, 365), the aversiveness of these events (48), and the psychological importance of the situation (365, 485) have been identified as important mediators of helplessness effects. Two recent studies of the institutionalized aged (260, 381) further suggest that helplessness may be reduced and possibly reversed by providing persons greater control over various aspects of their environment (e.g. the predictability of visitors).

The existing literature, while documenting the importance of cognitive and psychological determinants of stress, reveals several conceptual and empirical gaps. First, most studies have been guided by a single theoretical perspective and have not been designed to assess the relative validity of alternative models [see (396) for a notable exception]. Because the predictions of certain theories are quite similar, it becomes difficult to isolate rival explanatory mechanisms, especially when some studies focus on attentional measures, others emphasize motivational indices, and still others rely on measures of affect and arousal. The use of multiple levels of measurement and the comparative assessment of alternative theories in future research are prerequisites for developing a more comprehensive understanding of human stress than presently exists.

Second, the persistence and generalizability of stress responses across situations have not been adequately examined. The use of postexperimental assessments in field settings would be crucial in studies attempting to distinguish learned helplessness from temporary states of hyperarousal or attentional fatigue. Longitudinal research designs also would permit an assessment of broader theoretical issues that have been virtually ignored in previous research. For instance, what are the potential *costs* of perceived and actual control (e.g. frustration arising from disconfirmed expectancies for control; premature depletion of adaptive resources in the quest for *too much* control)? Also, what are the long-term benefits of temporary exposure to unpredictable or uncontrollable situations? In this regard, transactional theories of stress (265a, 266) and of human development (444, 452, 454) emphasize the positive relationship between environmental challenge and personal growth.

Impact of the built environment Several studies have examined the impact of residential environments on interpersonal relations. The influence of spatial proximity on friendship patterns, observed earlier by Festinger, Schachter & Back (149), was corroborated in two recent investigations. In one study, the degree of similarity

among friends was inversely related to the proximity of their apartments (322). In the other, residential proximity was predictive of both friendly and unfriendly relations among neighbors (123).

Studies of university housing have assessed the behavioral effects of high- and low-rise dormitories on students (193). In at least two investigations, high-rise dorms were associated with less favorable evaluations of social climate (461) and with lower levels of altruistic behavior (53) than were smaller dorms. Within urban housing projects, Newman (324) found the size and height of buildings to be jointly predictive of crime rates. These data were attributed to the limited opportunities for establishing defensible space in high-rise apartment buildings, although alternative interpretations of the findings have been offered (334). And on a more positive note, Weckerle (451) observed high levels of neighboring and residential satisfaction among the inhabitants of a high-rise singles complex, presumably due to their age similarity and shared preference for establishing social contact with neighbors.

The impact of interior design on building occupants also has been demonstrated in several studies (42, 104, 203, 242, 436). Valins & Baum (436) found that the residents of corridor-design dorms were more likely to complain about crowding and forced interaction than were those living in suite-design dorms, presumably because the former design provides less shielding from unwanted social contacts. Other investigations have examined the effects of architectural renovations on residents of rehabilitative institutions (203, 242). In one study (203), the provision of increased opportunities for privacy through physical remodeling of a psychiatric ward resulted in decreased passivity and more positive social interactions among residents.

Additional areas of research include the analysis of environments from a human factors perspective (332), the effects of traditional and "open" learning environments on children (79, 82, 253, 255, 366), the effects of housing quality on health (232), and the impact of residential relocation on the elderly (333, 379). [For additional reviews, see (27, 72, 214, 249, 375).]

Impact of the natural environment While much research has been conducted on landscape assessment (see preceding section on Environmental Assessment), the behavioral consequences of exposure to elements of the natural environment have received very little attention. Preliminary evidence suggests that involvement in the care-taking of plants may be associated with unique psychological and behavioral benefits (223, 260, 279). In one study (279), the implementation of gardening programs in low-income housing projects was associated with reduced vandalism and increased social contact among residents. In another investigation (260), nursing home residents who were assigned personal responsibility for the care-taking of a plant exhibited increased alertness and participation in social activities relative to those who did not assume this responsibility.

Researchers have begun to assess the effects of meteorological variables on behavior, but the findings from this work are quite preliminary and inconsistent (66, 319, 320). Behavioral geographers have examined motivational aspects of outdoor recreation (306a) as well as the impact of perceived natural hazards on human migration

patterns (372, 453). Also, the emotional impact of natural and built environments was conceptualized by Mehrabian & Russell (305) in terms of three basic dimensions: pleasure, arousal, and dominance.

Relative to other areas of the field, research on human response to the natural environment has been sparse. The development of a theoretical framework for empirical work in this area, and the derivation of planning criteria from such research, remain as important priorities for the future.

ECOLOGICAL PSYCHOLOGY The basic unit of analysis in ecological psychology is the *behavior setting,* a recurring pattern of human activity that takes place within specific time and space boundaries (e.g. colloquium, concert, baseball game). In comparison with other areas of environmental psychology, ecological psychology places considerably greater emphasis on setting-specific rather than person-specific determinants of people's reactions to the environment. The groundbreaking efforts of Roger Barker and his colleagues (29–32, 34) identified the major features of behavior settings (e.g. action patterns, personnel requirements, physical milieu) and traced the behavioral and psychological consequences of *undermanning,* a condition in which available participants are fewer than the number typically required to maintain the setting at an optimal level (e.g. three rather than five persons per team in a basketball game). An important finding of this research was that students attending small schools (assumed to be more undermanned than large schools) were more likely to perform leadership and supportive roles in extracurricular activities and to experience feelings of responsibility and importance than were those enrolled in larger schools (32).

The conceptualization and measurement of behavior settings have undergone considerable refinement in recent years. The concepts of "setting capacity" and "maintenance minimum," proposed by Wicker, McGrath & Armstrong (460) provide criteria for specifying conditions of *under, adequate,* and *overmanning* within settings, irrespective of the size of the institutions (e.g. schools, churches, hospitals) in which these settings occur. Also, the distinction between "performer" and "nonperformer" (or staff vs client) roles has permitted an assessment of manning levels for different groups within the same setting (458, 460). And at a community level of analysis, Barker & Schoggen (33) developed several innovative measures for assessing the extent, variety, and productivity of human habitats. One of these measures, the "urb," is based on the number, occurrence, and duration of a town's behavior settings and reflects the range of behavioral opportunities available or "at hand" to members of a community each year. Another measure, the "productivity index" of a community, reflects the "person hours" of participation required to operate and maintain community settings for a one-year period, and the extent to which inhabitants are engaged in crucial roles (i.e. "claim operations") within those settings. These and other theoretical refinements evolved from a comprehensive comparison of an English and an American town involving two year-long behavior setting surveys, conducted at each locale during 1954–55 and 1963–64.

Recent research in ecological psychology reflects significant empirical and methodological advances. First, the effects of under and overmanning on participants'

behavior and experiences have been examined experimentally (183a, 341, 459). The findings from this research indicate that members of overmanned groups feel less needed, less important, and less helpful to their group than do those of undermanned or adequately manned groups, and that these effects occur with group size held constant. Second, the influence of manning levels previously observed within schools and churches has also been found in more recent investigations of hospitals and rehabilitation centers (409), shopping areas (286), temporary environments in cold regions (44), and a national park (458). Third, progress has been made toward the empirical classification of environments based on analyses of data obtained through community-wide behavior setting surveys (33, 348). Barker & Schoggen (33), for example, suggest that behavior settings and whole communities might be categorized in terms of the major action patterns or behavioral "genotypes" (e.g. professional, educational, recreational) found within them.

An important trend reflected in recent studies is the use of behavior setting surveys in developing habitability criteria, as well as social or physical interventions designed to improve behavior-environment fit. For instance, Lozar (286) attempted to increase the number of responsible staff roles within a grocery store to reduce pilferage and to increase levels of customer-staff interaction. Willems (463) measured levels of behavioral "independence" and "complexity" among paraplegic patients to assess their rehabilitative progress and the effectiveness of the therapeutic setting. Also, Wicker & Kirmeyer (458) installed a queing device at tram stops in Yosemite National Park for the purpose of reducing overmanning and stress among park visitors. Thus, while earlier conceptualizations of the behavior setting (29, 30) emphasized the natural "synomorphy" or congruence among its physical and behavioral components, more recent analyses have attempted to identify conditions of inadequate fit between people and their environments, and to develop strategies for enhancing behavior-milieu synomorphy.

The expanding interface between ecological psychology and environmental design suggests several intriguing directions for future policy-oriented research, including (*a*) the use of manning theory to resolve problems of crowding and congestion in situations where population size cannot be reduced (457); (*b*) the intentional undermanning of organizations and institutions to increase their efficiency and productivity (43, 409); and (*c*) the enhancement of desired manning levels through architectural interventions [e.g. the establishment of legible territorial boundaries and accessible nodes of interaction within settings; see (267, 268, 286)]. Before the design relevance of ecological concepts and methods can be fully realized, however, major theoretical questions must be addressed. For example: (*a*) Under what conditions are settings established, modified, or terminated by their occupants? (*b*) Do the effects of manning conditions vary in relation to personality and cultural factors (404, 459)? (*c*) Are the effects of manning mediated by population size, architectural features, and specific action patterns (286, 341, 458)? The resolution of these and related questions most likely will require a more complete integration of ecological theory with cognitive and motivational constructs (300, 458), as well as more extensive laboratory and field experimentation. In addition, the development of a taxonomy of settings based not only on their modal action patterns, but also on their

relative psychological salience for different individuals and groups, would provide a more adequate basis for designing and evaluating environments than is now available [See also (405) for an extensive bibliography of research in this area.]

CONCLUSIONS

Research developments over the past 5 years demonstrate that environmental psychology is no mere fad of the 1960s—a short-lived product of environmentalist and political activism. Instead, this field has taken hold both conceptually and empirically and is now comprised of several active and focused research domains. Each of these domains is oriented not only to the resolution of environmental problems but also to the development of a more adequate conceptualization of human-environment interchange than presently exists.

The scientific vitality of environmental psychology is reflected in the substantial theoretical and empirical progress that has been made within many of its major subareas. Conceptual developments are especially evident in the literature on spatial cognition, proxemics, stress, and ecological psychology. Research in these areas has moved beyond simple application of established psychological theories (e.g. of cognitive development, information processing) to the derivation of new concepts and models pertaining to environment and behavior (e.g. fundamental vs macrospatial cognition, boundary-regulation processes, the crowding construct, under vs overmanning). Furthermore, empirical advances have been made in these areas as well as in the measurement of environmental dispositions and attitudes, the assessment of environmental quality, and the analysis of ecologically relevant behavior. To be sure, most of these developments await further validation and refinement. Also, preliminary research on certain issues (e.g. the impact of the natural environment on behavior) has been particularly sparse. But on the whole, engaging scientific questions have been discovered within the major areas of environmental psychology, and these have prompted considerable theoretical and empirical progress in recent years.

Though the major research areas of the field are rooted in diverse theoretical traditions and emphasize different modes of human-environment transaction, a number of linkages among these areas have been drawn. Such linkages are evident in the combination of behavior setting analysis with the concerns of environmental assessment; the analysis of personality variables as they mediate proxemic behavior and the intensity of stress reactions; and the combined use of cognitive and behavioral mapping strategies in studies of human response to the physical environment. As for the future, several of the most exciting and promising opportunities for research can be found at the interface of the major substantive areas of the field (e.g. the further integration of ecological and operant perspectives on the analysis of environmentally relevant behavior).

The major research domains of environmental psychology reflect certain common assumptions or themes which eventually may provide the foundation for a general theory of environment and behavior. One such theme is the transactional or bidirectional nature of human-environment relations (13, 130, 212, 266, 313, 415). Trans-

actional views suggest that any attempt to conceptualize the relationship between environment and behavior must account not only for the effects of the environment on people, but also for the reciprocal impact of people on their milieu. The related theme of human-environment optimization suggests that the various modes of transaction between people and their surroundings (i.e. interpretive, evaluative, operative, and responsive modes) are organized in relation to prioritized goals and plans. The optimization theme emphasizes the attempts of individuals and groups to create environments that are maximally supportive of their goals and activities.

The concepts of transactionalism and optimization are relevant to one of the major tasks currently facing the behavioral sciences: namely, the development of a taxonomy of environments (130, 266, 313, 385, 415). Specifically, the personal and group goals underlying human-environment transactions offer a basis for defining environments in terms of (*a*) their *salience,* or the extent to which they are associated with psychologically important goals and plans; and (*b*) their *congruence*, or the extent to which they permit behavioral opportunities for realizing salient goals and plans [see also Michelson's (307a) notion of intersystem congruence]. In combination, these dimensions predict environmental *quality,* an index of the proportion of salient goals and plans that are supported by a particular environment. For instance, residential settings are typically highly salient environments that can vary widely in terms of their congruence and desirability (e.g. high-income housing vs slum dwelling or prison cell).

The above dimensions of environments are "transactional terms" (265a, 266) in the sense that they reflect the interplay of human and environmental forces. The salience dimension, for example, emphasizes the range and importance of cognitive representations associated with a particular setting, whereas the congruence notion reflects what Chein (80) referred to as environmental "supports" or "constraints."

The description of settings in transactional terms may extend earlier attempts to categorize environments either in terms of their behavioral (33, 156, 348) or perceptual dimensions (211, 305, 317). By considering the behavioral (or functional) features of settings in conjunction with their psychological salience, it becomes possible to move from purely descriptive to predictive taxonomies. For example, the impact of environmental stressors on people is likely to depend on both the importance (salience) and controllability (congruence) of the setting in which these stressors occur (see preceding sections on crowding and environmental stressors).[10] And at a more general level, predicting the generalizability of research findings from one setting to another may be facilitated by knowing the extent to which the settings are of comparable salience and congruence.

Future refinement and operationalization of environmental dimensions such as salience, congruence, and quality may be advantageous at the practical level as well. Several areas of environment-behavioral research, including urban planning (19, 316), environmental design (82, 264, 375), environmental decision-making (28, 173,

[10]In general, it is assumed that environmental conditions will exert greatest impact on people where situational constraints are inflexible (i.e. where the operative mode of transaction is restricted) and/or where occupants are of low competence (263, 414, 471).

391), and population psychology (145, 326) are explicitly concerned with the creation of environments that are congruent with occupants' goals and activities. The specification and measurement of salient goals at the community level are prerequisites for designing behaviorally supportive environments and for deriving criteria of environmental quality (96, 415).

The conceptualization of community planning as a goal-oriented optimization process raises several questions for future research. For instance: (*a*) On what dimensions do people attempt to optimize their environments? (*b*) Do the salient dimensions of environmental optimization vary systematically in relation to the type of setting considered? (*c*) What kinds of assessment criteria are appropriate for measuring optimization processes and their outcomes at individual, group, and community levels of analysis (66, 68, 442)? (*d*) What are the appropriate time intervals for assessing optimization cycles within individuals, groups, communities (68)? (*e*) To what extent can competing goals be optimized both within and between systems (56, 343)? (*f*) In what ways can empirical information concerning human-environment optimization be translated into guidelines for environmental design?

Analysis of these issues will require an integration of the concepts and tools of environmental assessment with those from other areas of the field. Thus future research in environmental psychology is likely to reflect a consolidation of theory and data within its major substantive areas, as well as the further development of cross-paradigm research (95) as a basis for community planning and design.

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