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Graphic Pain: A History of the Tools Mediating Pain Quantification

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Graphic Pain: A History of the Tools Mediating Pain Quantification

A dissertation submitted in partial satisfaction of the requirements for
the degree Doctor of Philosophy

in

Art History, Theory, and Criticism

by

Gabriel Yuval Schaffzin

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2020

The dissertation of Gabriel Yuval Schaffzin is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

Chair

University of California San Diego

2020

DEDICATION

For Giovanni,
whose pain is all but inevitable,
but whose world is not.

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ACKNOWLEDGEMENTS

When I came to UC San Diego, I knew I wanted to think about pain and I wanted to think about design, but I had no idea how to approach a dissertation on either, let alone as a combined project. Professor Lisa Cartwright's vision and savvy as an experienced interdisciplinary scholar was instrumental in ensuring I pursued the most fruitful research directions, sought the most valuable funding opportunities, and sharpened the most salient points of my argument. Professor Cartwright recognized early on that my work needed a strong STS foundation to complement my designerly inclinations and my own experiences with pain. Her unfailing support and mentorship (not to mention the more-than-occasional pastry) helped me through those times when I doubted my ability to pursue relatively uncharted territory. I thank her, as well as the other members of my committee, Professor Lilly Irani, Professor David Serlin, Professor William Tronzo, and Professor Alena Williams, for their generosity and guidance. Professor Norman Bryson and Professor Elizabeth Guffey also played important roles in shaping the final project. It was an absolute privilege to work with these brilliant minds. I come away from my time in graduate school with a model of the sort of educator and mentor I wish to be.

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“Resolving the Incommensurability of Eugenics and the Quantified Self.” *Gnovis*, 2017, pp. 3–15.

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ABSTRACT OF THE DISSERTATION

Graphic Pain: A History of the Tools Mediating Pain Quantification

by

Gabriel Yuval Schaffzin

Doctor of Philosophy in Art History, Theory, and Criticism

University of California San Diego, 2020

Professor Lisa Cartwright, Chair

This project uses three histories of the graphic pain scale to demonstrate the medical and social construction of pain as graphic sign and as vital information. Indicative of the concurrent ascendance of data science and graphic design within the medical fields during the latter half of the twentieth century and the beginning of the twenty-first, the history of the graphic pain scale demonstrates a shift from pain medicine as a visual signifying practice and toward a paradigm of information, not representation. This

dissertation traces this shift via a Visual STS framework to which theories of design studies and disability studies contribute throughout.

While the investigation begins with the canonization of Henry Beecher's theories of pain as a subjective experience (rather than an objectively observable one) in the post-World War II West, the histories of each scale necessitate following genealogical trails that reach back as far as the end of the nineteenth century. By revealing the social, political, and economic layers of influence embodied within each of the three scales—the Visual Analog Scale, the body pain diagram, and the face-based pain scale—this dissertation suggests a number of material and conceptual implications which the graphic designs of the tools may have on the subject in pain. Throughout, it will be clear that researchers and practitioners have focused primarily on intensity and location—rather than the quality or origin—of pain when designing these scales, a product of their goals having been oriented towards creating efficient tools that could be widely applicable to produce valid data.

This project questions the motives and ramifications of these goals, especially in the context of a late twentieth century convergence of commercial pharmaceutical development, shifts in governmental appropriations for analgesic research, and a wholesale reconceptualization of the ways that pain presented in patients. However, rather than suggesting that western medico-scientific cultures might willingly adopt tools that jettison efforts to quantify, measure, and classify, I will eventually suggest and elaborate on the implementation of design methodologies that might create more just and inclusive scales.

Introduction

"On a scale of one to ten, how bad is your pain?"

The concept of pain as vital sign— a clinical measurement alongside pulse rate, temperature, respiration rate, and blood pressure—was introduced in 1995 by the American physician James Campbell in an address to the American Pain Society (Morone and Weiner 2013, 1728). Launched in an era of rapid adoption of digital and visual technologies in medicine, the "pain as vital sign" concept reduces an otherwise highly complex and changeable affect and phenomenological experience to the status of a gesture or mark that indicates the probable presence of another condition or ailment. Pain, throughout the history of medicine, has been variously regarded as a discursive and signifying phenomenon: it is a symptom that points to or tells to consider exploring the body further to determine its source, a pathology that we might not otherwise discern. As the field of pain research expanded and formalized by the latter half of the twentieth century, however, pain became information rather than representation—a measurable, quantifiable, classifiable quality.

This project is a history of the medical and social construction of pain as graphic sign and as vital information. It traces this connection from the emergence of pain as and in the form of a visual signifying practice and toward a paradigm of information. Throughout the latter part of the twentieth century, this project shows, pain was situated as sign on the cusp of image and symbol, and as such became a vital signifier of data science and graphic design's mutual and interdependent ascendance in medicine, and more broadly, into the 21st century, with the graphic pain scale, a set of standardized image-instruments used to measure and quantify pain, as its major form.

It may be tempting to say that pain, a complex experiential entity, was "reduced" to information. Rather than lamenting the characterization of pain as measurable, quantifiable, and classifiable, however, this project takes a cue from Geoffrey Bowker and Susan Leigh Star, who reminded us, a few short years after Campbell's pronouncement that pain is a vital sign, that to classify is human (2000). We cannot, then, simply dismiss the emergence of the graphic pain scale as dehumanizing or reductionist, suggesting that pain need not or should not be measured as a critical step towards diagnosis and treatment. Rather, this project acknowledges the twentieth century view within pain medicine that pain is a symptom—a signpost to further knowledge of the subject. As such, even when pain cannot be identified as a lesion or other visual indication on the body itself, it can be a map towards an otherwise invisible condition.

Pain medicine's classificatory mission has focused most intently, this project shows, on intensity and location rather than quality or origin. In the 1960s, we begin to see the emergence in research psychology of visual aids designed for the purpose of measuring pain's intensity: graphic pain scales. These tools were developed, designed, and implemented by clinical researchers and practitioners, first in psychology and then in medicine, who sought valid results from efficient tools that could be widely applicable and generally applied across large swaths of patient populations.

This project is motivated by the fact that graphic design and medicine converged in major ways in the emergence of pain medicine, a field that took shape with its own departments and journals, in the postwar years of the twentieth century (Meldrum 2003). While pain research had been progressing slowly from the late nineteenth and into the first half of the twentieth century, the latter part of the twentieth century saw the convergence of commercial pharmaceutical development, shifts in governmental appropriations for analgesic research, and a wholesale reconceptualization of the ways in which pain presented in patients. The graphic pain scale is a critical category of technique and a core component of pain medicine—and thus is a core component of the ways that pain came to be understood and communicated by medical professionals and by people in pain since the late 20th century. How and in what sorts of practices and forms did this graphic design entity, the pain scale, emerge, and how has it informed and delimited pain communication, pain knowledge, and pain experience? To address these questions, we must also consider how graphic design has intersected not only with medicine but also with the experiences of people in pain, informing our expression and communication of our pain. These are the concerns of this dissertation.

In the chapters that follow, I introduce and analyze three categories of scales that were developed in the twentieth century to measure both the intensity and the location of pain. I do so to explore the material and conceptual implications of the visual and graphic design methods, esthetics, and decisions embedded in each scale, in the emergent field of pain medicine, and in pain communication. Generally speaking, the "implications" of material and concept relate to the ways that the subject in pain is understood biomedically, scientifically, and socio-politically. The analysis considers not only the scales as such, but also both the de jure and de facto ways that pain was, in their purview, treated.[1] In this regard, the project at certain points moves in, on an individual level, to consider the issue of patients' one-on-one interactions with doctors, nurses, caretakers, researchers, and other interlocutors. This is done not through ethnographic data, but through historical research with records, giving close attention to the structure of interaction suggested by the scale used in documented interactions, and the technique associated with it, as documented in the primary pain research literature (a body of work that is found across psychology, nursing, pediatrics, and other medical specializations). This move, this focus on the scale in its documented use, is justified by the fact that design decisions themselves, as I will demonstrate, were individualized—in most cases they are attributable to specific researchers and their patient studies and trials, in most cases of which the scale was adapted, redesigned, and optimized for use with the one: the individual patient.

After opening with a brief overview of pain measurement's history and a number of socio-political phenomena influencing its cultural conceptualization, the dissertation moves forward in a chronological order, demonstrating each of the three categories of scale introduced with attention to its visual antecedents and influences. Its visual elements are historically situated and theorized not only in the field(s) of the particular scale type's emergence and implementation, but also in the context of the history of design and visual culture. The project draws as well on disability studies and makes a new

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[1] Here I use the term "treated" to mean both medically via therapies or medication, as well as culturally via, for example, trust, empathy, and accommodations made.

contribution to this field by showing how not just visual but also graphic and informational elements must be better understood if we are to grasp fully the medical and social understanding, management, and institutional experience of the pained subject. It might be said this is a project in the visual culture of pain and a corollary of the visual culture of medicine. However, it is more accurately a project in *graphic* pain and graphic *health*. The shift is from visual to graphic, and from the medicine subfield to health history, a concept that more readily allows me to account for the experience of the patient and align with STI&MS (science, technology, information, and medical studies; Clarke and Star 2003). The project closes with an exploration of processes and methodologies we might consider when planning our next generation of pain scales. This last section proposes not only a design approach, but also a social and political orientation, understanding that the two are co-constitutive and complexly entwined.

The Graphic Pain Scale

Graphic Pain traces the development and use of three types of graphic pain scales, visual tools used to mediate the communication of a pain description between the subject in pain and the individual who is recording the description. In the chapters that follow, I describe and interrogate three major categories of graphic pain scales: the visual analog scale, the face-based scale, and the body diagram. The visual analog scale (Figure 1), chosen for this study because of its overall popularity (Litcher-Kelly et al 2007), features a single, often horizontal line that is labeled at each pole with descriptive phrases such as "no pain" and "the worst pain I've felt." Subjects are asked to mark the spot on the line corresponding to how they feel at that moment. Though their mark will eventually be turned into a numerical value, they are rarely given any indication of the precise value assigned to the point they chose. The visual analog scale provides no fixed divisions, marks or labels, only a sheer graphic continuum.

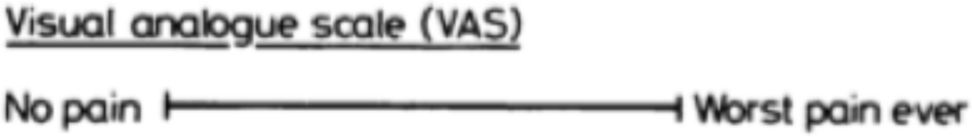
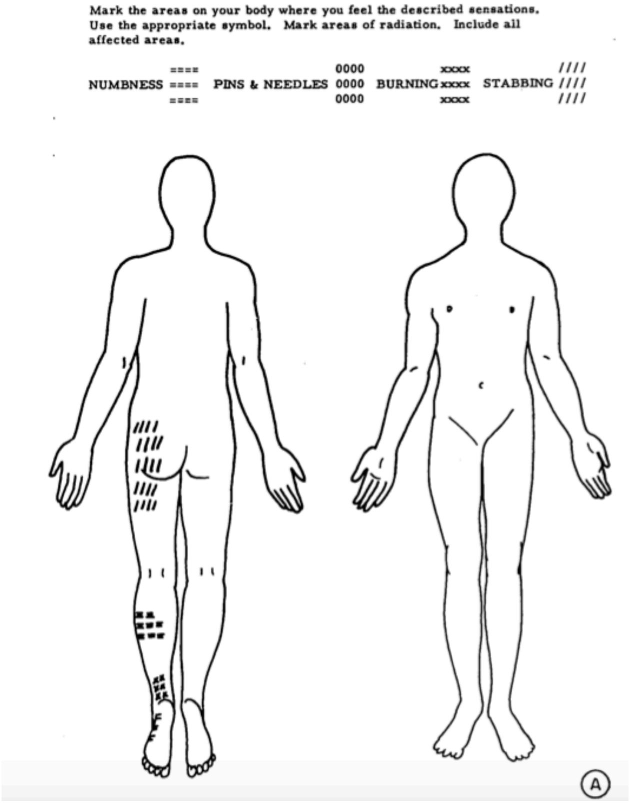


Figure 1: Visual Analog Scale from Ekblom and Hansson (1988)
© BMJ Publishing Group Ltd

Next considered is the body diagram (Figure 2), a system chosen for this project due to its inclusion on the McGill Pain Questionnaire, a graphic pain assessment instrument in wide use globally since 1975 (Mcafferty and Farley 2008). Body diagram instruments ask patients to mark the spot(s) where their pain primarily rests inside an outline of the human body. These scales are, in most cases, a non-descript (literally undescribed, undetailed) unisexual representation.



Mark the areas on your body where you feel the described sensations. Use the appropriate symbol. Mark areas of radiation. Include all affected areas.

Figure 2: Body outline on the McGill Pain Questionnaire from Melzack (1975)
© R. Melzack
© Elsevier/North-Holland, Amsterdam

The project's third focus is the face-based pain scale (Figure 3). Since the 1990s, these instruments, which feature illustrations or photographs of faces each representing a different intensity of pain, have been widely used in internal and emergency medicine clinics and are even more broadly used in pediatrics. For this category of scale, patients are asked to select the face that best represents how they feel, and evaluators record that face's corresponding numerical value.

Figure 3: Wong-Baker FACES Pain Rating Scale from wongbakerfaces.org
© WONG-BAKER FACES

Each of these three types of scales is approached in a framework that emphasizes its twentieth century history in order to elucidate how the specific design, adaptation, and use of each scale is turned to facilitate the quantitative measurement of pain.[2] In the case of the face-based pain scale, the research literature behind every version of the scale in use today refers back to a single thesis written by a nursing student in 1976. Rather than thickly embedding that thesis in its historical antecedents, I unpack the history of that thesis's emergence into a broader synchronic context in which we find the ascendance of the agency of nurses, the rise of a women's movement self-help culture, and advances in print-based graphic illustration in medical literature geared toward enhancing patient agency. The dissertation

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[2] This is not to say that the quantification of pain itself is unique to the second half of the 1900s, or suddenly emerged during this period. The dolorimeter, an instrument for measuring pain introduced in 1940 (discussed in the next chapter), is just one example of an instrument oriented toward measurement and classification of pain by degrees that has precedents in eighteenth and nineteenth century medicine. But this lineage is outside the scope of this study.

explores these connections in the service of contextualizing the design decisions made in the construction of each derivative scale in its future social world.

The extent to which the graphic matters and counts in pain management today needs to be underscored. Nearly all of the scale types covered in this project were designed to collect quantitative values relating to the intensity of pain felt by the subject. In the case of the body diagram, where location of pain is the primary concern, many versions are nevertheless designed to produce a quantitative value: after a subject indicates where the pain is by, say, shading in segments of the body, a number based on the area shaded is collected for research or treatment purposes (Figure 4). In this small shift the implications for visual and graphic culture are major: the drawing, a pictorial form, is rendered as a number, a graphic mark that operates in an entirely different system of signification, taking us from icon (the picture) to index (the shading) to digital sign (the number). In all of the scales analyzed throughout this project, subjects are never asked to quantify their pain directly—that is, they are always asked to interact with a visual icon, even if only in the form of a line, a spatial continuum. The digital sign and its numerical value are not the primary concern. In some cases, subjects may be asked to use an integer to evaluate the intensity of their pain, either at or before the moment they are being questioned. But the scales always offer a visual graphic.

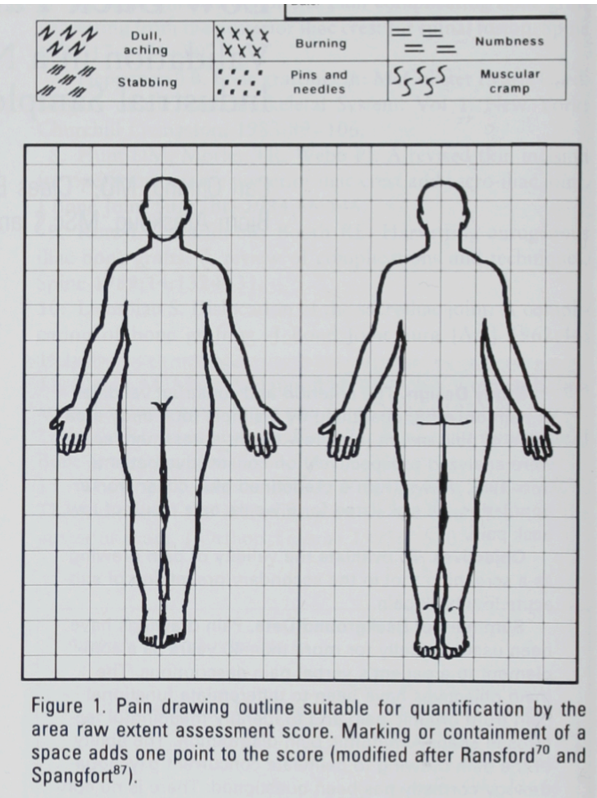

Figure 1. Pain drawing outline suitable for quantification by the area raw extent assessment score. Marking or containment of a space adds one point to the score (modified after Ransford[70] and Spangfort[87]).

Figure 4: “Pain drawing outline suitable for quantification by the area raw extent assessment score.”
from Öhlund et al. (1996)
© Lippincott-Raven Publishers

Fields of Inquiry

In addition to focusing on three classes of scales, this work pulls primarily from three disciplines: design studies, visual STS (science and technology studies), and disability studies. As I will explain in the final section of this chapter, I am trained as a graphic designer and have come to this project through a series of professional and academic experiences which would fall under the rubric of design practice. Beginning my inquiry in design studies, and attending to the relation between the designed and designer, made sense to me. In order to take the viewer-viewed relationship into consideration, I incorporated visual studies. The project's situation in the history and theory of pain medicine drew me to STS, particularly the branch of that field that intersects with visual studies. It may be said that this eventually became the project's primary home. Disability studies, with its strong history and theory of the non-normative and misfitting body (Garland-Thomson 1997), became a final and primary field for my work as well. I will explore each field in greater detail here.

Design Studies

I approach the pain scales covered in *Graphic Pain* as designed objects, as opposed to regarding them as works of art. As a designer, I emphasize "use" in the development and creation of their forms (Tonkinwise 2014, 15). None of these scales were put forth by their originators on the basis of their aesthetic value, or what historian Martin Jay might call "aesthetic effects" (2002, 88). Rather, pain scales are utilitarian visuals, what might be called "visual aids." Nearly every aesthetic decision behind each scale discussed was made to better accommodate the goals of the researcher to better identify location and quantity of pain. Still, there is value in embracing what art historians would call provenance—the aesthetic influences on and prior work by each scale's designer. This approach helps to build genealogies and leads us to recognize what values may be embedded within a design's development. In at least two of the examples in the following chapters, however, the tools used to produce and reproduce the scales in question—the printing press and the pen plotter—are unquestionably "designerly." In the case of the face-based pain scale, typography, cropping, and layout, all concepts from graphic design practice, become critical to the development of the form, and thus to my interrogation. As design theorist Cameron Tonkinwise writes, “design history is central to the know-how of designing—if, and only if, that design history comprises cases of previous designs *as used*.” Tonkinwise continues, situating use in the context of interaction: “What is of interest is the interaction precedent, not the form as photographed for a slide collection” (emphasis his; 2014, 13). Taking production and use into consideration requires understanding the “designerly field” as a context informed by a history and theory that grasps the complexity of interaction—among the object designed, the individual designing, and the individuals using the designed object, subjects who are in this project’s case the researcher or clinician and the patient.

As the designer became a more prominent figure in the postwar corporate West, scholars called for an analysis relating to how designers do what they do. This took the form of conferences and journals organized around the development of frameworks—often based on a loose understanding of a scientific method for design—through which to understand the designer and their processes (Cross 1993, 16–17). This in many cases and inevitably led to scholars in the field framing design as a science, a claim that made it easier for design researchers to publicize their own work (“the science of design” certainly has a ring of expertise to it). Further, it made sense in a field paired so often with architecture and engineering, fields with clear science orientations. By the late 1970s, however, critics began decrying this pairing. They suggested “design methods” might align more closely with the burgeoning interdisciplinary fields of history, philosophy, and sociology of science (Cross 1984, 238). In this vein, design historians and theorists began calling for the sort of work done by Karl Popper, Thomas Kuhn, and Paul Feyerabend—but in a design context. Continuing in line with STS, design studies has undergone, in the first part of the twenty-first century, an ethnographic turn—or, what Tonkinwise calls a “sociotechnical turn” (2014, 20). Tonkinwise, an advocate of this turn, points to anthropologist of science Lucy Suchman’s work at Xerox PARC in the 1980s on human-computer interaction (HCI) and situated cognition as an example of the sorts of situating that he wishes design studies researchers to do. This turn towards situated cognition is an important backdrop to the story my dissertation tells. It is an important history to know for any account that unpacks designed artifacts such as pain scales in an applied context.

This project, however, does not rely on ethnographies of design or design use. Instead, I point to theorist and historian Victor Margolin's work to elucidate the sort of design studies embraced throughout *Graphic Pain*. Margolin made a call in 1989 for a design studies approach that could take on the discipline from which it was derived in the same way that history, philosophy, and sociology of science took on science, their practical counterpart. In Margolin's design studies, scholars would begin to break apart designed work and interrogate the values and politics contained within it. This is a version of Langdon Winner's landmark argument of 1980 that artifacts are embedded with politics. "What matters is not technology itself," Winner stated, "but the social or economic system in which it is embedded" (122). Winner's argument parallels a whole generation of work in art history and visual studies on ideology of the image and representational tools and instruments. I consider the graphic pain scale to be a technological artifact, a product of a century of advancements in pain science, in printing and reproduction technologies, and in statistics and mathematics. Winner argues that an adequate analysis of the politics of a new technology takes into account not only its impact on society but also the political, economic, and social circumstances of its development, distribution, and use. The same may be said for graphic images as instruments. When, for instance, I suggest that the DIY aesthetic of early face-based pain scale prototypes is an indirect result of the nursing industry's reaction to Reagan-era austerity measures, I am engaging in STS and design studies methodologies as I project that sociopolitical reality onto the relationship between the designer and the designed.

Still, the broader, practice-focused design academy, organized as it is around application and professionalization, rarely welcomes this sort of interrogation. This incongruence emerges primarily out of the way that design is situated within the academy, as a studio art and not a liberal art. Guy Julier (2006), Tonkinwise (2014), and design historian and theorist Rick Poynor (2011) all lament this point as they each make calls for a design history (Poynor), a design studies (Tonkinwise), or a "design culture" (a term preferred by Julier, though ostensibly a synonym for design studies) that can be written by, taught to, and engaged with by those outside of traditional studio design departments. However, the heavy focus on professionalization within design pedagogy hinders this envisioned shift. Poynor explains: "Graphic design history's compromised location as an adjunct to the design studio—its lack of full departmental status—denies it the appearance of academic legitimacy" (para. 23). It is exactly the practice-based nature of graphic design, he goes on to suggest, that makes it a strong candidate for the subject of a critical interrogation: "Graphic design has been overlooked precisely because it forms the connective tissue that holds so many ordinary visual experiences together" (para. 26). And yet, the primary subject matter contained within most major works of graphic design history is the poster, magazine cover, book design, or advertisement. More recent textbooks, such as Drucker and McVarish's *Graphic Design History: A Critical Guide* (2009), have made room for the digital age of graphics production, but I would argue that in the works considered, there is very little of Poynor's ordinary connective tissue: designs in major exhibitions and texts are ambitious and groundbreaking, done by well-known names with storied histories. Within design studies, there has been little if any attention given to the graphics used within the clinical or laboratory context to aid in the diagnoses or measurement of a patient or subject's condition.

Design historian and theorist Robin Kinross, in an article contained within the 1989 Margolin-edited *Design Issues* anthology, interrogates the design of twentieth-century European train timetables as indicative of the social and political movements of their time, eventually concluding that "nothing is free of rhetoric, that visual manifestations emerge from particular historical circumstances, that ideological vacuums do not exist" (143). Exemplifying the sorts of connections that design studies approaches encourage, Kinross goes so far as to argue that the use of the typeface Gill Sans in 1920s British timetables portends the fate of modernism in the twentieth century. Similarly, in the film *Helvetica*, Gary Hustwit (2007) assembles a variety of designerly voices in order to demonstrate the discursive power held by the eponymous typeface.

While I do not suggest that the fate of modernism is revealed in the designs of graphic pain scales, I do argue throughout that the fate of the in-pain subject is held in them. To make this claim requires me to position with equal weight in my argument the relationship between the viewer and the viewed and that between the designer and the designed. This work emerges from and alongside design studies scholarship, but methodologically it is primarily a work of Visual STS, a field I aim to more fully engage in design studies.

Visual STS

Visual Science and Technology Studies, or Visual STS, is a field which organizes the history and social science study of the visual output and technologies of scientific practices—what Peter Galison (2015, 199) has termed "first-order VSTS"—as well as the visual ethnographic documentation of scientific practice—what Galison calls "second-order VSTS." Interest in the visual output of science goes back to the 1980s, though Visual STS began to coalesce formally around what Michael Lynch and Steven Woolgar referred to as "representational activities in science" (2) in their introduction to the 1990 volume *Representation in Scientific Practice*, an early work in visual STS. In "Visual Science Studies: Always Already Materialist," Cartwright argues that science studies has borrowed approaches from art history and visual studies primarily to discuss objectivity and knowledge, rather than to address subjectivity and the phenomenology of experience, but that there is in fact a strong legacy of feminist materialist work on representation and embodiment that has been underutilized. "Feminist research about images, representation and visuality," she writes, "has been critical to the development of the interpretation of images and imaging in science, technology and medicine studies" (2015, 246). In this dissertation, I wish to build on this tradition in order to consider the complex relationship between the patient and the pain scale, the viewer and the viewed, and pain as an experience that is ultimately embodied and experiential.

In order to do so, I will draw from visual STS work that theorizes the patient as subject. The concern with the graphic and the numerical makes STS work on measurement, instruments and outputs of particular relevance. Bisecting film studies and STS, Cartwright (1995) discussed the x-ray and microscopic motion study, technologies predicated on producing data about quantity (bone density, cell growth) in graphic, flat form. She argues that "this penchant for flatness was symptomatic of a more pervasive cultural disavowal of the physical body as phantasm, as nightmarishly visceral and disorderly—a denial rationalized by a modernist demand for order, simplicity, particularity, and clarity" (1995, 91). In studying pain scale development, I came up against a similar penchant for flatness—single, two dimensional lines on paper arranged in an attempt at ordering perhaps the most visceral affect, pain. These lines—some perfectly straight, others contoured to the shape of a face or body—become the only interface between a pained individual and the caretaker or researcher responsible for recording a measurement to document and chart that experience.

Cartwright's work encourages attention towards how technologies of representation have physical effects on bodies and subjects, constituting the subject and shaping their treatment (1995, 170). In the case of the pain map, a mark made on the body diagram drawn as a normatively shaped male will influence how a physician regards and treats that patient, whether or not that patient's body remotely resembles the diagram. Critical here, however, is the differentiation of the object of my study as neither pictorial nor filmic, but graphic. Here, I point to the work of Susan Squier, a scholar of literature, science, and the arts, on graphical medicine. In her 2017 *Epigenetic Landscapes*, Squier notes that cartoonish representations of embryos "brought laboratory findings into the social realm" (87) and facilitated communication between scientists and the lay public (92). Focusing on the graphical, rather than the pictorial, as Squier does, allows me to interrogate at the interface level the specific graphics used as a communication tool not just between science and the lay public, but inside the clinical setting. In the pages that follow, I will be asking *how* these graphics represent. More importantly, what is "the graphic" as a form in itself, and what does it bring to medicine and to the understanding of experience?

Françoise Bastide (1990) uses Bruno Latour's concept of "traces" to describe how diagrammatic representations of scientific phenomena work to make visible "not the object itself, but the result of its action" (189). Historian Roger Krohn, in 1991, emphasized the centrality of graphs in science, asking "How can a number be similar to an aquatic plant?" (200)—that is, how can the visualization of numerical data be considered in the same vein as depictions, pictorial illustrations, or the sorts of diagrams written about by Bastide and others? Read together, Bastide and Krohn inspire directions of inquiry undertaken in *Graphic Pain*, prompting questions such as: What *is* visible on the scale itself before and after it is filled out? Is it simply a "trace" of pain? Is it an abstracted value of a fleeting affect?

How can a number be similar to a sharp stabbing sensation or a dull throbbing ache? In this last question—and in citing Krohn's essay—I am highlighting my focus on the graphical in its complex and enmeshed relationship of difference from and continuity with the pictorial, as well as my attention to the informational in its similarly complex relationship to the representational.

Visual STS, then, provides the critical groundwork for the theory and history of graphic medicine and graphic pain launched in this dissertation. This project considers how a designed graphical interface collects quantitative information, shapes the subjectivity of the patient, and transforms conceptualizations of what pain looks like. Building on work in visual and digital STS, I draw from the legacy of "representation in scientific practice" launched in the 1990s with some of the works cited above, and expanded in contemporary attention to information, computerization, and patient as data. The spectrum includes science studies scholars Christopher Kelty and Hannah Landecker's (2004) work on how images shape knowledge, STI&MS sociologists Lisa Jean Moore and Adele Clarke's (1995) work on the material implications of illustrated anatomies on the medical perception and treatment of women's' bodies, and art historian James Elkins's (2007) work on visual mapping practices in scientific disciplines. The recently published *Representation in Scientific Practice Revisited* (Coopmans et al. 2014) and *Visualization in the Age of Information* (Carusi et al. 2014) contribute a discourse that takes into consideration nearly twenty-five years of innovation in the field. Visual STS-adjacent scholars such as Vivian Sobchack on the line (2008) and Miriam Sweeney and Kelsea Whaley on emoji skin-tone (2019) will be important sources as well. Theodore Porter's (1986, 1996) and Ian Hacking's (1990) varied histories of statistics and the power of numbers in society for the past 150 years are also valuable.

Disability Studies

There is an irony, to be sure, that this project places so much emphasis on the visual when what is being measured is so impossibly recalcitrant with respect to the visible. Susannah B. Mintz, writing in *Keywords for Disability Studies* (2015), notes that "in a visual culture, what cannot be seen cannot be known, and so it is easy to discount or distrust" (323). So much of pain scale design is about [dis]trust in what a patient or subject might tell you without the help of the tool—a tool that facilitates the communication of pain from one individual to another. The disability scholar Tobin Siebers (2006) argues that pain is incorrectly perceived as highly individualized, immune from the sort of social construction that defines the disabled body. In this dissertation, I consider pain to be, unconditionally, a disability. Doing so helps me lean on a field that understands how to conceive of the body that is constantly being othered by the rarely challenged normativity of design practice. As Simi Linton wrote in 1998, disability studies "is the socio-political-cultural model of disability incarnate. It provides an epistemology of inclusion and integration, formulating ideas that could not have been imagined from the restrictive thresholds of the traditional cannon" (526). The "traditional cannon" that Linton pits disabilities studies against in her essay is made up primarily of the applied medical sciences, fields that she argues were coopting the "disabilities studies" moniker at the time. This is no longer the case two decades into the twenty-first century, but as I will argue—primarily in the final chapter—Linton's assertion could perhaps apply to traditional design approaches that see the disabled body as mutable, thanks in great part to the design canon's willing ignorance towards her epistemologies of inclusion and integration.

As disability studies scholar Lennard Davis (2006) writes, "The average man, the body of the man in the middle, becomes the exemplar of the middle way of life" (5), and this is very often the way of design in the name of marketization. In the case of the graphic pain scale, efficiency and validity goals drive the development of tools that are of widespread applicability, often jettisoning the non-conforming body. Historically, in the West, when bodies do not or cannot conform, they are hidden away, incarcerated or committed, in the name of the public good. This is the history traced by Susan Schweik's (2009) *Ugly Laws*, a book that will inform my arguments relating to the ways that pain scales construct social conceptualizations of pain and disability. And when that body cannot be hidden, it might be placed front and center to be stared at as spectacle. Using the "freak" to think through face-based pain scales and normatively drawn body diagrams, I point to Rosemary Garland-Thomson, who writes, "Even supposedly invisible disabilities always threaten to disclose some stigma, however subtle, that disrupts the social order by its presence and attenuates the bond between equal members of the human community" (2002, 57).

Elizabeth Guffey, in *Designing Disability* (2018), specifically points to Garland-Thomson's work when she argues: "as an idea, misfit allows us to produce a humanist, rather than medical, view of how designers have imagined, practiced, contested, and revised our notions of disability" (4). Guffey's work is exemplary of the fruitful analysis that can be produced when design studies and disability studies are put in conversation with one another, even without the sort of ethnographic work called for by Tonkinwise (2014) and others. In her introduction, she notes that she began by researching the International Symbol of Access (also known as the wheelchair symbol: ♿, the ISA is used globally to indicate services, paths, areas, or other accommodations and affordances specifically tailored to disabled individuals) and realized she needed to break her analysis out into what both symbols and access mean to disabled bodies. The project became an interrogation of the ISA "not just as a design, but also a manner of thinking" (2).

Engaging in disability studies throughout helps this project take on the design of pain scales as a means to think about the experience of pain. Along the way, I will raise questions about the felt properties of pain as they are represented in a single line, how body maps implement a language of engineers and architects that flattens and decontextualizes the human body, and what the image of the normative face in pain means to the disabled body in general. Disability studies lines those investigations with the critical question: For whom? For whom is pain known? For whom are these material implications forced onto the subject? Siebers wrote, "the greatest stake in disability studies at the present moment is to find ways to represent pain and to resist current models that blunt the political effectiveness of these representations" (2006, 177). The materiality and design of the pain scales discussed in this work have been considered objects of much research throughout their development and use. That research, however, has always been focused on the efficiency, validity, and applicability of the tool for the task at hand—measuring the intensity or location of a subject's pain. Never has the research considered how a single smooth line might convey a false sense of freedom, how a body diagram might recontextualize the human figure as an engineered part or building, or how a cartoon face might reinforce cultural biases regarding what a body in pain should look like. Through an interrogation framed by, design studies, visual STS, and disability studies, I plan to do just that.

Chapter Outline

I have already made reference a number of times to the three case studies around which *Graphic Pain* is arranged: the Visual Analog Scale, body diagram pain maps, and face-based pain scales. Historicizing and theorizing the development of these scales cannot be done without first tackling a number of contexts in which the tools have been conceptualized, launched, and used. Chapter 1, then, takes on two brief but specific histories of pain: one that asks how the infliction and expression of pain has been conceptualized culturally, and one that focuses on the medico-scientific reasons for large-scale pain studies. These two histories come together in an effort to situate the discrete sufferer in a socially constructed understanding of pain that requires individualized expressions while simultaneously grouping them into larger classificatory systems.

From here, the next three chapters move generally chronologically, though with some timeline overlap, beginning with Chapter 2, in which I delve into the history of the Visual Analog Scale, a single line, usually 10cm long, which the interrogator asks the pained subject to mark. Having emerged as a tool for medico-scientific pain research in the 1960s, over half of all pain science research cites its use. The mechanism derives from the Graphic Rating Scale, a tool designed and implemented for the rapid evaluation of workers by management in the first few decades of the twentieth century, at the height of industrial psychology's popularity. I situate the VAS's history among theories of the line. Here, the perhaps unlikely pairing of artist Wassily Kandinsky and media phenomenologist Vivian Sobchack help us understand the power of the line. Situating the tool's roots in labor subordination allow me to suggest that there is a perceived freedom along the line that is betrayed as soon as it is actually put into practice.

Chapter 3 highlights mid-century efforts in engineering and architecture to draw the human body using industrial conventions—what I call the language of drafting—to create a near-universal guide for human sizing and proportions, and links those efforts to the emergence of a standardized human body outline for marking pain localization. These body diagrams or pain maps appeared on the 1975 original version of Ronald Melzack's McGill Pain Questionnaire, propelling them to widespread use both with and without Melzack's work. I situate the pain map among a brief history of anthropometrics, theorizing it via Visual STS scholarship that touches on medicine, body images, and standardized measurements. I eventually suggest that, drawn as such, these body diagrams represent a quantifiable and manipulatable body that serves to reify the expertise of scale administrators.

Chapter 4 ushers us into the Reagan era, a time during which pressure from private insurers and austerity measures led to the disproportionate removal of chronic pain sufferers from disability benefit rolls (Osterweis et al. 1987, 1). This is also a period during which the face-based pain scale emerged, often designed by the nurses and researchers who were not only responsible for measuring their subjects' pain, but to do so in a timely and cost-efficient manner. The nurse, then, is a central figure in this chapter, especially as I trace the genealogical roots of some of the most widely used scales in medico-scientific contexts in the first part of the twenty-first century. Turning to disability studies once again, I explore how the illustrated face in pain might change cultural conceptualizations of what pain itself looks like.

Finally, in Chapter 5 I suggest a way forward. Rather than using my histories and analyses simply to envision a new pain scale for the future, I argue that the process to get there must be one of inclusivity, equity, and justice—three elements that were neither part of our current crop of pain scales, nor are they part of many design projects. I begin by elucidating the inherently capitalist qualities of the pain scales at hand and, using anti-capitalist thinker Erik Olin Wright (2019), outline how we might embrace the logic of collective action to set the stage for a new kind of design process. Citing recent thinkers among that topic, including Sasha Costanza-Chock (2020), Arturo Escobar (2018), and others, I end by highlighting a number of projects (including my own) that might inspire the steps to take in this process.

Standpoint History

I close this introduction with a brief preview of my conclusion, which veers from the historical work of the main body of the text, with this aim of taking a stand. Feminist standpoint theory asserts that knowledge is situated. More than simply a perspective or viewpoint, a standpoint—or, acknowledgement of its inevitable role in research—"makes visible a different, somewhat hidden phenomenon that we must work to grasp" (Harding 2004, 8). I come to this project as a chronic pain sufferer[3], something I will elucidate in the final chapter. This is what inspired my initial research into the quantification of pain and it is what makes this project so meaningful. But, in the name of considering the situatedness of the designer and researcher in the process of measuring a subject's pain, I believe it important to disclose what other possibly hidden perspectives and privileges I bring to the work.[4] Firstly, I am a trained designer with an MFA in communication design from the last remaining public art and design school in the United States. I have a decade's experience working in the advertising and marketing industry, a path that emerged from connections I made while pursuing my undergraduate degree in business administration at a specialized business school. My experiences in the commercial design field have shaped my understanding of the ways that both design as a practice and design as a field operate in conjunction with, in opposition to, and in indifference to the marginalized body.

It was not until I began exploring directions for my PhD pursuit that I recognized how formative my experiences with pain had been to my own practice as a designer/artist and as a scholar. Even though I had been diagnosed with a chronic and painful condition half a decade earlier, I had never characterized my body or self as disabled. This is, perhaps, thanks to the immense privilege that I carry as a cis-het

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3. I have used the term "suffer" a number of times to this point and acknowledge here its problematic nature. In the social model of disability, wherein someone's disability is defined by the attitudes and structures of society, including the inaccessibility of the built world, disabled individuals do not suffer and they are not in need of healing (UPIAS 1975; National Center on Disability and Journalism 2018). I consider pain to be an affective consequence of disability, even and especially as that disability is defined by the built world. Further, whether or not an individual suffers as a result from feeling physical is irrespective of how disability is defined but can still constitute someone's identity (myself included).

4. Here, I am also practicing crip politics (Lewis 2015) vis-a-vis feminist standpoint theory (see Garland-Thomson 2005). This is an exercise undertaken by Sasha Costanza-Chock, whose work I cite in the final chapter and who was an important figure in my development as a scholar (see Costanza-Chock 2020, 9).

white man from a middle-class upbringing, privilege that I wish to acknowledge here. I will discuss the importance of intersectional thinking in building a movement towards new ways to measure pain in the final chapter, but for now I want to make clear that I wrote the following document in hopes that individuals from a myriad backgrounds might recognize their participation in, marginalization at the hands of, complacency in, or subconscious resistance to the ways that the design of graphic tools in medicine shape and structure our world.

I wish to extend Bowker and Star by arguing that not just classifying, but quantifying and measuring are human as well. To simplify is human. To make graphic is human. Elaine Scarry's *The Body in Pain* (1985) is often cited by pain researchers working from the humanities and I will utilize her work here throughout as well. Her goal was to understand the nature of expressing pain and mine is to explore how one tool shapes not just that expression but the pain itself. The graphic pain scale is indicative of the ways that design determines how the body in pain is perceived, understood, trusted, and treated. I begin, then, with perception.

Chapter 1: A Biopolitical Regime

> "Subjective responses are symptoms. They are evident only to the individual experiencing them; they can be imparted to an onlooker generally only through a co-operative statement by the subject." – Henry Beecher, *Measurement of Subjective Responses* (1959)

The historian Keith Wailoo, in his 2015 *Pain: A Political History*, assembles a thorough and complex amalgam of politicians, insurers, regulators, lawyers, researchers, and others, as he chronicles the legislative and judicial efforts to regulate and make available pain treatments from the end of World War II to the middle of the Obama era, just after the passing of the Affordable Care Act. Along the way, pain is defined and redefined by various administrations who wish to implement their own ideologically driven policies, primarily through the Social Security Administration, Medicare Act, and Veterans Administration. Even as scientists gain and proliferate knowledge on the causes and conditions of pain, per Wailoo, "it has been the courts…that have settled questions about the validity of chronic pain" (12). As the Reagan administration took office, its members tried to build a litmus test of sorts for what being in pain meant, "To 'change back the definition of disability so that it would rest solely on medical grounds and would not take into account vague…factors, which are so difficult to determine in a consistent manner'" (99). Seeking to define pain via purely medical factors is a disingenuous venture that ignores the social construction of the ways in which it is felt, communicated, measured, treated, and so on. When the Reagan administration worked to purge benefits programs of pain sufferers, a concrete effort was made to deny disabled bodies a place under whatever social safety net remained after the carnage left by neoliberal austerity. Making decisions on whose body does and does not belong was not new, however, and the Foucauldian concept of governmentality helps us unpack this phenomenon. In this brief chapter I review governmentality, followed by two important histories: the cultural conceptualizations and medico-scientific infrastructures of pain expression. I end with a discussion that attempts to situate the concept of the self within pain measurement through disability studies theories of the individualization of pain and Foucauldian technologies of the self. These histories and theories lay important groundwork to help contextualize the graphic pain scales unpacked in the chapters that follow. They become important as well in my final chapter as I put forward methodologies that could inform the design and development of a new generation of pain scales. I begin and end this chapter with Foucault as I attempt to establish the ways that power operates through graphic pain scales, ultimately establishing that recognizing the material implications of their use requires understanding by whom and for what reasons they came to be.

Governmentality

As sovereign power shifted at the end of the seventeenth century from individuals ruling over principalities and whomever lived inside of them to governments overseeing populations understood to live in, travel to, trade with, and war with neighboring lands, keeping track and organizing became state priorities. In a 1978 talk to the Collège de France, Michel Foucault outlined this shift in governance, arguing that it ushered in the birth of economies: collections of goods, people, and money that all fell under the sovereignty of a state. Critical to the management of these economies were technologies of counting and tracking—statistics, anthropometrics, and the like. Majia Nadesan, reading Foucault as well as Nikolas Rose, notes that governmentality addresses some key concepts surrounding the organization of society's technologies, problems, and authorities; it recognizes, too, that individuals are both turned into "self-regulating agents" and/or marginalized as invisible or dangerous (2011, 1). In order to explain how hegemonies develop and deploy technologies to control the life of populations, Foucault developed the concept of biopower, "arguably the most pervasive form of power engendering the homologies and systemic regularities across the diverse fields of social life" (Nadesan 2011, 3). It is under these conditions that the efficient, valid, and applicable graphic pain scale became commonly used.

Eventually, neoliberal governmentalities took hold of Western populations in the latter years of the twentieth century, and so the cost and efficiencies of healthcare became an obsession. Designer Lauren Williams writes that "this period also amplified the enmeshments between design and neoliberalism, which were already entwined in significant ways" (2019, 308). As Reagan's FDA was deregulating the pharmaceutical market, Nancy Reagan was declaring “Just don’t do it” on television, a motto of the newly launched “War on Drugs.” Subsequently and ironically, physicians were scared into under-treating and overmedicating their patients, effectively opening the conduits through which today’s opioid epidemic came to be (Wailoo 189). Williams notes, “The dismantling of the welfare state, the privatization of public sector services, and the neoliberal framing of ‘individual responsibility’, especially, further expanded a void which private markets would seek to fill with innovations in efficiency and scale” (308).

Efforts to know pain are products of a biopolitical regime in which we, the subjects of governmentality, police and are policed. Geoffrey Bowker and Susan Leigh Star remind us that “to classify is human” (2000, 1) and, as I argue further on in this chapter, measurement is a similarly human instinct. When the graphics facilitating this measurement serve efforts to prove, trust, and believe, it is critical to know who authors those graphics and for whom. None of the scales reviewed in this book originate from ordained “designers” but instead emerge from the minds of researchers and practitioners who are simply looking for a more efficient, valid, and applicable way to measure their subjects’ pain intensity or location. Still, what these scale authors have put forward are instruments with material implications for their subjects—individuals who are so often at the margins of a society not designed to accommodate the way their bodies act, look, or feel. The construction of this biopolitical regime begins long before our graphic pain scales come to fruition.

Transactional Pain

In *The Abu Ghraib Effect*, a 2007 book by the art historian Stephen Eisenman, the author elucidates how visual depictions of pain and suffering—from Greco-Roman antiquity through to the troubling photographs of the torture perpetrated by US forces at the Iraqi prison during the second Gulf War—desensitize the viewer to the image-subject’s suffering (9). He argues that there is a close tie between nationalism, imperialism, and militarism and the visages of torture and pain that have been so prevalent over the past half-millennium, and while it is not a controversial stake to claim that pain and suffering have been popular motifs in Western art for centuries, Eisenman's book provides a unique look at how cultural conceptualizations relating to the ways that pain exists outside the subject's body can change and has changed since antiquity. Before we begin an interrogation of graphic pain scales in the coming chapters, it is necessary to take a brief look at these shifts in order to establish how pain is understood within culture to be inherently transactional.

The desensitization that Eisenman points to—his "Abu Ghraib Effect"—is, per the historian, a direct descendant from Aby Warburg's *pathosfomel*—the "pathos formula" wherein torture and pain are eroticized both in their visual depiction for the sake of aggrandizing the oppressor and in their necessity for seeking truth (that is, as a CIA agent might torture a prisoner for information). Eisenman traces the presence of pathos formula in work from antiquity (Figure 5) through to the mid-nineteenth century **(**Figure 6**)**, at which point the visual language of Realism, among other movements, eroded the cultural value of suffering: "Torture is shown here [Figure 7] to degrade both torturer and victim and to hold no promise of revelation. By the late nineteenth century, the pathos formula in any form—oppressive or redemptive—was only rarely visible in the artistic media and venues for which it had been devised: painting and sculpture exhibited in churches, palaces, salons, academies and museums" (88). Religiosity was no longer portrayed as transcendental; heroism of the gods no longer anything but an ironic relic of a classicist past. As Europe and the West saw the emergence of totalitarian regimes in the first part of the twentieth century, however, so did the art of those regions see a trickle of *pathosfomel* return. Art featuring as motifs the muscular and menacing became representative of the Soviet and Nazi orders (Figure 8), representing "the complete subordination of the body to doctrine, and the willing surrender of the autonomous, critical subject to the dictates of state authority and power" (90). Eventually, Eisenman argues, the torturer was once again held in high regard, inscribing "an oppressive ideology of master and slave on our bodies and brains" (99) through both art and pop-culture, reinforcing the acts of inflicting pain on another as a "necessity for obtaining the truth and ordering society" (95).

Figure 5: Michelangelo, *The Execution of Haman*, 1511–12, fresco, Sistine Chapel ceiling, Vatican Palace, Rome.
From *The Abu Ghraib Effect* by Eisenman (2007)
Photo © Stephen F. Eisenmann

Figure 6: Francisco Goya, *A Fight with Clubs*, c. 1820, oil transferred to canvas.
From *The Abu Ghraib Effect* by Eisenman (2007)
Photo © Museo del Prado, Madrid

Figure 7: Edouard Manet, *The Mocking of Christ*, 1865, oil on canvas.
From *The Abu Ghraib Effect* by Eisenman (2007)
Photo © Stephen F. Eisenmann

Figure 8: Felix Albrecht, *Wir Arbeiter sind erwacht Wir wählen Nationalsozialisten, Liste 2 / / Felix Albrecht '32*.
Germany, 1932
No known rights holder.

In order to transition us from the traditional visage of torture and suffering to the utilitarian graphic pain scale, the relational properties of pain are necessary to unpack. Here, I turn to the philosopher Elaine Scarry's important 1985 work, *The Body in Pain*, wherein the author argues that pain is, by default, private and incommunicable (25) while also objectless (162)—that is, until it is expressed, either through a scream or yell or through metaphorical description ("I have a stabbing pain in my arm"). In the former scenario, a torturer has extracted the expression of pain through infliction and has subsequently objectified his subject, unmaking the subject's world. In the latter, the subject has utilized their own pain to create a mental image with which to communicate with their interlocutor. In both scenarios, without the interpersonal exchange, there is only that private and incommunicable void inside the subject.

The graphic pain scale is a material manifestation of the necessarily transactional nature of pain measurement (and, as such, expression). Recognizing how the graphic pain scale works requires an understanding of the roles involved in these transactions: the interrogator versus the subject in pain. Graphic pain scales exist, as I will demonstrate, to facilitate a relational transaction—they were not developed for personal reflection. In each of the three case studies I present in the following chapters, I explain how the design of a scale arranges and influences the relationships involved in pain measurement and tracking: in the case of the Visual Analog Scale, subjects are meant to feel a certain freedom of possibility regarding their declared levels of pain, while the evaluator is well aware of the fallacy of that freedom; when the evaluator refers to the subject's body using a so-called "pain map," they are implicating their patient in a standardized discourse of body dimensions, able to be rearranged at the whim of the designer; and finally, face-based scales condition the evaluator to have certain preconceptions about the way pain looks in the subject, reifying generally accepted cultural tropes and framing the subject in those tropes.

In my introduction, I noted that this project is about the material implications of the design on the subject in pain. But this subject is a stand-in. Much like Eisenman's painted suffering figures or Scarry's tortured but hypothetical victims, my subject is meant to elicit affect in my reader that can then be applied to a community of sufferers. As disability studies scholar Martha Stoddard Holmes writes, "focusing on the individual body in pain compounds an existing tendency to view disability itself as an individual misfortune rather than a social and political identity, and pain as private suffering rather than a socially produced condition" (2015, 379). Historicizing or theorizing pain on its own is not part of this project[1]. However, in considering how the graphic scale has been a part of socially produced pain, it is impossible not to struggle with the relationship between individualized felt and measured pain and cultural conceptualizations of and reactions to pain. This relationship is especially complicated by the specific

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[1] For an impressively thorough account of pain science from antiquity through the first half of the twentieth century, see Roselyne Rey's *The History of Pain* (1995). Javier Moscoso's 2012 *Pain: A Cultural History* supplements medico-scientific texts with 500 years of pain's representation in art and culture.

emergence of the large-scale pain trial in the post-war nineteen fifties United States—an emergence that occurred, largely, thanks to Dr. Henry Beecher, and one that demanded the development of a tool such as the graphic scale.

Subjective Pain

In 1952, the Harvard Medical School and Massachusetts General Hospital anesthesiologist Henry K. Beecher published a paper in the August 15 edition of *Science* in which he argued that a previous reliance within experimental pharmacology on those phenomena "that can be measured objectively in response to drug administration" (157)—primarily as a result of experiments on animals—was not enough to understand which drugs were most effective in treating patients. Instead, Beecher put forward, the so-called subjective responses of human hospital patients should be studied: "headache, difficulty in concentrating, difficulty in focusing eyes, fatigue…increased 'nervous' tension, paresthesias, itching…and pain" (157), to name a few. The paper came at a time during which major changes were taking place in the world of analgesic experimentation, brought on by a number of factors, including but not limited to a post-World War II emphasis on treating pain both on and off the battlefield, as well as the relatively new availability of synthetic opiates developed by the Germans during the wars (Tousignant 2011, 163, 167).

The findings from Beecher's *Science* paper would eventually make it into his major 1959 work, *Measurement of Subjective Responses*, a thorough examination of the logistics and benefits of using "actual" post-operative patients as subjects for analgesic trials. By this point, as Noémi Tousignant documents in her 2011 article, "The Rise and Fall of the Dolorimeter," much of the funding for analgesic research had shifted to Beecher's trial methodology. At the center of Tousignant's piece is a 1940 invention, the dolorimeter[2] (Figure 9), that directed a beam from a 1,000-watt lightbulb onto the forehead

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[2] Tousignant points out that this name was misleading. While a dolorimeter measures pain thresholds, an algometer measures pain stimuli. The lightbulb was actually the latter, "designed first to stimulate subjects in precise and potentially painful ways, and then to quantify the minimal intensity of stimulation that results in a response to pain" (2011, 146).

of subjects. James Hardy, Helen Goodell, and Harold G. Wolff, who had invented the device, claimed results stable enough to convince researchers around the world to adopt the dolorimeter to study analgesic effectiveness. A spot of China ink was painted on a subject's forehead to normalize results across varying skin tones (part of the device's novelty was that it enabled the inclusion of human subjects in studies normally designed around animals), the beam was turned on, and trained technicians observed the reactions of each subject as the intensity of the bulb was gradually increased (151). If a patient was able to reach a higher beam intensity after the ingestion of an analgesic, that drug was deemed effective.

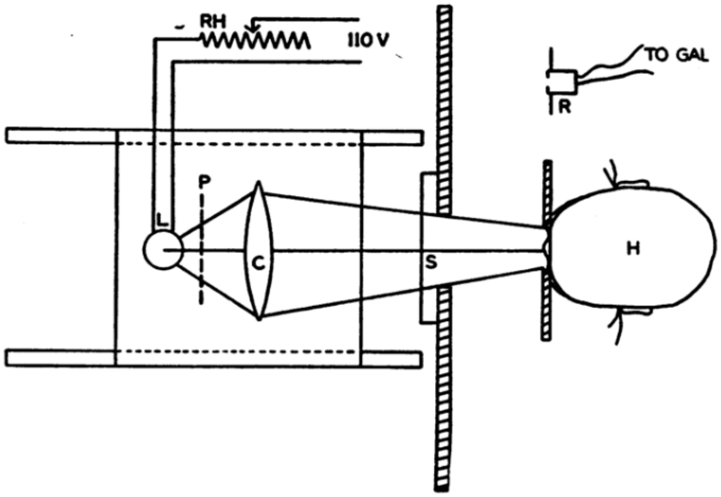

Figure 9: Hardy's Thermal Dolorimeter from Tousignant (2011)
© Oxford University Press

Beecher is careful to explain that he did not wish to single out the Hardy-Wolff-Goodell method in his *Science* piece, as there were many others promoting similar techniques. Still, he dedicates a good amount of space to explaining the pitfalls of studying "contrived" pain, as opposed to the "natural" kind "which arises in a pathological focus" (1952, 159). Finding these "natural" patients and enlisting them in studies was more than just a conceptual shift in how studies were to be designed. As Tousignant explains, ensuring the reliability of studies "was increasingly described as being grounded in clinical settings, large numbers of subjects, specific methodological devices (randomization, placebo controls and double-blinding), and statistical analysis" (149). This was a logistically and financially taxing method, as the purchase of and training on a Hardy-Wolff-Goodell dolorimeter was by no means cheap (Tousignant puts the retail price of the device itself at $850 in 1940 (155)). But until a post-war emphasis on large-scale "subjective" studies, analgesic experiments were relatively small in size: in the 1940 study introducing their dolorimeter, Hardy, et al. enlisted three subjects who were tested repeatedly over the course of a year. Thus, one study required at most a hand-full of devices and technicians trained in its operation. Post-war budgets for analgesic trials, however, grew exponentially. A bureaucratic reshuffling of the regulating bodies in charge of pharmaceutical testing, marketing, and distribution brought Beecher and his work to the fore of decision making regarding analgesic experimentation (Tousignant 2011, 167). Further, as I reference above, a new wave of synthetic analgesics, primarily products of German innovation, meant an increase in corporate funding behind drugs ready for testing. Whereas studies had been paid for by government and military grants previously, now, larger-scale studies—specifically the kind proposed by Beecher—could be financed.

Remember, however, that primary to Beecher's approach was measuring "subjective" responses as reported by the subject. Rather than reading a value from a dolorimeter and marking it in their notebook, researchers and technicians were now responsible for asking and recording a series of questions of their (sometimes hundreds of) subjects, the qualitative responses to which were never guaranteed to be standardized across subjects. The field required, then, a new method for the collection of data, one that could guarantee an efficiency across large trial participants that a tool such as the dolorimeter never could. "It must be agreed that thousands of experiences of hundreds of physicians over years of time can lead to useful drug evaluation; but at the rate new agents are appearing it is unlikely that many agents will receive this useful but slow appraisal" (Beecher 1959, viii). Much of Beecher's work on the subjective nature of pain came as a result of his time on the battlefield during World War II in Northern Africa and Italy. A consultant on anesthesia to the army surgeon general, Beecher observed how wounded soldiers and civilians reacted differently based on the varying factors surrounding each patient's situation. When he returned from the war in 1946, he published "Pain in Men Wounded in Battle." The paper, distributed in *Annals of Surgery*, seems to be the first published documentation of Beecher's questionnaire method:

as patients arrived at the forward hospital, he asked them about their pain, taking care to do so in a uniform manner across 215 patients “with major wounds” (96–97).

In 1949, Beecher and Jane E. Denton presented a report entitled “New Analgesics” to the Council on Pharmacy and Chemistry. Walton Van Winkle Jr., secretary of the Therapeutic Trials Committee, wrote in the preface to the report’s publication in the *Journal of American Medicine*, that “The Committee feels that although the procedures described are not yet perfect, they represent a distinct advance in the methods available for quantitative evaluation of the therapeutic efficacy of [analgesics]” (1051). Here, fifty-seven patients were asked (this time by technicians) about their pain as they emerged from surgery and before and after doses of varying analgesic during the days after (1053). In both studies, Beecher and his researchers posed questions with “yes or no” answers (including whether the subject has experienced “50% or more pain relief" (Beecher 1959, 46)) as well as those with a set of steps on a so-called Likert scale:[3] for level of pain, he offered “slight, moderate, or bad” (1946, 97); for extent of relief, the patient was given “none, slight, moderate, or complete” as choices (1949, 1052).

To be sure, Beecher was not the first researcher to argue that pain was a subjective experience. Rather, he was the most notable voice of the era advocating for the documentation of subjective responses to pain in analgesic studies. Further, as made evident by Van Winkle, cited above, Beecher’s works were seen as rather breakthrough for their time, especially in the United States, where Beecher had a major influence on government policy concerning analgesic experimentation (Tousignant 2011, 169). His 1959 work is extensive, including just over one thousand individual paper citations, inclusive of thirty-three essays of his own. In it, Beecher reviews a number of mainstays in the field and their varying methods to record shifts in their subjects’ felt pain. Throughout is a reliance on scales that incorporate pre-set levels of pain included in Beecher’s work. For example, Kenneth Keele labeled his pain chart’s y-axis with “Agony”, “Severe”, ”Moderate“, “Slight”, and “Nil” (Keele 1948, 6; Figure 10). Some variations include

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[3] Beecher never uses the term “Likert,” but the scales fall under the category of the type first introduced by the psychologist Rensis Likert in 1932.

attempts to have patients keep their own charts. “This did not work out well,” Beecher commented, “for data were lost owing to failure of patients to fill out their charts,” among other reasons (61). The Sloan Kettering group assigned levels of pain numerical values—that is 1 for “none,” 5 for “agony,” and a corresponding integer for each step in between—which could “permit careful statistical examination of the effects found” (61).

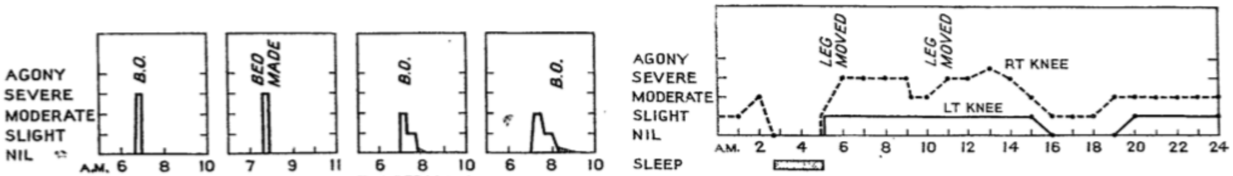

Fig. 2—Chart of substernal pain in angina pectoris (case 2) showing (1) onset of pain after slight efforts, and (2) different types of attack, some being followed by hyperalgesia. B.O. = Bowels open.

Fig. 1—Chart of pains in right and left knees recorded separately on seventh day after excision of knee-joints for arthritis with deformity (case 1) showing more pain in right knee, in which, unknown to the patient, apposition at operation had been more difficult.

Figure 10: Pain Chart from Keele (1948)
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In some ways, the approach that Beecher introduced to pain research is almost paradoxical: increase the number of subjects in a study because we must take into consideration the individual’s lived experiences—congregate the many to attend to the few. We might better understand the Beecherian turn and its relation to the graphic rating scale, however, by observing it through the lens of what Bowker and Star have called “the situated temporal biography of the patient” (2000, 168). Writing in *Sorting Things Out*, the two use classificatory systems developed during the middle of the twentieth century as case studies to argue that, while “to classify is human” (1), the resulting systems must be contextualized in the emergence of advanced information technologies. “How to name things and how to store data,” they write, “in fact constitute much of human interaction and much of what we come to know as natural” (326). In one case study, the pair take as a subject tuberculosis and look at how a disease classification can adjust over time, subsequently implicating the individual body, one that is “going through its own biographical and physiological, historical development, and as it develops tuberculosis changes” (170). As classificatory systems changed the way tuberculosis was described and categorized, who had it, why, how severely, and so on changed alongside. The individual patient experience was constantly "in motion" (170).

As Beecher's groundbreaking work became generally accepted pain science, his research initiated biographical changes in the patient's experience with pain. This project considers what sort of role the graphic pain scale might have in reshaping how researchers and caretakers understand the patient. This change does not simply happen on an individual level, of course, and by acknowledging that classificatory changes initiate biographical motion, we recognize how the use of a graphic scale on a patient or subject has a recursive effect. That is, as I will demonstrate throughout the following chapters, results from one study are cited by another and have material consequences on how a scale is designed, which in turn changes how evaluators understand their subjects' pain, and so forth. In almost chicken-and-egg-like recursiveness, classificatory systems cannot be built without the individuals whose data is contributed and considered as part of that system. When the individual is asked to rate their pain on a designed scale—to, as Beecher put it, provide a "co-operative statement" (1959, 43)—the pain moves from individualized to classificatory and eventually, per Bowker and Star, back to the biographical. All the while, the pain measurement itself moves in and out of the subject who is asked how they feel and then either doubted or trusted. The pain is treated or ignored, all based on how that measurer or interlocutor has been conditioned to understand or react to pain. The subject can no longer take back their pain.

The Self

I began this chapter with a discussion of Foucault's governmentality, something he describes as the "contact between the technologies of domination of others and those of the self" (1988, 19). These technologies of the self—the means through which individuals have the power to affect their own ways of being—help the subject achieve a higher state (he uses the examples, "happiness, purity, wisdom, perfection, or immortality" (18)). Foucault establishes a homologous relationship between early Christian rituals surrounding penance and construction of the self through the "human sciences" (a category under which pain science would certainly fall). Penance and salvation, per Foucault's depiction of Christian morality, required not just knowledge of the self but a declaration—an explicit verbalization—of this knowledge in the service of finding light and accepting death (1988, 43). "To know oneself," he writes, "was paradoxically the way to self-renunciation" (22). Often, the mode of testing which the graphic pain scale aids is referred to as "self-reporting": rather than an observer noting how much pain an individual appears to be in, the subject themselves are asked to make a declaration. The pained individual is expected to utilize this technology of the self to facilitate the transfer of that sort of knowledge of the self which relates to intensity or location of pain.

Why these tools are designed and by whom become critical to understand the ramifications of that facilitation. In the coming chapters I will repeatedly point to research that supports the use of tools in the name of efficiency—that many subjects can be tested in little time; applicability—that large swaths of the population can use the tool; and validity—that the resulting pain data is accurate and reliable. These are the goals of a biopolitical regime interested less in the individual informant and more in the larger movements towards research, treatment, the launch of a new analgesic, the purging of social welfare programs, and more. Pain scale authors work towards tools that can be used with the populations who need it. In doing so, however, a generalized subject must be utilized, one that does not give those at the margins of society much chance at being considered. Tobin Siebers writes that "people with disabilities are not yet 'subjects' in Foucault's disciplinary sense: their bodies appear as a speck of reality uncontrolled by the ideological forces of society" (2008, 174). Disability problematizes the governmentalized body: disabled bodies are counted, but they do not count. They are the exception to prove the rules.

In the final chapter of this work, I will utilize a number of design theories that center a justice-focused practice in order to wonder what a measurement scale that embraces the exceptions might be. In her article, Williams writes of the Washington, DC-based DC Equity Lab, which embraces the typically neoliberal and marginalizing Design Thinking concept and attempts to encourage racial equity through design practices (317). I will also look at the Design Justice Network, a collaborative based on antioppressive principles of inclusive and collaborative design (Costanza-Chock 2018). Finally, bringing in Arturo Escobar's *Designs for the Pluriverse*, I will explore what his "autonomous design" practice might do to liberate the in-pain subject from the oppressive biopolitics of the current spate of pain scales. This last approach is particularly salient as the Americans with Disabilities Act celebrates its thirtieth year this year, a product of collective and autonomous action by disability rights activists demanding "Nothing about us without us."

Chapter 2: Visual Analog Scale

> "Thus we look upon the point as the ultimate and most singular union of silence and speech." – Wassily Kandinsky, *Point and Line to Plane* (1926)

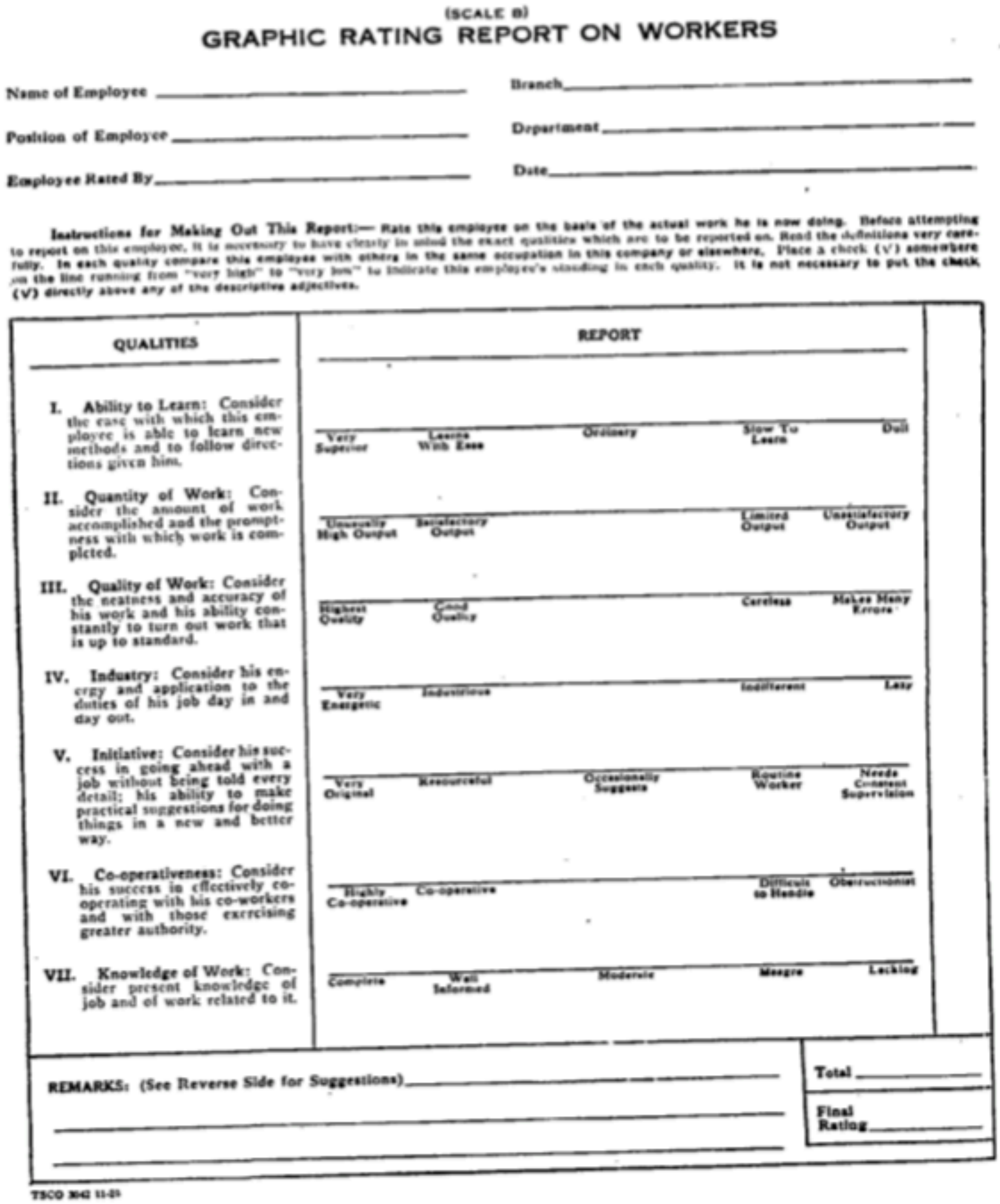
This chapter traces the history of the Visual Analog Scale (VAS), used today as a graphic measurement tool in over half of every pain trial. I begin with a breakdown of what this simple line-based scale looked like in its early forms, making the case for why its visual properties are critical to a history of graphic pain studies, and asking how its key features propelled the VAS through industrial and psychological studies in the first part of the 20th century. Tying its roots to the experimental psychology of Wilhelm Wundt, I perform a formal analysis of the VAS with the help of Wassily Kandinsky, whose own abstract work was inspired, perhaps paradoxically, by Wundtian exercises.

Eventually, the chapter draws upon a variety of works including N. Katherine Hayles's account of the rise of cybernetics and post-humanism and Elizabeth Wilson's history of computation and affect to consider the rise of pain management through a specifically graphic and quantitative system. Bridging the successful efforts made by Beecher and his contemporaries to reshape how pain is conceptualized, measured, and reported on, I will be showing how a well-capitalized pharmaceutical industry today utilizes the VAS, a tool that I will demonstrate to have been designed for the organization and management of populations, to reify the patient in pain as a market that can be controlled and dominated. Throughout, my primary concern is to consider the design of the tool—that is, the smooth line, and its implementation in a process that is associated with the offer of a sense of freedom to the clinical subject—a sense that, I will finally propose, is false.

The Graphic Rating Scale

The use of a horizontal line as a basis for indicating units of time or some other entity is a relatively modern innovation, going back only 250 years or so (Grafton and Rosenberg 2010, 19). In 1921, however, the line as a graphic scale for quantitative evaluation was decreed to have a particular role with respect to interpretation and power in the field of psychology. That year, the American Psychological Association published an abstract in its *Psychological Bulletin* in which the authors, Mary Hayes and Donald Paterson, make a rather momentous declaration about the line. “The Graphic Rating Method,” they state, “is a new method for securing the judgment of superiors on subordinates” (98). Thus the ubiquitous use of the simple line and its associated design parameters are deemed to have been elevated to a system for securing judgment and power in their field. The authors were sure to emphasize two primary benefits to clinicians using the scale: its lack of direct quantitative terms, and its flexibility with respect to its incrementation.

The Graphic Rating Scale (GRS), as introduced by the Scott Company Engineers and Consultants in Industrial Personnel of Philadelphia in 1921, is a straight horizontal solid line of indeterminate length. Four or five “short descriptive adjectives” sit directly below the line providing a rater guidance on the various degrees against which he evaluates his subject. In the rating form published by Paterson in a subsequent article from 1922 (Figure 11), for instance, the first quality, “Ability to Learn,” is accompanied by a GRS with “Ordinary” centered directly below the midpoint of the line in small type (perhaps 8pt to the line’s 1pt height). To the left of “Ordinary,” “Very Superior” hugs the edge and “Learns With Ease” sits about 30% of the way in from the end. “Dull” and “Slow To Learn” are similarly spaced from the right edge. The text of each block is centered within.



(SCALE B)

GRAPHIC RATING REPORT ON WORKERS

Name of Employee ________________ Branch ________________

Position of Employee ________________ Department ________________

Employee Rated By ________________ Date ________________

Instructions for Making Out This Report:— Rate this employee on the basis of the actual work he is now doing. Before attempting to report on this employee, it is necessary to have clearly in mind the exact qualities which are to be reported on. Read the definitions very carefully. In each quality compare this employee with others in the same occupation in this company or elsewhere. Place a check (√) somewhere on the line running from "very high" to "very low" to indicate this employee's standing in each quality. It is not necessary to put the check (√) directly above any of the descriptive adjectives.

QUALITIES	REPORT				
I. **Ability to Learn:** Consider the ease with which this employee is able to learn new methods and to follow directions given him.	Very Superior	Learns With Ease	Ordinary	Slow To Learn	Dull
II. **Quantity of Work:** Consider the amount of work accomplished and the promptness with which work is completed.	Unusually High Output	Satisfactory Output		Limited Output	Unsatisfactory Output
III. **Quality of Work:** Consider the neatness and accuracy of his work and his ability constantly to turn out work that is up to standard.	Highest Quality	Good Quality		Careless	Makes Many Errors
IV. **Industry:** Consider his energy and application to the duties of his job day in and day out.	Very Energetic	Industrious		Indifferent	Lazy
V. **Initiative:** Consider his success in going ahead with a job without being told every detail; his ability to make practical suggestions for doing things in a new and better way.	Very Original	Resourceful	Occasionally Suggests	Routine Worker	Needs Constant Supervision
VI. **Co-operativeness:** Consider his success in effectively co-operating with his co-workers and with those exercising greater authority.	Highly Co-operative	Co-operative		Difficult to Handle	Obstructionist
VII. **Knowledge of Work:** Consider present knowledge of job and of work related to it.	Complete	Well Informed	Moderate	Meagre	Lacking

REMARKS: (See Reverse Side for Suggestions) ________________

Total ________

Final Rating ________

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Figure 11: Graphic Rating Report on Workers from Paterson (1922)
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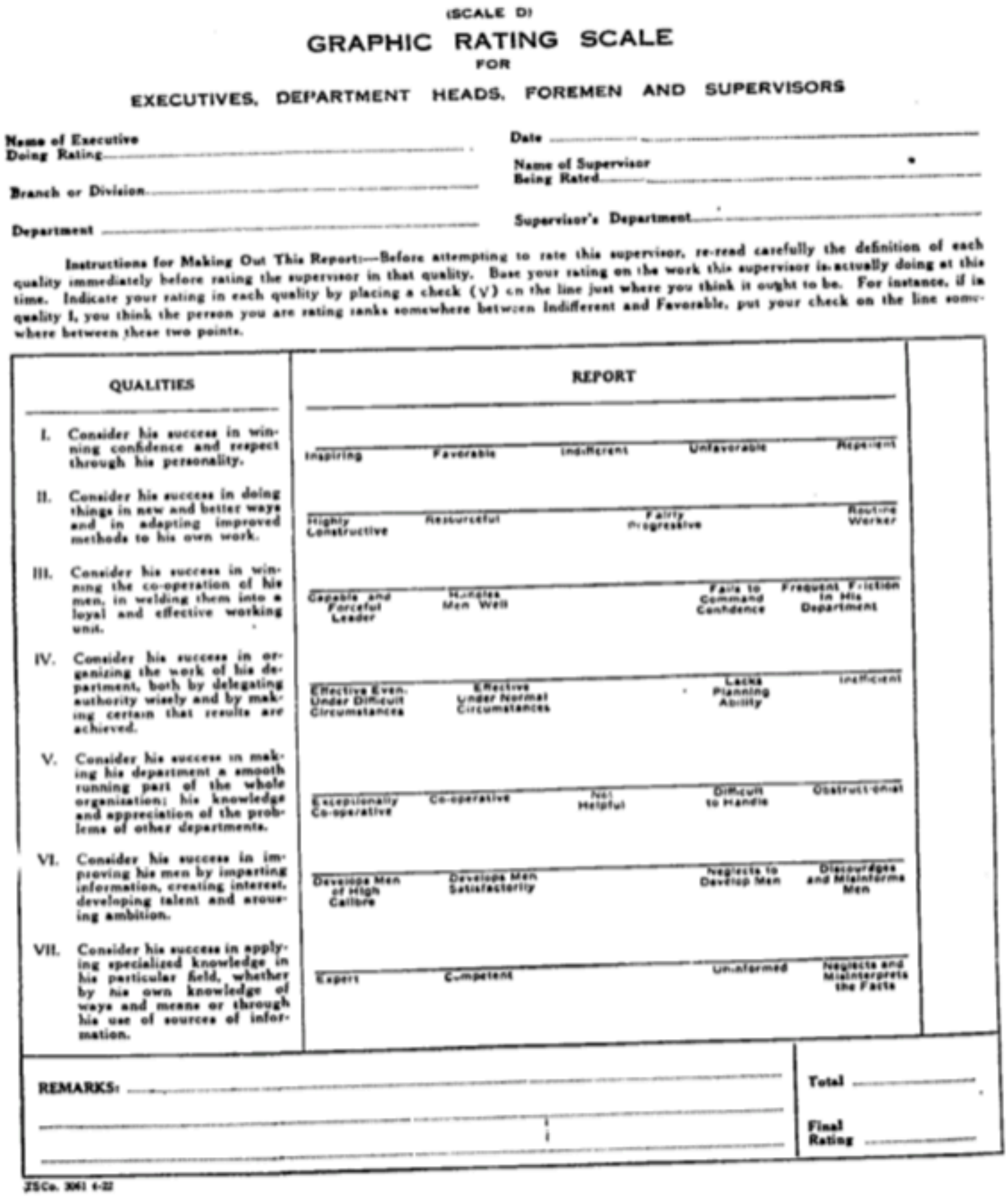
The next six qualities on the "Graphic Rating Report on Workers" reproduced by Paterson are similarly arranged, some of which include a midpoint label (see "V. Initiative"), while others do not (see

"II. Quantity of Work"). The report includes a space at the top of the page for information about the rater and subject, as well as the location and date of the evaluation. Underneath the seven qualities, a space for remarks is designated by an outline and three blank lines, as well as a reminder that a rater may "See Reverse Side for Suggestions". To the right of the remarks area, a short line is labeled "Total," below which another is labeled "Final Rating." Each rule (a typesetter's term for a line) on the page is solid on this particular example. Later on in the paper, however, Paterson includes a version of the report featuring a "Rating Scale for Executives" (364; Figure 12). This version of the report includes all dotted lines for any rule outside of the actual GRS, indicating the critical nature of the style of the lines on the GRS. That is, why should the typesetter be burdened with differentiating between the styles used for each rule if the style change is not critical to the form's use?



(SCALE D)

GRAPHIC RATING SCALE

FOR

EXECUTIVES, DEPARTMENT HEADS, FOREMEN AND SUPERVISORS

Name of Executive Doing Rating ……………………

Date ……………………

Branch or Division ……………………

Name of Supervisor Being Rated ……………………

Department ……………………

Supervisor's Department ……………………

Instructions for Making Out This Report:—Before attempting to rate this supervisor, re-read carefully the definition of each quality immediately before rating the supervisor in that quality. Base your rating on the work this supervisor is actually doing at this time. Indicate your rating in each quality by placing a check (√) on the line just where you think it ought to be. For instance, if in quality I, you think the person you are rating ranks somewhere between Indifferent and Favorable, put your check on the line somewhere between these two points.

QUALITIES	REPORT
I. Consider his success in winning confidence and respect through his personality.	Inspiring Favorable Indifferent Unfavorable Repellent
II. Consider his success in doing things in new and better ways and in adapting improved methods to his own work.	Highly Constructive Resourceful Fairly Progressive Routine Worker
III. Consider his success in winning the co-operation of his men, in welding them into a loyal and effective working unit.	Capable and Forceful Leader Handles Men Well Fails to Command Confidence Frequent Friction in His Department
IV. Consider his success in organizing the work of his department, both by delegating authority wisely and by making certain that results are achieved.	Effective Even Under Difficult Circumstances Effective Under Normal Circumstances Lacks Planning Ability Inefficient
V. Consider his success in making his department a smooth running part of the whole organization; his knowledge and appreciation of the problems of other departments.	Exceptionally Co-operative Co-operative Not Helpful Difficult to Handle Obstructionist
VI. Consider his success in improving his men by imparting information, creating interest, developing talent and arousing ambition.	Develops Men of High Calibre Develops Men Satisfactorily Neglects to Develop Men Discourages and Misinforms Men
VII. Consider his success in applying specialized knowledge in his particular field, whether by his own knowledge of ways and means or through his use of sources of information.	Expert Competent Uninformed Neglects and Misinterprets the Facts

REMARKS: ……………………

Total ……………………

Final Rating ……………………

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Figure 12: Graphic Scale for Executives, Department Heads, Foremen and Supervisors from Paterson (1922)
© Journal of Personnel Research

As Paterson describes it, an evaluator "may make as fine a discrimination of merit as he chooses," thanks primarily to the lack of pre-set delineations on each Graphic Rating Scale's rule (363). Further, because the labels are purely qualitative in nature, per Paterson, “The person who is making the judgment is freed from direct *quantitative* terms in making his decision of merit in any quality” (363; emphasis his). “These two facts,” he goes on, “eliminate the restrictions on natural judgments which other rating methods impose” (363). Thus, using dotted rules for the form’s metadata act to—deliberately or not—emphasize the continuous and non-discrete nature of the GRS lines in contrast.

Notably, Freyd’s 1923 review of the GRS—a paper published in *The Journal of Educational Psychology* and oft-cited by both GRS- and VAS-utilizing studies from within a wide variety of fields, even as recently as January 2019 (Yao et al.)—reproduces a report with dotted rules (92; Figure 13). The paper also includes graphs (95–6) and a table (98) with solid lines, indicating that printing solid lines was not an impossibility for the publisher. That said, the publication date, combined with an inspection of the typographic properties of the rest of the paper, indicate that the majority of the article was most likely compiled on a Linotype machine, a mechanism not equipped to produce solid rules quickly. Instead, typing a series of periods in succession would help produce the dotted lines for the in-paper exhibit. The solid lines on the graphs appear to be hand-drawn or traced, indicating that those pages were compiled using a combination of Linotype plates, as well as copper etchings (or, perhaps, flexographic plates—sections of chemically engraved rubber).[1] The table on page 98 (Figure 14) would have been “locked up” in a press individually, as it sits on a page by itself, allowing the typesetter to use both lead rules (for solid lines) and lining figures[2] for the numerals without worrying about accommodating large blocks of type around it.

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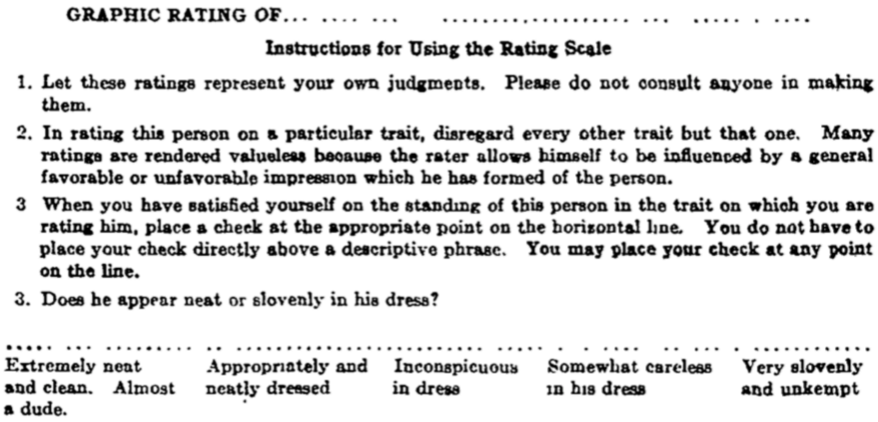
[1] 1. Per Clive Message, Art Logistics Manager at The Lancet Journals, hot metal type was used in conjunction with copper engraving through the 1970s. A brief review of industry norms (see Meggs and Purvis 2012) throughout the early-to-middle part of the century indicates a relative lack of change in typesetting, compositing, and printing technologies for publications such as the journals in question.

[2] 2. Numerals aligned in a table require a different set of characters than those in line with text. These are called lining, or tabular, figures.



GRAPHIC RATING OF... ....

Instructions for Using the Rating Scale

1. Let these ratings represent your own judgments. Please do not consult anyone in making them.
2. In rating this person on a particular trait, disregard every other trait but that one. Many ratings are rendered valueless because the rater allows himself to be influenced by a general favorable or unfavorable impression which he has formed of the person.
3 When you have satisfied yourself on the standing of this person in the trait on which you are rating him, place a check at the appropriate point on the horizontal line. You do not have to place your check directly above a descriptive phrase. You may place your check at any point on the line.

3. Does he appear neat or slovenly in his dress?

Extremely neat and clean. Almost a dude.	Appropriately and neatly dressed	Inconspicuous in dress	Somewhat careless in his dress	Very slovenly and unkempt

Figure 13: Graphic Rating Scale from Freyd (1923)
© American Psychological Association

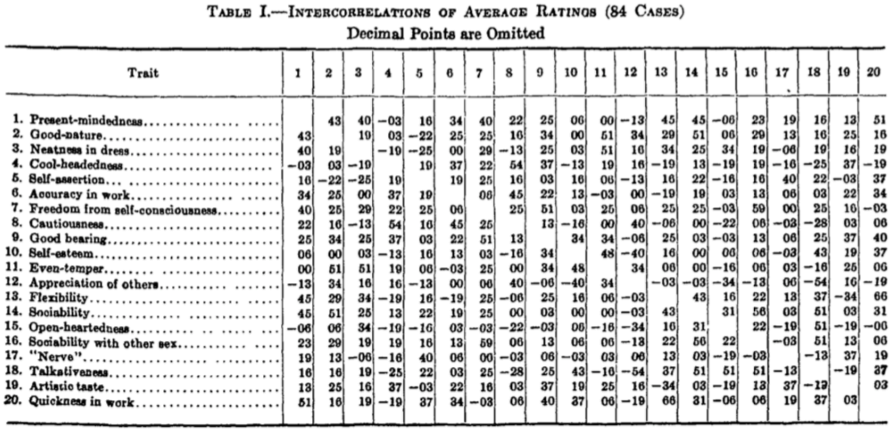
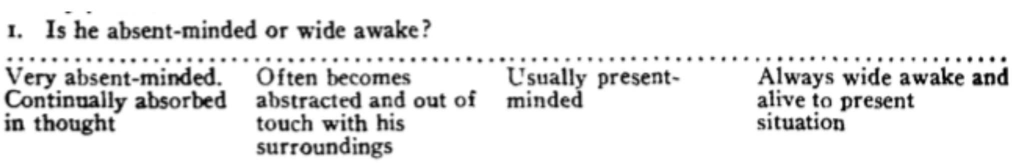


TABLE I.—INTERCORRELATIONS OF AVERAGE RATINGS (84 CASES)
Decimal Points are Omitted

Trait	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Present-mindedness		43	40	−03	16	34	40	22	25	06	00	−13	45	45	−06	23	19	16	13	51
2. Good-nature	43		19	03	−22	25	25	16	34	00	51	34	29	51	06	29	13	16	25	16
3. Neatness in dress	40	19		−19	−25	00	29	−13	25	03	51	16	34	25	34	19	−06	19	16	19
4. Cool-headedness	−03	03	−19		19	37	22	54	37	−13	19	16	−19	13	−19	19	−16	−25	37	−19
5. Self-assertion	16	−22	−25	19		19	25	16	03	16	06	−13	16	22	−16	16	40	22	−03	37
6. Accuracy in work	34	25	00	37	19		06	45	22	13	−03	00	−19	19	03	13	06	03	22	34
7. Freedom from self-consciousness	40	25	29	22	25	00		25	51	03	25	06	25	25	−03	59	00	25	16	−03
8. Cautiousness	22	16	−13	54	16	45	25		13	−16	00	40	−06	00	−22	06	−03	−28	03	06
9. Good bearing	25	34	25	37	03	22	51	13		34	34	−06	25	03	−03	13	06	25	37	40
10. Self-esteem	06	00	03	−13	16	13	03	−16	34		48	−40	16	00	06	06	−03	43	19	37
11. Even-temper	00	51	51	19	06	−03	25	00	34	48		34	06	00	−16	06	03	−16	25	06
12. Appreciation of others	−13	34	16	16	−13	00	06	40	−06	−40	34		−03	−03	−34	−13	06	−54	16	−19
13. Flexibility	45	29	34	−19	16	−19	25	−06	25	16	06	−03		43	16	22	13	37	−34	66
14. Sociability	45	51	25	13	22	19	25	00	03	00	00	−03	43		31	56	03	51	03	31
15. Open-heartedness	−06	06	34	−19	−16	03	−03	−22	−03	06	−16	−34	16	31		22	−19	51	−19	−00
16. Sociability with other sex	23	29	19	19	16	13	59	06	13	06	06	−13	22	56	22		−03	51	13	06
17. "Nerve"	19	13	−06	−16	40	06	00	−03	06	−03	03	06	13	03	−19	−03		−13	37	19
18. Talkativeness	16	16	19	−25	22	03	25	−28	25	43	−16	−54	37	51	51	51	−13		−19	37
19. Artistic taste	13	25	16	37	−03	22	16	03	37	19	25	16	−34	03	−19	13	37	−19		03
20. Quickness in work	51	16	19	−19	37	34	−03	06	40	37	06	−19	66	31	−06	06	19	37	03	

Figure 14: Intercorrelations of Average Ratings from Freyd (1923)
© American Psychological Association

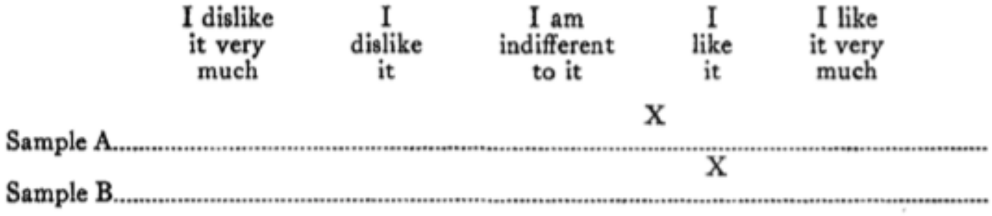
In 1924, Freyd published another version of the same form. Whereas in his 1923 publication, he included eighty-seven dots per GRS rule, this time he included ninety dots (Figure 15). This further supports my assertion that this was a printing decision and not one related to the quantitative properties or specific design of the GRS itself. However, while Freyd still argues in both 1923 and 1924 that an evaluator is freed from directly delineated lines when presented with a GRS, certainly anyone using his lines would be drawn to mark on or between a specific dot, effectively negating that freedom. He never directly addresses this inconsistency. Rigg (1948) provides no reasoning for their use of dots in their study on "Propaganda in the Enjoyment of Music," though the large typewritten X (Figure 16) indicates that the choice is similarly based on a typesetting problem, especially as the X is not on the same baseline as the periods—something that would be difficult to accomplish within one line of Linotype output, or "slug."



1. Is he absent-minded or wide awake?

Very absent-minded. Continually absorbed in thought	Often becomes abstracted and out of touch with his surroundings	Usually present-minded	Always wide awake and alive to present situation

Figure 15: Question from Graphic Rating Scale from Freyd (1924)
© Psychological Review Company



	I dislike it very much	I dislike it	I am indifferent to it	I like it	I like it very much
Sample A				X	
Sample B				X	

Figure 16: Graphic Rating Scale from Rigg (1948)
© American Psychological Association

In addition to using dotted lines for typographic purposes, there have also been a number of efforts over the history of the Graphic Rating Scale to adjust the line style and arrangement, resulting in the publication of both graduated—horizontal or vertical lines with small perpendicular tick marks along the way—and broken lines. One of the earliest examples of the former comes from a psychology study by Moffie in 1942 (Figure 17): the instructions on the form read, "Make a straight, vertical mark on the line…it need not necessarily be under a descriptive phrase" (609). Moffie never goes on to explain why the graduation marks are present, but in 1953, Dreger readily admits that their graduated scale to evaluate college-level courses (Figure 18) "violates several principles considered best for rating scales, in particular, using definite marks along the rating line" (145). They go on, "it was thought, possibly unjustifiably, that the use of marked points would encourage use of any part of the scale rather than just the white space in the middle" (145).

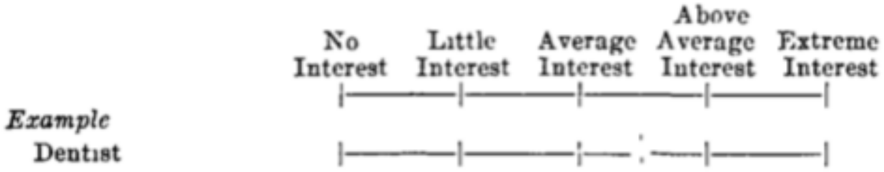
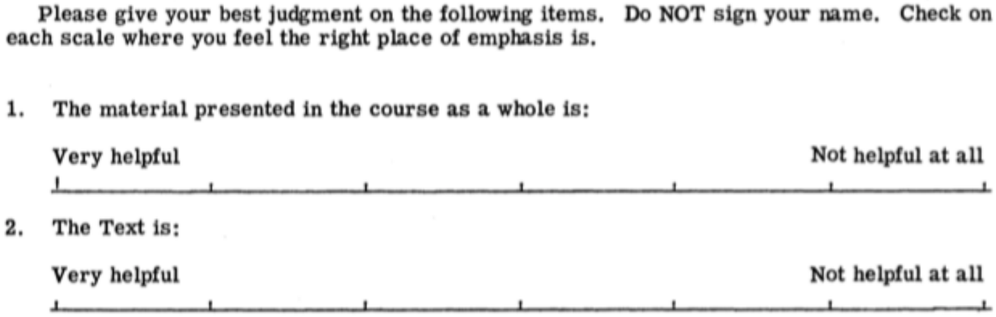


Figure 17: Graphic Rating Scale from Moffie (1942)
© American Psychological Association



Please give your best judgment on the following items. Do NOT sign your name. Check on each scale where you feel the right place of emphasis is.

1. **The material presented in the course as a whole is:**

Very helpful **Not helpful at all**

2. **The Text is:**

Very helpful **Not helpful at all**

Figure 18: Graphic Rating Scale from Dreger (1953)
© Heldref Publications

Bryan and Wilke's 1941 paper, "A Technique for Rating Public Speeches," includes a GRS that appears broken, but may as well be graduated. They note that by breaking the solid GRS line into twenty-one discrete units, they are following Champney and Marshall's 1939 advice that adding refinement to a scale (Champney and Marshall recommend eighteen to twenty-four steps) "increases the reliability" (Champney and Marshall 327). They do not acknowledge that this might negate any benefit of having a continuous line in place for the rater to mark.

Rather than adding graduations or breaks along the line, Hesketh et al. (1989) sought to provide the rater with the opportunity to add variability—or what the researchers call "fuzziness"—to their score. The methodology, explained in *The Journal of Counseling Psychology*, is based upon custom-written computer software that allows a rater to "first [indicate] their preferred position on a scale by moving the pointer, then indicat[ing] how far to the left of this preferred position they were prepared to extend their rating…[and] how far to the right" (104; Figure 19).

How attractive do you find ... (see Table 1)?

7.

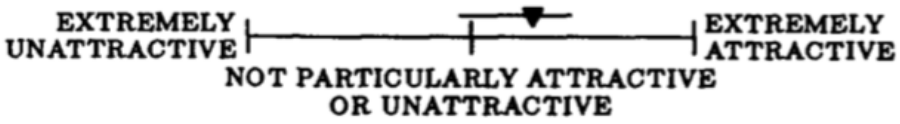


Figure 1. Prestige, sex type, and interest anchors with illustrative fuzzy ratings.

Figure 19: Graphic Rating Scale from Hesketh et al. (1989)

By reviewing the above GRS examples—from Freyd's (1923 and 1924) typographically constructed scales to Bryan and Wilke's deliberately broken lines—I hope to demonstrate the rule that these exceptions prove: the Graphic Rating Scale is deliberately sparse. However, given that an inherent variability does not violate either of Hayes and Paterson's basic tenets of the GRS—lack of direct quantitative terms and flexible incrementation—the Hesketh scale fits their definition. But, as we will see in the next section, the GRS emerged from scholarship rooted in theories of instinct and impulse—the sorts of inquiry that cannot accommodate "fuzziness."

Scott's Wundtian Lineage

In his 1922 article introducing the Graphic Rating Scale, Paterson credits Beardsly Ruml with "originating the graphic rating method as well as supervising its experimental development" (361). Ruml, who was instrumental in the establishment and growth of the Social Sciences Department of the University of Chicago (McNeill 2007, 12), co-founded the Scott Company Engineers and Consultants in Industrial Personnel with Walter Dill Scott. At the time of Paterson's publication, Scott was president of Northwestern University, president of the American Psychological Association, had been founding Director of the Bureau of Salesmanship at the Carnegie Institution of Technology, and was the 1917 recipient of the Distinguished Service Medal as a colonel in the US Army for his work establishing a rating method for officers (”Walter Dill Scott, University Archives”). He was, to be sure, one of the first in the United States to combine industrial management with the emerging field of applied psychology.

Scott’s background in psychology was rooted in his doctoral work with Wilhelm Wundt at the University of Leipzig at the turn of the century. Wundt, who is best known as the founder of experimental psychology, opened the first “laboratory” for psychological studies in 1879. Under Wundt, Scott wrote a dissertation that, through an historical exploration of human impulses (*triebe*) from 1755–1900, argues that a Wundtian definition of instinct “better than any other, summarizes the various historical treatments of the subject, while at the same time harmonizing with the modern psychological views” (Scott 1900, 52).[3]

As Scott explains it, Wundt’s approach to human impulse is “of a reflex-mechanical nature” (43), which is worth unpacking further if we are to understand the implications of Scott’s training in the development of the Graphic Rating Scale. Scott goes on to quote Wundt: “These (innate impulses), however, are, as we say, states of a particular striving or reluctance, in which an existing feeling of pleasure or pain causes bodily movements, the effect of which is directed to the intensification of the feeling of pleasure or to the elimination of the feeling of lack” (Wundt 1893, 593, qtd in Scott 1900, 43)[4]. Scott uses Wundt here to tie impulsive bodily movements to psychological systems, not physiological. Critically, Wundt suggests that instinctual movement is not the same as a physical reflex because the former is an act of volition. Scott goes so far as to describe instinctual movements as dignified by their being influenced by will, especially in opposition to reflexes. For Scott’s understanding of Wundt—an understanding that he will bring back to the United States with him soon after completing his doctorate—

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3. …welche besser als irgend eine andere die verschiedenen historischen Behandlungen des Gegenstandes zusammenfasst und gleichzeitig mit den modernen psychologischen Ansichten harmoniert. Many thanks to Dr. des. Teresa Fankhänel of Technische Universität München for help with translation.

4. Diese (angeborenen Triebe) sind aber, wie wir sagen, Zu stände eines bestimmten Strebens oder Widerstrebens, bei denen ein vorhandenes Lustoder Unlustgefühl Körperbewegungen her beiführt, deren Effekt auf die Verstärkung des Lustgefühls oder auf die Beseitigung des Unlustgefühls gerichtet ist.

an impulsive bodily movement is not only indicative of the "unconscious," but it is indicative of *what a subject wants*: "the first stage in the development of the will" (52).[5]

The Graphic Rating Scale (and, eventually the Visual Analog Scale), is an attempt by a researcher to trigger an impulse—it asks an evaluator to make a mark based on a feeling or observation. In his 1903 *The Theory of Advertising*, Scott spends an entire chapter explaining the power of suggestion and how advertisers take advantage of it to encourage or inspire a consumer to spend money. If, as Scott suggests, humans are easily inspired to act by simple advertising copy (1903, 60), then it follows that when seeking an impulsive—and, as such, volitional—response from an evaluator, then there must be as little suggestion as possible. In the same work, Scott offers his "Law of Suggestion:" "Every idea of a function tends to call that function into activity, and will do so, unless hindered by a competing idea or physical impediment" (47). Ideas such as breaks in lines and graduation, then, must be eliminated from the scales in order to remove any suggestions. Enter the Visual Analog Scale—a descendent of the Graphic Rating Scale stripped even more bare than those lines put forth by Paterson, et al.

The Visual Analog Scale

In a letter to the editor of the June 24, 1961 issue of the *British Medical Journal*, three researchers from the RAF Institute of Aviation argued that the statistical analysis for an article published previously in the same journal was done using faulty data. Specifically, the study in question—centered around respiratory diseases among workers—offered binary choices ("yes" and "no") for questions which, the letter's authors argued, should in fact be more continuous in nature: "It would seem that the use of such a technique for subjective assessment fails to extract the maximum information, by not providing any quantitative measure of degree, and may even have produced false information by having forced a biased answer from those in doubt. Clarification by further questions or elucidation by an interview may provide more information, but still does not achieve the maximum" (Gedye et al., 1828). The writers offer instead

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[5] …das erste Stadium in der Entwickelung des Willens.

what they call "a continuous scale" and include an example visual (Figure 20): a single thin horizontal line with two thin vertical marks at each end. Centered under the left mark is the word "Never" and under the right, "Every day" (Gedye et al., 1828). They suggest that the line be 10cm long and that a quantitative score might be gathered from a subjective answer by measuring the distance in millimeters from the left end to the mark placed on the line by the subject. Eight years later, one of the authors of the letter would publish a paper and give this new scale the name by which we recognize it today: the Visual Analog Scale (VAS; interchangeable with the Queen's English "Visual Analogue Scale"), effectively a Graphic Rating Scale without the intermediate labels. The term analog was used because the line represents a spectrum of values, not a pre-delineated scale (Aitken 1969).

Figure 20: "Continuous scale" from Gedye et al. (1961)
© British Medical Journal Publishing Group

Prior to the 1961 letter, only Dreger (1953)—whose scale is referenced above in my discussion of graduated Graphic Rating Scales (i.e., scales that did not adhere to the Scott Company's original guidelines)—argued for a bi-polar line. After defending the use of tick-marks along their scale, Dreger adds, "since the scale is meant for a quick expression of feeling…the fewest descriptive phrases consonant with clarity had to be included" (145, 147). Here, we can once again make a connection from a Wundtian emphasis on impulse to the "quick expression of feeling," one that minimizes an evaluator's time to consider an answer before marking the line.

Remember from the previous chapter that the time during which this revised graphic scale was emerging, the middle of the 20th century, was also the same period when Henry Beecher's arguments regarding the subjective nature of pain began to take hold. Pain studies were being redesigned to accommodate the newly required scale of "n-values" and there needed to be tools that could quickly and reliably record pain data that could then be crunched by the statisticians. For Beecher, et al., the Visual Analog Scale may have been the perfect tool to address many of the considerations raised by the researchers relating to how best to record the intensity of felt pain in the patient during subjective clinical studies. In *Measurement of Subjective Responses*, Beecher notes that "Keele recognized…the difficulty of verbalizing descriptions of pain" (63). Certainly, when Beecher used the term "verbalizing," he was referring to the subject's ability to come up with the right word to describe pain. There is also the scenario, however, when a patient in pain literally cannot speak, either due to incapacitation or the severity of the pain. With a Visual Analog Scale, a subject need not speak. They may just leave a mark on or point to a line. The non-verbal nature of the VAS also helped mitigate those situations when the physician, researcher, or technician does not speak the same language as the patient (Langley and Sheppeard 1985).

It is no coincidence, then, that the 1960s saw the emergence of VAS usage in pain studies specifically. This began with a collaboration between a psychiatrist, Issy Pilowsky, and a physician, Michael Bond at the University of Sheffield. Colleagues of theirs had been using a graphic scale[6] (Clarke and Spear 1964) around that time and so the pair recorded subjects' pain by asking each one to pencil mark on a blank ten-centimeter line. On one side of the line, "'I have no pain at all'" was written, and on the other side, "'My pain is as bad as it could possibly be'" (Bond and Pilowsky 1966, 203)[7]. The 1966 paper is often cited as the first implementation of a GRS-like scale in a pain related study and Bond, during a conference on "Innovation in Pain Management," noted that he "asked patients to estimate their pain levels, and incidentally the analogue scale for measurement of pain first appeared in Sheffield at about that time" (Reynolds and Tansey 2004, 21). The line had thus arrived at pain research.

Pain is the ultimate Wundtian impulse, garnering physical and emotional reactions. Certainly, pain can bring on the type of reflexive movements that Wundt discarded as non-volitional, but those are not the movements being recorded with the Visual Analog Scale. Instead, there is a relationship between the in-pain and the line that comes into play before a mark is made. As a project of design studies, I have

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[6] Unfortunately, Clarke and Spear's 1964 paper was only published as an abstract and it is unclear if their line had the GRS's intermediate or the VAS's bi-polar labels.

[7] They did not include a visual of the scale in their published paper.

at my disposal lenses provided by designers or artists who might see in a tool such as these something more complicated than simply a line to be measured. I will now turn, then, to a figure who might help us understand that relationship between a subject and a designed scale—someone who has links to both Wundt and the theoretical underpinnings of a simple line.

Kandinsky's Experimental Foundations

The art historian John Gage, in *Color and Meaning* (1999), notes that the abstract painter and designer, Wassily Kandinsky, was strongly influenced by the sort of experimental psychology introduced at the end of the nineteenth century by Wundt and his contemporaries, drawing direct connections between Wundt's writings and Kandinsky's efforts to align various colors to specific affects. These efforts intensified in both complexity and prominence once Kandinsky arrived at the Bauhaus in 1922, just after his friend and colleague Paul Klee. The two were responsible for foundational courses in color and form; Kandinsky had been exploring subjective responses to both while at the institute of artistic culture (*Inkhurk*) in Moscow before his stint at the Bauhaus began. As his explorations continued at the Weimar-based institution, the painter distributed his infamous color/shape questionnaire to students and faculty in 1922–23 (Figure 21). On a piece of paper, he printed a triangle, circle, and square and asked subjects to fill each form with the color that they most associated with that shape (Bergdoll and Dickerman, 26).

Specialität (Beruf): Lehrer

Geschlecht: männl.

Nationalität: Deutscher.

Die Werkstatt für Wandmalerei im Staatlichen Bauhaus Weimar bittet zu experimentellen Zwecken der Werkstatt um Beantwortung der folgenden Fragen.

Figure 21: Wassily Kandinsky *Questionnaire distributed by the wall-painting workshop, filled in by an unidentified Bauhaus student (possibly Gertrud or Alfred Arndt).* 1922–23, lithograph, pencil, and colored crayon on paper, from Bergdoll and Dickerman (2009) © Bauhau-Archiv Berlin

It may seem tenuous to group Kandinsky and Scott simply because both eschew the linguistic in favor of the formal and both were inspired at least in part by the experimental work of Wilhelm Wundt. In fact, Éva Forgács suggests, much of Kandinsky's time at the Bauhaus was spent "retreat[ing] from the school's…industrial orientation and technocentric outlook" (1995, 137)—a fact that would place the painter at nearly exact odds with Scott's endeavors, from Bureau of Salesmanship to the Scott Company Engineers. In some ways, Kandinsky's visual works—the colors and forms that he described like musical compositions (Figure 22)—represent an attempt at writing in his own personal code, whereas Scott's efforts are about *decoding* an individual's mark-making to the calculable language of statistics.

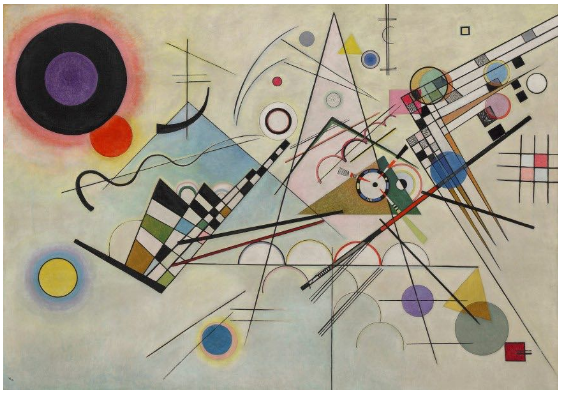


Figure 22: *Composition VIII* by W. Kandinsky (1923). Oil on canvas, 140x201 cm. Guggenheim Museum, N.Y
© Estate of Wassily Kandinsky

Still, Kandinsky was as equally frustrated by the linguistically inspired scenes of representative painting as he was by "those schematic, mediocre, condensed patterns by most so-called abstract painters, whose decorations are as far removed from being art as the organ-grinder is from musicianship" (Forgács, 9). His Bauhaus questionnaire and other experiments demonstrate that he was someone concerned with backing up his abstractions through empirical data. Gage puts it best: "Introspection needed only the authority of a statistical survey to become the compelling basis of a universal pictorial language" (253). In *Point and Line to Plane*, which will be looked at more closely in the following section, Kandinsky seeks to establish "the new science of art" (1947; 19). And so, as a figure with a Wundtian legacy, who struggled with not only the representative and abstract, but also the systematic and arbitrary, the universal and the individual, he provides perhaps the most appropriate voice through which to understand the formal elements of a simple, marked line.

Point to Line

Point and Line to Plane (*Punkt und Line zu Fläche*), published by Kandinsky while still at the Bauhaus in 1926, presents a systematic breakdown of the three basic elements to any painting or graphic. In basic Euclidian geometry, two points define a line. Lines, then, are made up of an infinite number of points. In *Point and Line*, however, Kandinsky applies a kinetic force to points, arguing, quite dramatically, that the line "hurls itself upon the point which is digging its way into the surface, tears it out and pushes it about the surface in one direction or another" (1947; 54). Unsurprising, given his synesthetic tendencies, the author uses aural metaphors in describing the way that points relate to silence, the lyric qualities of lines, and the relationships between sounds of the "basic plane."

Before utilizing Kandinsky here, however, it is critical to understand that the following will narrow in on the Visual Analog Scale used for the communication and evaluation of pain in the human subject. Having traced the VAS lineage back nearly 100 years to the Scott Company and its followers, I hope to have demonstrated three important qualities of the GRS which have survived and been reinforced in modern day instances of the VAS: 1) the line is solid, without any graduations or breaks; 2) the line is a quantitative tool presented without any numbers to the evaluator; and 3) the researcher presenting the line (either in person or through a surrogate) will always have access to the scale against which to measure the evaluator's response. All three of these qualities can be demonstrated in one innovative version of the VAS presented by Bahar et al., (1982). In this iteration (Figure 23), tape is placed along one side of a 100mm length of tubing, already marked in millimeters. "The patient holds the tubing between thumb and forefinger of one hand, and indicates the degree of pain with the index finger of the other" (342). The researchers who developed this VAS did so in order to accommodate those patients who may be in a drowsy post-operative state, but it serves as an excellent segue into Kandinsky's work.

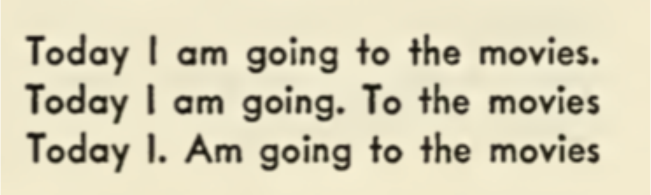
Fig. 1.

Figure 23: From Bahar et al. (1982)
© Association of Anaesthetists

In the introduction to *Point and Line to Plane*, Kandinsky asks his reader to consider two ways to observe a street: "through the windowpane, which diminishes its sounds," or as we step into the street and "experience its pulsation with all our senses" (17). He uses this scenario throughout the book to interrogate the significance of the various ways that each of the point, line, and plane might be implemented or considered. For instance, in a section on the point and the written word, Kandinsky argues that "in the flow of speech, the point symbolizes interruption…and at the same time it forms a bridge from one existence to another" (25). This is its inner role. Externally, the point (that is, in this case, the period) is simply an external sign, veiling the inner sound or silence of the words. Perhaps a better way of understanding this dichotomy is the inner literally being immersed in the phenomenon, while an external perspective looks through the glass pane from afar.

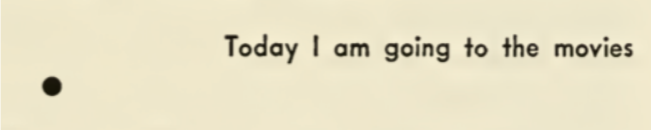
Consider, then, the subject being measured in Bahar et al.'s Visual Analog Scale. The patient emerges from sedation and is unable to speak. They are asked to gesture—literally, point—to a spot on an imaginary line and, in doing so, bridge their silence with an act of speech, a declaration of pain. Who in this scenario is behind the pane of glass and who is experiencing the liveliness on the street? On the one hand, we might consider the patient as being blocked off from speech by a window, unable to express with sound how they feel (at least, that is, interpretable sound—they very well may be able to let out a moan or sigh). This scenario sanitizes the patient's experience, however, and closes them off from a pain-related affect. Instead, perhaps the clean, quiet separation from the street may better represent the orderly tables of data which will inevitably be compiled to represent a patient's or subject's expression of pain via the visually sterile VAS. In this case, the human experience—no matter the level of anguish—can best be captured by the cacophony of the street. "The inner"—that is, the personal experience of pain—"becomes walled-up through the outer"—the orderly efforts of data collection and calculation (25).

Setting aside the plastic tube and returning to the single horizontal line of the traditional VAS, Kandinsky's "point" is the spot where the patient or subject has indicated their level of pain via a written mark. The artist gives two examples where the point is placed in illogical scenarios: typographically—that is, placed in the wrong spot in a sentence (Figure 24)—or spatially, wherein the point moves so far away from the sentence that it no longer acts as a typographic period (Figure 25). "As the surrounding space and the size of the point are increased, the sound of the print is reduced and the sound of the point becomes clearer and more powerful" (27). The patient is not allowed to place their mark or point anywhere that does not intersect a line labeled "No Pain" on one end and "Worst Pain Imaginable" (or the like) at the other. The amplification of the pained's expression is limited, then, to the relationship between the line and the mark placed. Certainly, a patient may express themselves verbally or perhaps mark the line more aggressively (a scribble or a thicker or larger mark), but the system of logic behind the VAS does not accommodate for this—a single, nearly invisible point is observed where the mark intersects the line. It then represents pain's expression in units of measurement.



Today I am going to the movies.
Today I am going. To the movies
Today I. Am going to the movies

Figure 24: From Kandinsky and Howard (1947)
© Estate of Wassily Kandinsky



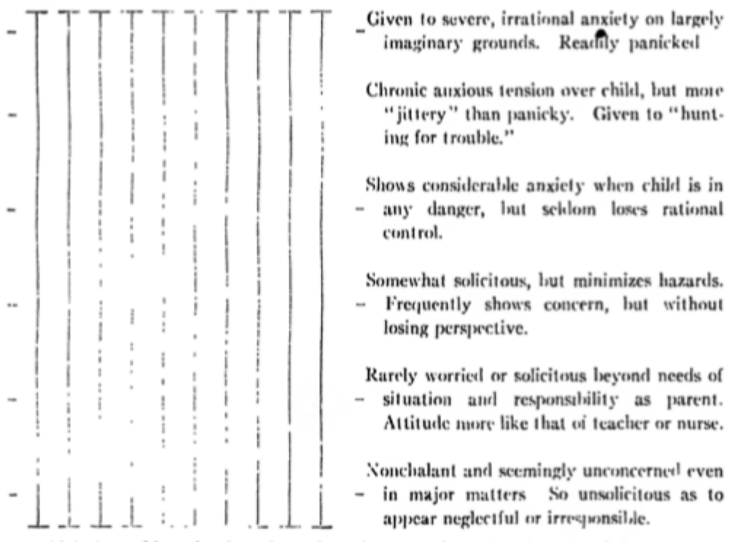
Today I am going to the movies

Figure 25: From Kandinsky and Howard (1947)
© Estate of Wassily Kandinsky

Once the mark is made, it cannot be unmade. In that sense, it is permanent—it will continue representing a quantified measurement of pain for as long as the researcher's records or subsequent publications are extant. "The point digs itself into the plane," writes Kandinsky, "and asserts itself for all time" (32). As the line is removed from the patient or subject—literally taken away for measurement and calculation—what is left but just the point? "It presents the briefest, constant, innermost assertion: short, fixed and quickly created" (32). The mark is not the patient; it represents the Wundtian volition, instinctual and impulsive. Once removed, it becomes the focus of a researcher or physician and the subject—and their pain—become fleeting. "The point is a small world cut off more or less equally from all sides and almost torn out of its surroundings" (32).

Before the mark can be made, however, the line exists on its own. As I noted earlier, Kandinsky understands the line as a kinetic force acting on the point, eventually destroying the point to live “a new, independent life in accordance with its own laws” (54). In the case of the VAS, I suggest we consider the point-to-line relationship in reverse order. That is, the line contains the potential energy for the mark about to be made by the evaluator, patient, or subject—a conceptualization that is not totally counter Kandinsky, who prefers the term “tension” to “movement” (57). Whereas a point is a form with tension but without direction, a line has both. Again, let us consider this direction to be built-in to the line as potential energy.

The potential force of a line is defined by the researcher/designer of the scale in question. Per Kandinsky, orientation (a measure of temperature) and length (a concept of time) are both critical in imbuing the line with a force. There have been attempts to orient the GRS and VAS as vertical lines, including Guilford’s 1954 version (Figure 26) which includes 10 scales lined next to one another. The author argues that a vertical scale can be more meaningful and space efficient when oriented vertically. Wewers and Lowe (1990), however, point out that horizontal scales are preferred by evaluators and that data distributions are more reliable. Whatever the reason, the horizontal is widely preferred across both published GRS and VAS examples.



Given to severe, irrational anxiety on largely imaginary grounds. Readily panicked

Chronic anxious tension over child, but more “jittery” than panicky. Given to “hunting for trouble.”

Shows considerable anxiety when child is in any danger, but seldom loses rational control.

Somewhat solicitous, but minimizes hazards. Frequently shows concern, but without losing perspective.

Rarely worried or solicitous beyond needs of situation and responsibility as parent. Attitude more like that of teacher or nurse.

Nonchalant and seemingly unconcerned even in major matters So unsolicitous as to appear neglectful or irresponsible.

Figure 26: Excerpt from “Fels Parent Behavior Rating Scale” from Guilford (1954)
© Samuel S. Fels Research Institute

For Kandinsky, the horizontal line is “a cold supporting base” which is “the most concise form of the potentiality for endless cold movements” (58). The vertical, on the other hand, is warm in its height, sitting at right angles to the horizontal. Figure 27 (Huskisson 1974) demonstrates a histogram of VAS results, a popular method of displaying aggregate data from both GRS- and VAS-related studies. Here is the vertical potential of the line being released, but only for the researchers behind the inquiry. The upwards growth of the graphic represents *not* increased pain, but a collection of individuals declaring their pain to be a similar percentage of “the worst possible.” And what of the individual who claims that their pain is over the 90% threshold? If they are alone or joined only by a small proportion of other raters, then their evaluation remains cold and unworthy of great attention—no matter how searing that pain may be.

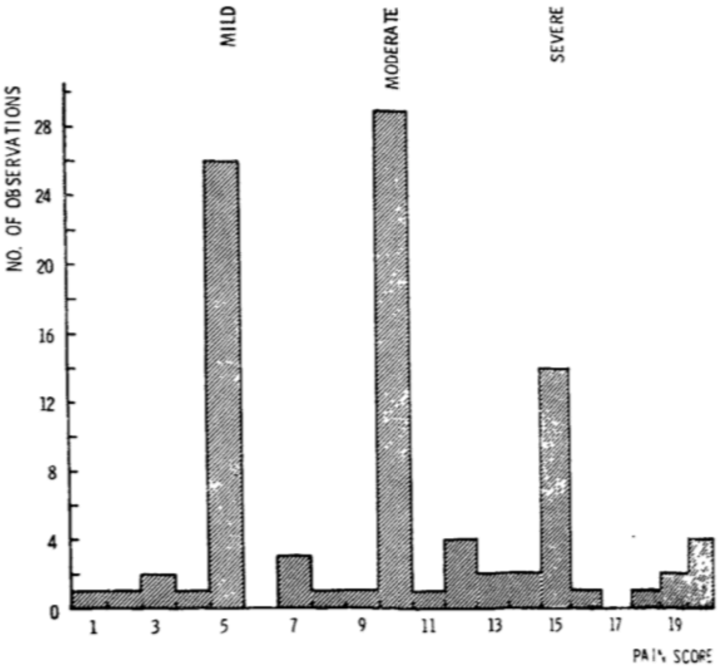


Figure 27: “Distribution of 100 consecutive measurements of pain severity using the graphic rating method” from Huskisson (1974)
© Elsevier Inc.

Kandinsky’s warmth, then, is a privilege afforded only to the researcher. Even in the case of the physician evaluating their patient’s pain via VAS for the purpose of medicating, the patient is allowed access only to the cold horizontal scale. Just like the evaluated factory employee does not know what is being done with the data, the in-pain do not know where the threshold may be for treatment or discharge. The lines are not marked “I need more medicine” and “I can withstand this pain,” they are significantly colder. Eventually, however, a decision or recommendation must be made using the data collected via the scale. This is where we will move from the visual considerations of the form and onto the informational.

Decision Making

I have, to this point, noted that the blank line suggests a certain kind of freedom for the subject. Writing about lines in the context of hand-drawn animation, Vivian Sobchack (2008) notes that the line is a “meta-object”—that it “points to (and sometimes bound[s]) something that matters but is not itself matter” (253). She quotes legendary animator Chuck Jones, who calls the line a “‘subterfuge’” (253). Sobchack’s essay is focused on the ways that the line is an integral and highly visible element in animation and never a consideration in live-action, photoreal cinema. As a case study, Sobchack takes up an advertising campaign from Hilton Hotels wherein a single, animated line transforms from a straight connection between two points—“A and B”—into the outline of, for example, a couple dancing (Figure 28) or father and son building a sandcastle on the beach. Each ad’s payoff line, that “Travel should take you places,” reinforces that the leisurely activity depicted using the line’s stroke is a reward for pausing, luxuriating, or, presumably, staying a Hilton hotel, between origin and destination. As Sobchack points out, the line in these advertisements guides our travelers to liberation—literally shaping them into whatever possibilities that Hilton can provide (254). This is the sort of freedom I am suggesting our subject is faced with, consciously or otherwise, as they are asked to make a choice along the Visual Analog Scale. Be it through the endless points of the Euclidian line, or the kinetic energy of the Kandinskian one, the subject’s liberation lies between A and B.

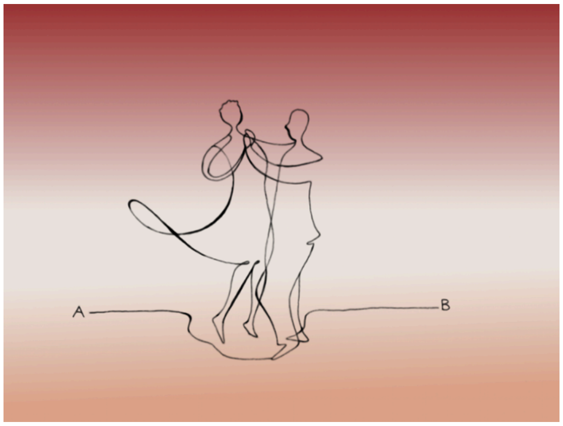


Figure 28: Raimund Krumme's TV ad for Hilton Hotels (2005/6): *Dancing Couple*. Client: Hilton Hotels Corporation; Agency: Young & Rubicam Brands; Production Company: Acme Filmworks. From Sobchack (2008)
© 2008 Hilton Hotels Corporation.

A simple line promising at once freedom and reliability, the Visual Analog Scale mediates what N. Katherine Hayles calls "the disembodiment of information" (2010, 21). In *How We Became Posthuman*, she writes that "Decisions are important not because they produce material goods but because they produce information" (22). The story of the VAS is one of decisions. One year before Freyd wrote about the graphic scale, he published "A Method for the Study of Vocational Interests" (1922), an essay on the best methods for placing students in the right jobs. He writes, "One of the goals…of the worker in the field of Applied Psychology, is to harmonize the individual with his vocational environment" (243). Nearly one hundred years later, the VAS is used to inform decisions on a plethora of levels: whether or not to believe (Masuda et al. 2009), to diagnose (Factor and Azuma 2001), to treat (Langley and Sheppeard 1985), or to go to market (Angst et al. 1999). And each of these decisions embody their own labyrinth of judgements and recommendations. As Annemarie Jutel writes (2009), "Diagnosis…serves as an administrative purpose as it enables access to the services and status, from insurance reimbursement to restricted-access medication, sick leave and support group membership…" (278).

When Bond and Pilowsky decided to use the VAS for their study on felt pain, they were doing so with the understanding that the scale was not only an appropriate tool for the measurement and tracking of the subjective experience, but also an efficient and reliable one. It was not until Beecher, however, that the idea that reliable pain measurement required efficiency and volume proliferated. In light of this, as well as the VAS's history as a tool for the likes of Walter Scott and company, we must consider the Visual Analog Scale to be used as a decision mechanism. Just like the machines in the factories studied by The Scott Company, the VAS brings in raw material in the form of pencil marks, and processes it to become "useful" to the physician, nurse, researcher, etc.

Returning to Jutel, the author begins her essay by declaring that "Diagnoses are the classification tools of medicine" (278). How might we understand the implications of a classificatory tool, especially in the context of the design decisions that led to its form? To begin with, we might look at Geoffrey Bowker and Susan Leigh Star's 2000 work, *Sorting Things Out*, a thorough and valuable look at the ways which tools of classification have been designed and implemented in a post-war West, and how scholars might best study them going forward. In their penultimate chapter, the pair seeks to reconcile the ethnographies and histories of classificatory tools and the theoretical underpinnings informing their investigation. They write, "…information is only information when there are multiple interpretations. One person's noise may be another's signal or two people may agree to attend to something, but it is the tension between contexts that actually creates representation. What becomes problematic under these circumstances is the relationships among people and things, or objects, the relationships that create representations, not just noise" (291). Critical for this discussion here, then, is to consider what the relationship might be between the scale and the subject and the scale and the individual using its data (or, as Hayes and Paterson might refer to the latter, the judge). To the subject in pain, the VAS is a smooth line with only two poles. The possibilities for selection are, literally, endless, as there are no rules requiring a decision to be snapped to any specific location on the line.[8] To the judge, the line is delineated—most likely one hundred times, if dividing a 10cm length by millimeters. While the judge is privy to the view of the VAS as both a single smooth surface and a graduated line, the subject is not. The diagnosis is made, medication given or taken

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[8] There has been some work on the validity of the screen-based VAS (Delgado et al. 2018) which would, by definition, be digital and, as such, delineated by pixel-level limitations of the devices being used. I would like to put those aside for now, however, as this is a study on the intended design of the original VAS.

away, pharmaceutical granted public availability, and the individual being surveyed has, based on the graphic in front of them, no idea what sort of influence the mark they made has on that decision.

Consider the use of the term “analog”: opening his 1969 paper in support of the use of the VAS in psychological studies, Aitken notes of rating scales unlike the graphic method, “A digital system is imposed on the observer, when the freedom of an analogue system would be welcome” (989). It is logical that the term “visual analog scale” emerges in the latter half of the century, at exactly the same time that computers and computing culture were proliferating into research laboratories (amongst other venues)—a time when the term “digital,” per the researchers at the Oxford English Dictionary, “underwent an explosion in usage and in meaning” (Holden 2012). Analog scales are, on their surfaces, in direct opposition to the digital, the binary, the discrete. But once the placement of the mark on the VAS is measured, the data is no longer analog, but in discrete units.

Affect and the Subject

This transformation and the power it exercises might best be understood by first taking a sidebar through psychologist and science studies scholar Elizabeth Wilson’s book *Affect and Artificial Intelligence* (2010). Wilson’s argument is multifaceted. She makes a case for a reconceptualization of AI away from the stereotypical view of it as a “cool,” emotionless field for unfeeling mathematicians and computer scientists and toward a significantly warmer, more emotional domain in which these professionals engage in emotion-rich activities. She also suggests that the proliferation and improvement of AI technologies will increase when all parties involved agree on the aforementioned reframing. She uses biographies of both humans (chess master Gary Kasparov, computer science pioneer Alan Turing, logician Walter Pitts, et al.) and machines (IBM’s Watson, virtual psychoanalyst ELIZA, its descendant, PARRY, and MIT robot Kismet), alongside theories taken from the social sciences, culture of technology, and psychoanalysis to weave an argument that challenges many assumptions we as a society have about computers and computing.

Wilson's work is important to this study primarily when she begins to probe our relationship to what she terms "calculating machines"—she "advocates greater emotional attachment" to them, appealing to users: "yes, please, feel them" (xii). She amplifies those who argue for a more complicated, emotional relationship between user and device; quoting Clifford Nass and Byron Reeves (1996, 5): "we have found that individuals' interactions with computers, television, and new media are fundamentally social and natural." Of particular interest here is Joseph Weizenbaum's psychoanalytic artificial intelligence program, ELIZA and the ways that the MIT researcher sought to reveal the program's inner-workings in an effort to "detach users from their peculiar affection for it" (92). "'Once a particular program is unmasked,'" he writes, "'once its inner workings are explained in language sufficiently plain to induce understanding, its magic crumbles away; it stands revealed as a mere collection of procedures'" (Weizenbaum 1966, 36, in Wilson 92). Wilson uses ELIZA and Weizenbaum to open a pathway to the work of Sylvan Tomkins, whose *Affect Imagery Consciousness* (four volumes published over thirty years, starting in 1962) is a sweeping work on the way that affects and cognitive processing work together in the human psyche to help us process and utilize information. Critically, Wilson explains that "Affects…are analogic events: being ashamed or afraid or interested is a highly variegated experience. Accurate measurement of the affects typically requires continuous rather than discrete calibration" (116–17).

Pain, Tomkins would argue, is already a highly analogic event and, as such, one that would garner much affect. Returning, then, to the Visual Analog Scale, we might consider the relationship between the subject and the smooth analog scale—upon which a seemingly endless possibility of choices are present—to be one infused with great affect as well. Wilson argues that "When relatedness…between digital and analog…is obstructed, there is a high price to pay" (108). That is, artificial barriers between these two seemingly opposite concepts put us at risk of missing the ways that the construction of human experiences through the layering of the analog and digital is at the foundation of these experiences in the late twentieth and early twenty-first centuries. This is the force of Kandinsky's line acting on the independence of the point. The history of the Visual Analog Scale is littered with words like "freedom" (Aitken 1969), "interesting" (Freyd 1923), and "sensitivity" (Bond and Pilowsky 1966), but also "validity" (Aitken 1969), "reliability" (Hayes and Paterson 1921), and "objective" (Freyd 1923). To the outside observer of the system and to the judge, the layering of analog and digital is clear; to the patient—the subject, the pained—it is hidden.

Return again to Paterson and his written instructions: "Rate this employee on the basis of the actual work he is now doing" (362). Imagine, then, a factory in 1920s America: machines on the floor churning out widgets, workers manning their stations, foremen patrolling the catwalks above them, clipboards in hand, rapidly marking the 10 cm lines in front of them. In this scenario, the judges are hidden, but the fate of each employee rests on those clipboards. To be sure, the situations involving the factory worker and the subject in pain are not perfectly analogous. For the latter, they see the line being marked, while the former does not. However, for both, what is being measured is not inherently quantifiable, the data taken may be used in an individualized or aggregated manner, and both are submitting data that will eventually influence their futures. And within the use of this designed tool, meant to disembody information and take advantage of the subject's affect, are layers of power relationships that must be unpacked.

Power and the Judge

In the biopolitical realm, knowledge of man—at once global, quantitative (i.e., concerning the population), and analytical (i.e., concerning the individual)—is exploited by loci of power to divide, categorize, and act "upon populations in order to securitize the nation" (Nadesan 2011, 25). As the nineteenth century came to a close, the negative effects of laissez-faire policies turned the tide towards a more active liberal state, one that enabled citizens to maximize their liberties. Picking up at the beginning of the twentieth century, it takes no stretch of the imagination to understand how technologies like the rating scales of the Scott Company Engineers and Consultants in Industrial Personnel might have been welcomed into a society seeking to solidify who is normal and who is not. Beecher's work was strongly inspired by his work on the battlefield, the ultimate space for what Foucault would refer to as the securitization of the population. When the physician returned from war, he published and implemented what he had learned so that a newly empowered pharmaceutical industry might move towards effective analgesic testing. The ultimate goal was the widespread availability of pain killers. As Nadesan notes, "By stressing 'self-care,' the neoliberal state divulges paternalistic responsibility for its subjects but simultaneously holds its subjects responsible for self-government" (2011, 33).

Circling back as we move forward, then: Can the VAS be considered a part of this "self-care" movement? In *The Empowered Pain Patient*, Kim Kristiansen suggests that there is a clear relationship between the graphic rating method being implemented by Bond and Pilowsky in the 1960s and the "youth revolt" occurring in that decade (2013, 67). Reviewing the evidence available, I am relatively skeptical of this claim. It is clear, however, that the overwhelming justification for the use of the line-based scale is one of empowerment—the "freedom" discussed in the previous section—and distancing the subject from the direct mechanisms of quantification.

And yet, this tool is meant to measure intensity of pain. As it moves from the individual as a mark on a line to the collective as a numerical value representing distance, that mark is effectively erased. Does a patient in great pain press hard with their pencil on the piece of paper? Do they place a lighter mark because the pain has sapped their strength? Do they just point, as getting their eyes to focus on the line might be too difficult given the headache they are battling? In all of these instances, the Visual Analog Scale sanitizes the affect of the subject as soon as a value is noted by the physician, recorded by the technician, and smoothed by the data scientist.

Above, I referenced N. Katherine Hayles: "Decisions are important not because they produce material goods but because they produce information." The next line of that passage is, "Control information, and power follows" (2010, 52). Certainly, this entire project is dedicated to the study of the control of information through the design of information-gathering tools. I use the Visual Analog Scale as my first example, not just because of its early proliferation as a rating tool, but because of the surface-level simplicity of the piece. It is just a single line drawn on a piece of paper, how can it possibly affect the shape of information being gathered? In fact, its unassuming form ensures that the information gathered is as un-affected as possible. Without pre-set steps, the subject should feel free to move about the line as they wish. Without suggested vocabulary (save for the phrases at each pole), they need not find their own words to describe their pain.

But to understand the history of the Visual Analog Scale means to understand the measurement system and vocabulary that was used to build and adapt it over the past one hundred years. We give our pain ratings like we are grading a student or evaluating an employee. We seek to manage our pain like we might an assembly-line worker. Our individual, subjective experience is in one moment recorded and considered, and in another, grouped and calculated. When we talk about pain with our doctors, insurance agents, or pharmacist, we are using a language that can be tied back to the way people were measured and controlled. On the surface—literally—we are empowered to declare our pain using a mark we make ourselves. That power is fleeting, however, and without a proper understanding of the ways that it works, we risk a false sense of control.

Industrial psychology played a critical part in the development, design, and proliferation of the Visual Analog Scale. In the next chapter, I will highlight a genre of graphic scale that, while not as directly rooted in industry, can be understood alongside the proliferation of a mid-twentieth century aesthetic steeped in industrial and commercial ventures.

Chapter 2, in part, is currently being prepared for publication as a chapter entitled "From Efficiency to Pain: A History of the Visual Analog Scale" in *Synapsis: Critical Readings in the Health and Medical Humanities*, edited by Arden Hegele and Rishi Goyal, Emerald Publishing, Forthcoming. The dissertation author was the primary author of this chapter.

Chapter 3: Body Diagrams

> “Drafting is really a process of drawing pictures rather than saying something in word…a ‘universal language.’ It is understood by everyone regardless of race or nationality. It is a language based on the use of a picture rather than on the spoken or written word.” – American Technical Society, *Drafting* (1954)

If the proliferation of the Visual Analog Scale was predicated on not “leading the witness” with any markings on a simple horizontal line, then the next graphic tool for pain measurement that I wish to interrogate opens up more possibilities for the subject or patient. The pain map, or body guide, is a graphic representation of the human body intended to allow, in the early years of its implementation, an examiner and, later on, the patient themselves to indicate visually where their pain exists. As with the VAS, however, there is more to consider about the way that the material experience of the individual in pain is shaped by the aesthetic choices made by the designers of the scale. In particular, the emergence of the simple line drawn body map in the middle of the twentieth century must be contextualized alongside a concurrent turn within the broader design field towards the incorporation of anthropometrically driven aesthetics that generalize the body in pain. This turn indicates a complicated relationship between the expertise of the physician and the experience of the subject, wherein the patient must be careful how they fill out the body map, lest they risk not being believed by the examiner.

Early Examples

In order to understand how the eventual mainstay in body maps visuals is notable, it is important to highlight its predecessors in order to establish how the form has changed over time. I begin with Henry Head’s 1984 “On Disturbances of Sensation With Especial Reference to the Pain of Visceral Disease: Part II—Head And Neck,” a 147 page work featuring 61 black and white figures and two plates,[1] the majority of which are two-dimensional illustrations of his patients in front- and side-view. The author

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[1] The plates, per the description given by the author, feature blue and red coloring, though these areas are not discernable in the reproduction provided online by Oxford Journals.

expresses his gratitude to "Mr. W.J. Griffiths" for creating the figures in the document, though there is no other information about the artist beyond a single credit. Still, the amount of work put into the diagrams in Head's chapter are impressive, particularly because each individual subject was uniquely drawn. That is, in the work, Head includes over fifty cases of patients from various hospitals in London during the first part of the 1890s, each one accompanied by an illustration of the patient, in order to indicate to the reader where on their body each subject located their pain. Rather than using a generic figure upon which to map the pain for each case, Griffiths drew unique hair styles (see, for example, Figure 29), profiles (note the difference in nose shapes in Figure 29), and even body shapes (note the difference in body figures in the female forms in Figure 30). That said, there is a clear similarity between many of the male figures, especially in stance (see Figure 31, for example), whereas there is a variation in the way that the women are positioned (Figure 29). Hair is removed altogether when the pain is on the scalp (Figure 32).

Figure 29: Case No. 1 and Case No. 10 from Head (1894)
© Oxford University Press

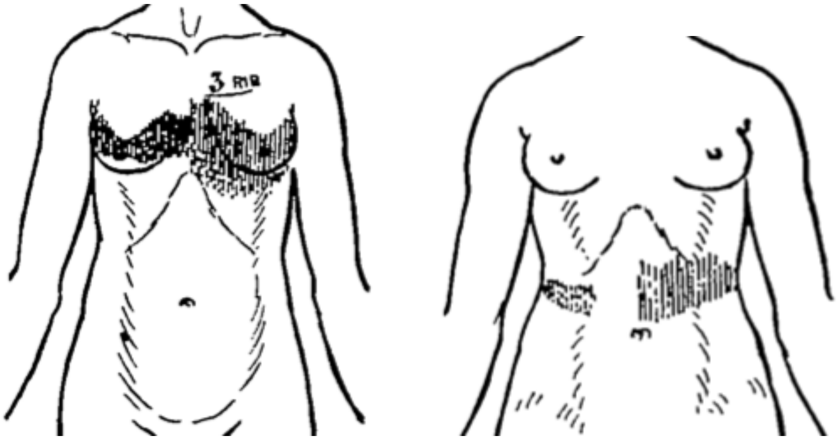

Figure 30: Case No. 3 and Case No. 6 from Head (1894)
© Oxford University Press

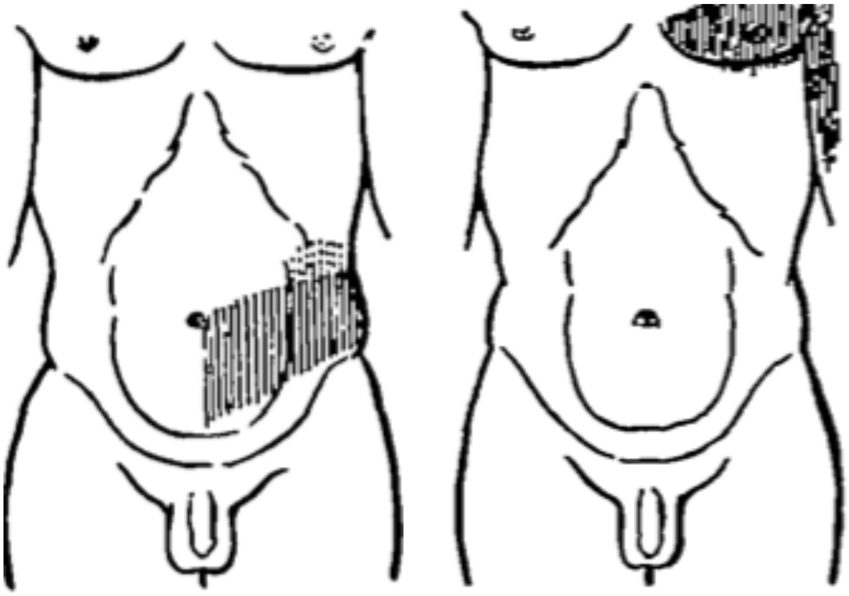

Figure 31: Case No. 7 and Case No. 16 from Head (1894)
© Oxford University Press

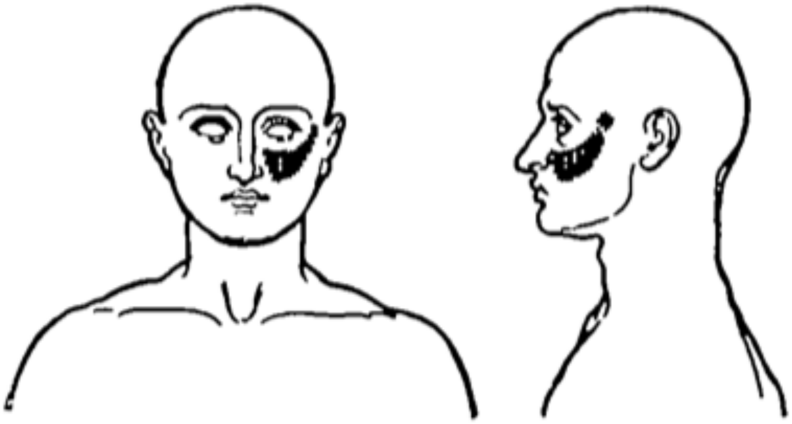

Figure 32: Case No. 8 from Head (1894)
© Oxford University Press

Efforts on the part of Head and Griffiths to depict visually the physician's subjects individually may be understood here as representative of the drive to include visuals that were "true to nature" in the late nineteenth century, as outlined by Daston and Galison (1992). Uniformity in angle and posture indicate a "procedural safeguard" (95) while the adjustments made to each subject's profile and facial features defend against any allegation that the illustration does not represent properly the exact situation it is meant to accompany. And by removing the hair from figures where the pain is localized to the scalp, the author and illustrator prioritize the scientific over an otherwise painstakingly representative aesthetic.

At the turn of the twentieth century the photograph reached "special epistemic status" (Daston and Galison 1992, 114) by allowing scientists simultaneously to separate themselves from the creation and reproduction of representations of their subjects and also ensure that the individuals responsible for said reproductions were doing so devoid of error or personal judgment. In their follow-up volume from 2007, the authors note that "photography was ingeniously deployed to make visible phenomena otherwise invisible to the human eye" (126). Here, Daston and Galison are writing about those phenomena which have physical manifestations but cannot be seen, such as how a bird flaps its wings or how a bullet moves through the air. Still, photography was employed to demonstrate to readers where another invisible phenomenon, pain, existed on a subject.

As an example, Thomas Monro's 1895 "A Case of Sympathetic Pain: Pain in Front of the Chest Induced by Friction of the Forearm" includes a photograph of a 44-year-old visitor to the Royal Infirmary in Glasgow. The figure (Figure 33), a steamship fireman, sits shirtless with his right arm bent and his right hand on his thigh. The photograph is taken at a three-quarter angle and his left shoulder, which is blown out by the way his white skin blends into the background, perhaps due to the quality of the print, is the furthest point from the camera. His forearms are dark with tan or hair, his hair closely cut, and his upper lip covered with a mustache wider than his head. On his upper right arm, there is a tattoo of a figure, perhaps a woman in a dress, and his skin has been marked by Monro to indicate where he feels pain: a large rectangle encircles the top of his right forearm, a square covers his right outer ribs, an x sits directly below his right breast, and a straight line connects his nipples.

Figure 33: Patient from Monro (1895)
© Oxford University Press

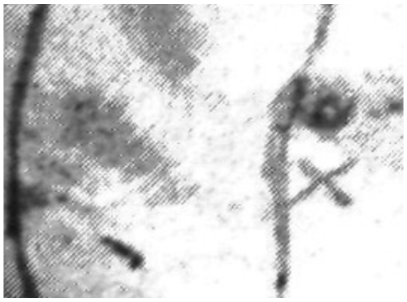

Figure 34: Crop from Monro (1895)
© Oxford University Press

I came across this example via Joanna Bourke's "Visualising Pain" (2018), wherein she speculates that Monro printed the photograph of his sailor primarily to show off the subject's tattoo—both visible tattoos and printed photographs were rare occurrences at the end of the century. The print itself is done via halftone (see detail in Figure 34), a technique wherein continuous shading from photographs is converted to a pattern of dots when special woven screens are exposed to light. At the time of the article's publication, halftoning was rather inexpensive and common, per print historian Michael Twyman (1970, 32), thus I suggest that the author's intentions went beyond the novelty of his tattoo. The author himself writes: "The patient…consulted me…at the dispensary of the Royal Infirmary. On account of the curious nature of the case, I afterwards called at his house, traced out the important areas on the surface of the body with pen and ink, and then photographed him" (566). Two elements stand out here: firstly, Monro made the effort to visit the subject at his home after the patient already left the hospital; and secondly, Monro marked the subject's body directly with dark ink before photographing him. Why didn't Monro have an artist draw a sketch of the patient (or just do so himself)? And why did he have to mark the body directly instead of, such as with Head's figures, shading the regions of pain on the halftone itself?

Monro's investigation was done in the same year that the x-ray was discovered (Cartwright 1995, 107), but it would still be a few years before the technology became a commonplace option for medical imaging. The idea that a practitioner could easily create photographic evidence of subdermal structures without having to cut the patient open was perhaps rather foreign for a young physician in Glasgow at the time. Still, I want to propose that perhaps Monro was participating in what media studies scholar Kirsten Ostherr calls the "myth of total imaging" (2012, 356), a phenomenon she explores through the history of a series of medical films produced in the late 1920s. These films, which were made by the Eastman Kodak Company and the American College of Surgeons, featured drawn animations superimposed on top of photographic representations of the body (Figure 37). "Significantly," she writes,

> the Eastman–ACS medical films go to extraordinary lengths to expand the visual capacity of the naked eye by blurring the lines between 'actual' photography and animation. In doing so, the films also blur the line between the visible and the invisible, enabling their viewers temporarily to experience the 'myth of total imaging' by occupying the idealized perspective of the all-seeing physician who can tell from a glance at the body's exterior what pathologies lay hidden beneath the surface of the skin. (356)

The great lengths to which Monro went to produce this image—following up with the patient, bringing his photographic equipment to their home, marking the body, and taking and processing the photograph—should be considered similarly extraordinary. By drawing on the actual subject, Monro was acting as

Ostherr's "all-seeing physician." Considering Monro's work alongside Head, who employed Griffiths to present meticulously drawn representations of his subjects before mapping their felt pain, both physicians were making it clear that they were the authority on locating their patients' pain—expertise demonstrated through mechanisms seen as producing scientifically objective visuals. A third example from Bourke represents a similarly grand gesture to locate a subject's pain, but this time, scientific objectivity was demonstrated through an effort towards realism, rather than accuracy.

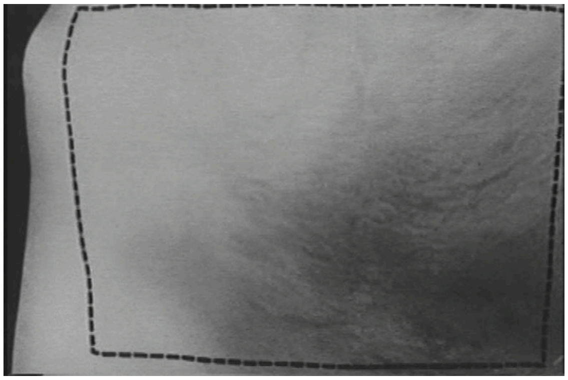

Figure 35: "Square frame on 'actual' photography of dissection area on cadaver. *Indirect Inguinal Hernia* (1929)."
from Ostherr (2012).
No Longer in Copyright.

Glentworth Reeve Butler's 1904 *The Diagnostics of Internal Medicine* is a thorough medical reference that contains 246 illustrations and five plates across its 1,000-plus pages. His section of pain comes early on and features 12 figures that act as a key of sorts for referred pain—that is, pain that cannot be directly attributed to a surface lesion or injury. For instance, in one image (39, Figure 36) a shaded oval on his subject's left thigh indicates that any pain in that area is due to a condition of the ovary, whereas nipple pain is directly related to a problem with the uterus. There is very little if any consistency across all 12 pain-related images in terms of aesthetic style, though it is immediately clear that they are neither photographs nor drawings of his actual patients: for his first two images (Figure 36 and Figure 37) Butler uses what he calls "the well-known diagrams of Dana" (38), though Bourke (24) clarifies that he is referring to the classical figure of Diana, the Roman goddess of the countryside and hunters. The graphics depict a nude woman in poses perhaps reminiscent of pinup girls of the time[2], Butler notes that the second of these two images (Figure 37) is “after a painting by Royer” (41), most likely referring to the Realist painter Henri Royer, whose 1893 *Nyphe* (Figure 38) and undated *Nude* (Figure 39) include figures with striking resemblances to Butler’s models. All but three of the pain figures match this aesthetic style; one appears to be an uncredited drawing of a sculpture of Diana (Figure 40); two others are cited as “drawn after Collins” (Figure 41) but it is unclear who that is.

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2. Bourke specifically refers to one image as “erotic” (24)

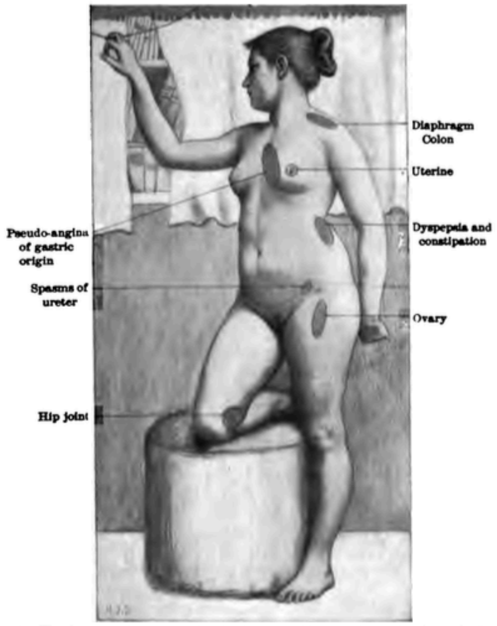


Figure 36: “The location of the transferred pains (Dana).” from Butler (1901)
Not in Copyright

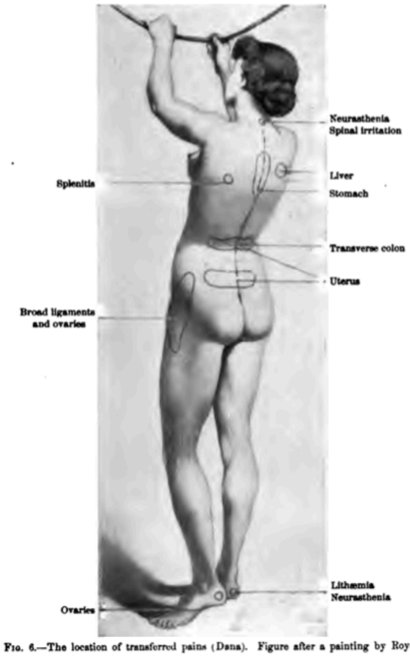


Fig. 6.—The location of transferred pains (Dana). Figure after a painting by Royer.

Figure 37: “The location of the transferred pains (Dana).” from Butler (1901)
Not in Copyright

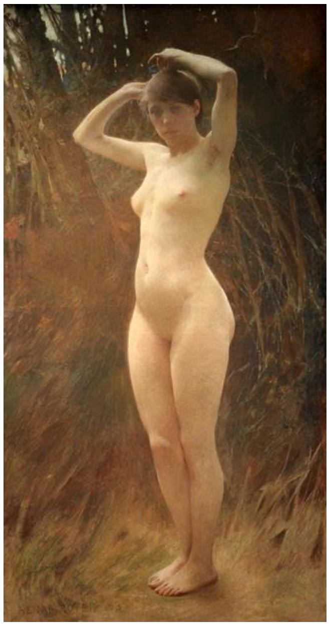


Figure 38: *Nymphe* by Henri Royer (1893)
Not in Copyright

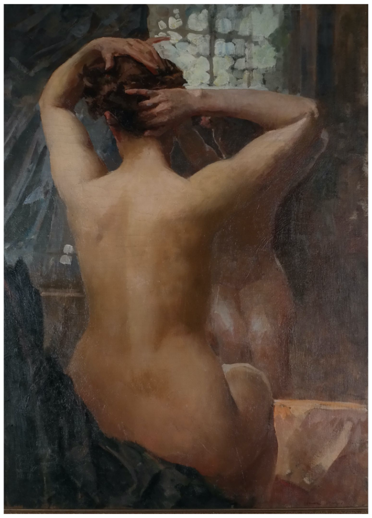


Figure 39: *Nude* by Henri Royer (undated)
Not in Copyright

Figure 40: "The general diagnostic indications to be derived from the seat of pain in the head and face."
from Butler (1901)
Not in Copyright

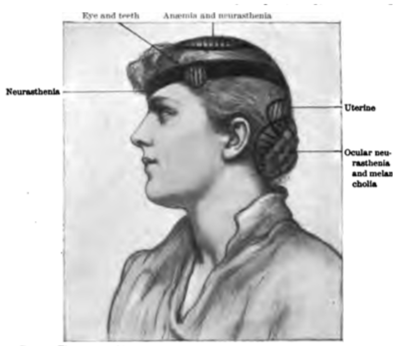


Fig. 9.—The causes of localized headache, according to the exact site of the pain. Redrawn after Collins.

Figure 41: "The causes of localized headache, according to the exact site of the pain."
from Butler (1901)
Not in Copyright

These images are notable both for the ways that they align Butler with Head and Monro while also making clear the differences between his work and theirs. In directly crediting Royer, a Realist painter, as the inspiration for his figures in *Diagnostics of Internal Medicine*, Butler is signaling his intent to represent the human body as it is, without subjective modification. To be sure, his visuals lack any sort of scientific aesthetic. However, unlike his contemporaries who present specific case studies, Butler's work covers generalized knowledge of pain: he writes of "typical headaches of hysteria" (43) and how "a source of irritation may exist at one point and be felt at another widely separated from the actual seat of the lesion" (38). And so even as he uses figures who are posed without the statuesque consistency of Griffith's drawings in Head, and even as he relies on paintings as inspiration for his figure rather than photographs of an actual patient as Monro did, Butler resists implicating a specific subject in locating a generalized patient's pain.

The move to the generalized patient is an extremely significant one in the evolution of sighting pain on the body. This is the sort of move that Greg Myers has called "from the particularity of one observation to the generality of a scientific claim" (1990, 235). Whereas Head and Monro used their patients as the canvases upon which each subject's pain would be marked, Butler sought an anonymous figure, albeit a visually complex one, upon which to demarcate pain regions on the body. This shift becomes critical as we transition to the body diagrams below, all of which are composed of highly generalized outlines of the human body without any discernable characteristics or qualities. Myers again:

> *Maps* (of places or of bodies) are read as symbolic representations, rather than as images of the observed world. But in their backgrounds, they still have some reference to the way we familiarly conceive of space, in the irregular outline of a waterhole, or the cutaway image of an ant's insides. In contrast, *Graphs, models,* and *tables* redefine space, wiping it clean of all irrelevant details and structuring it so that each mark has meaning only in relation to the presentation of the claim. (235; emphasis his)

In the next section, I will present graphic models used to locate pain on the patient. Often, they are referred to as "pain maps," but the difference between the way Myers uses the term "maps" here and how they are used in the diagrams' nomenclature will eventually become clear. More important is the way that Myers depicts the graphically depicted image as "redefin[ing] space" and "structuring it" (235). By the middle of the twentieth century, the body came to be understood as an object that could be depicted using similar conventions to a building or machine part. The resulting aesthetic can be observed both in designerly anthropometric guides, which I will explore further below, as well as the primary focus of this chapter, a body diagram introduced in 1949.

Palmer's Technique

The graphic pain map with which most patients will be familiar today, originally drawn by Harold Palmer in 1949 (Figure 42), is comprised of two hand-drawn silhouettes of a human figure, viewed from the front and back. In both, the figure is holding their arms at their sides, palms forward, thumbs out. Their feet are drawn to appear as if they are standing up on their toes, though neither their toes nor their face are straining in any way. The best word to describe the gender of the individual in the figure may be “androgynous”. They have no hair anywhere on their body, their chest is indicated by two horizontal curved lines originating from just under the armpit and extending towards the sternum (though coming up just short), a nipple is drawn on each breast as a small dot, and the groin is not drawn with any discernable sex organ. The figure is slim and has excellent posture. Their legs do not bow, their face is symmetrical, and they are not without any limb or extremity. In derivative examples, some of these details may vary: Ransford et al (1976, Figure 43) and Öhlund et al (1996, Figure 44) omit the details of the face and the horizontal lines on the chest; Margolis et al (1986, Figure 45), Escalante et al (1995, Figure 46), and Von Baeyer et al (2011, Figure 47) all draw lines to demarcate areas of the body, with the first two papers’ illustrations featuring numbered sections on the body for reference; Shaballout et al (2019) include a number of figures in their review of body maps that feature pregnant or specifically gendered bodies (Figure 48). No matter the version, the figure in the drawing is affectless. Their facial features, if they exist, represent a blank stare. Further, they are, for the most part, flat—that is, two dimensional (see two exceptions in the examples from Shaballout et al).

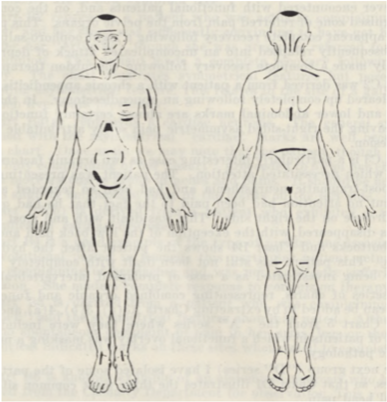


Figure 42: “Composite chart showing most common sites of functional pain on both sexes”
from Palmer (1949)
© New Zealand Medical Association

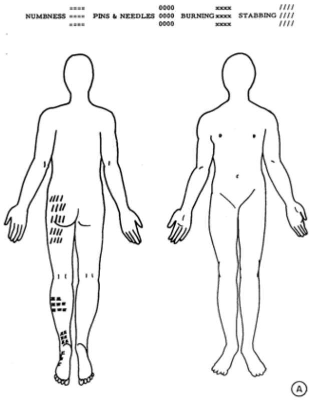


Figure 43: “Pain picture of a 31-year-old male (JK) with an 18-month history of low-back pain and sciatica.”
From Ransford et al. (1976)
© *Lippincott-Raven Publishers*

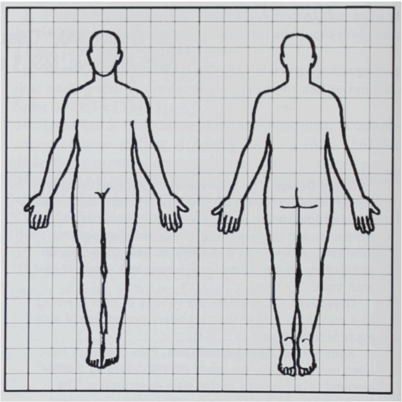


Figure 44: “Pain drawing outline suitable for quantification by the area raw extent assessment score.”
from Öhlund et al. (1996)
© Lippincott-Raven Publishers

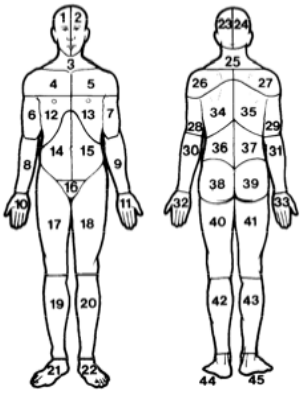


Figure 45: “Scoring template for pain drawing.”
from Margolis et al. (1995)
© Elsevier B.V.

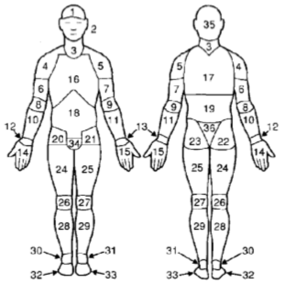


Figure 46: “McGill Pain Map scoring template.”
from Escalante et al. (1995)
© Springer Nature

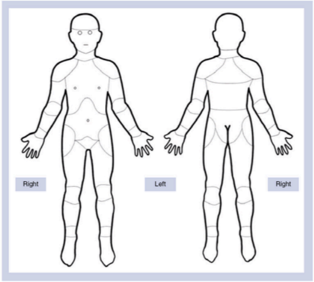


Figure 47: “Suggested pain chart for studies of recurrent and chronic pain adopted as part of the SUPER-KIDZ pain assessment project”
from Türp et al. (1998)
© Future Medicine Ltd.

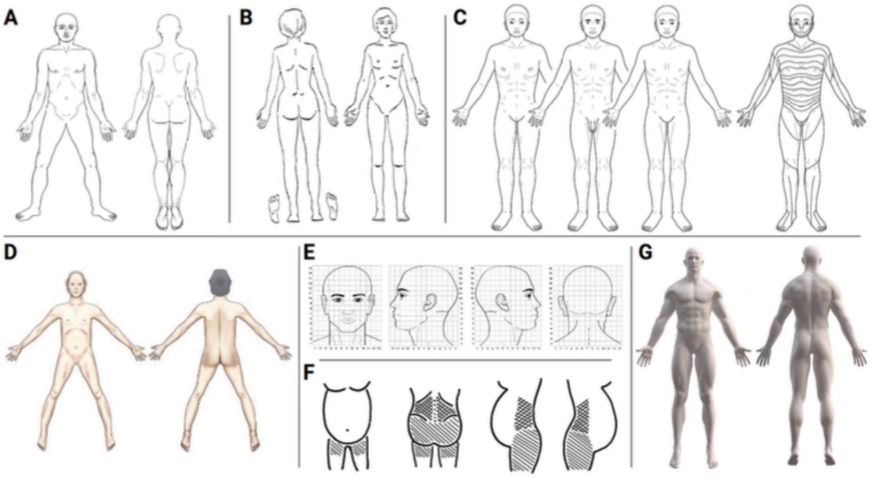
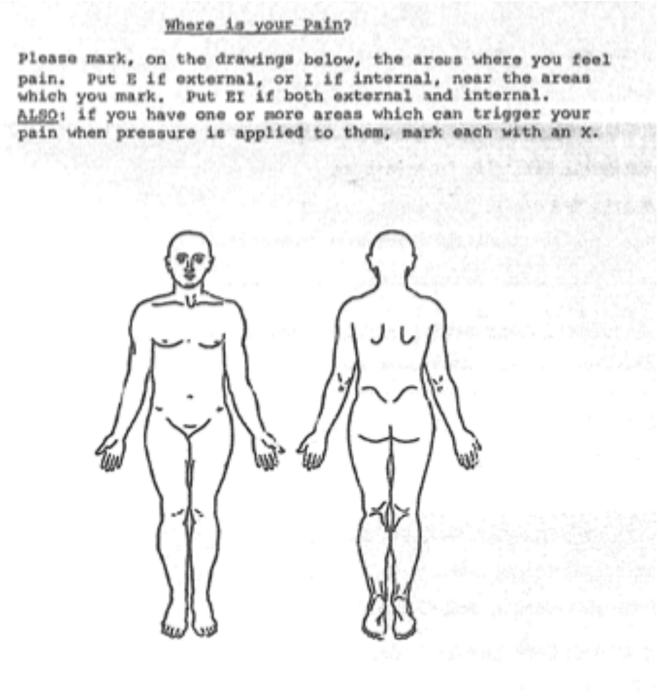


Figure 48: Various body templates from Shaballout et al. (2019)
© Nour Shaballout, Till-Ansgar Neubert, Shellie Boudreau, Florian Beissner



Where is your Pain?

Please mark, on the drawings below, the areas where you feel pain. Put E if external, or I if internal, near the areas which you mark. Put EI if both external and internal. ALSO: if you have one or more areas which can trigger your pain when pressure is applied to them, mark each with an X.

Figure 49: “Where is your pain?” from Melzack (1975)
© Elsevier B.V.

Palmer’s work is a clear visual antecedent to the drawing used by Melzack as part of the long form McGill Pain Questionnaire (1975, Figure 49), a mainstay in pain research and treatment today. Beyond its aesthetic influence, however, it is important to recognize that Palmer’s work is an early, if not the first, example of a tool with which the physicians expects the patient to mark the body-shaped diagram on their own, rather than one that is marked by an examiner upon questioning the subject. The author notes a few benefits to this technique: “We now have a permanent record of the patient's symptoms. It is vivid, easily memorised, readily filed in his notes and readily referred to at subsequent visits. It is extremely useful for teaching purposes” (188). There is another benefit, however, which he makes primary to his investigation, a paper from the *New Zealand Medical Journal* titled “Pain Charts: A Description of a Technique Whereby Functional Pain may be Diagnosed from Organic Pain.” Note the dichotomy that he presents at the outset: between “functional”—or psychological—and “organic”—or tissue based—pain. Palmer puts forward that by asking his patients to fill out the charts themselves, he will be able to isolate those subjects whose pain is due to a “nervous disorder” (187). These patients, he argues, mark their pain symmetrically, “sometimes depicted with almost artistic fidelity” (188). Giving the patient the body diagram to do their own markings, then, becomes a test of sorts of whether the pain at hand has manifested physically in the patient’s body as a lesion or is purely a result of their psychological state.

It is worth understanding here what Palmer most likely meant when he classified certain pain, as he does with his first example of symmetrical diagramming (his Chart A4, Figure 50), as “neurasthenia.” For the half-century or so before 1920, per author David G. Schuster (2011), neurasthenia was considered a legitimate psychopathological term by neurologists, physicians, and psychologists alike. By the time Palmer’s article was written, however, physicians would have been using the term to refer to purely psychiatric and psychological conditions (Schuster 157). As Schuster points out, relegating pain as indicative of neurasthenia or, as was the case in the later part of the twentieth century, any one from an array of chronic illnesses such as depression, mononucleosis, or irritable bowel syndrome, meant assigning a “waste bin” diagnosis, “too vague and generalized to meet the rigorous diagnostic standards of scientific medicine” (165).

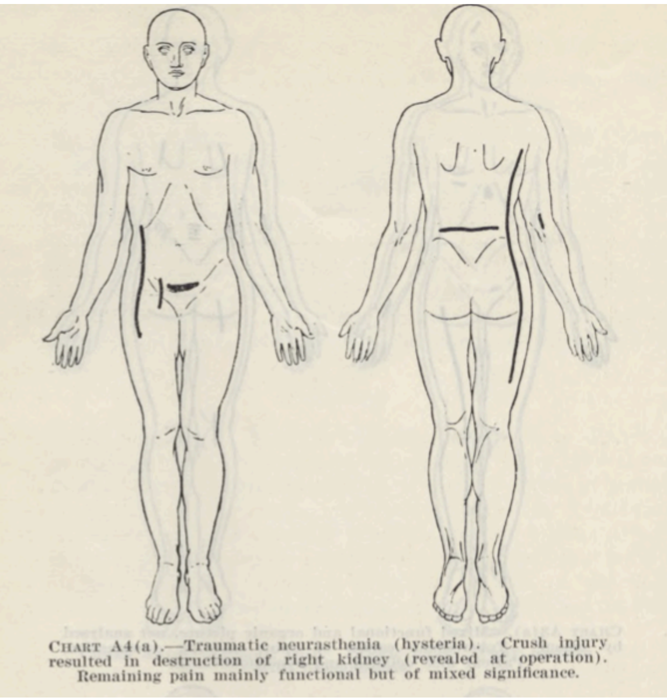


CHART A4(a).—Traumatic neurasthenia (hysteria). Crush injury resulted in destruction of right kidney (revealed at operation). Remaining pain mainly functional but of mixed significance.

Figure 50: “Traumatic neurasthenia (hysteria).” from Palmer (1949)
© New Zealand Medical Association

Shifting the onus of diagramming the pain from the physician to the patient meant that the subject was not only asked where their pain was located, but was also tested to determine if that pain was worthy of a medically significant diagnosis or one to be discarded as purely psychological. This approach did not die with Palmer: in 1976, Ransford et al proposed that patients with scores indicating hysteria or hypochondriasis on a popular personality test of the time, the Minnesota Multiphasic Personality Inventory, correlated with certain qualities of patient drawings. In particular, the authors suggested that patients “with poor psychometrics” may return diagrams marked with “poor anatomic localization,” “magnification of pain,” extra markings such as circles or lines mean to direct the physician’s attention to particular locations, and “additional painful areas…drawn in” (128). This study has been cited hundreds of times since.

Further, the introduction of a standardized body diagram with perfectly symmetrical dimensions allowed other researchers to conceptualize the body as a spatial map with quantifiable sectors. Margolis et al, for example (Figure 45), suggest that by dividing the body into 45 areas, “body surface scores” could be compared with Ransford et al.'s techniques in order to predict "psychological distress/dysfunction in patients with chronic pain" (63). Türp et al, who cite Margolis et al, Ransford et al, and Palmer, divide the body into a total of 3,804 "cells"—1,875 in front, 1,929 in back (Figure 51)—in order to produce highly compelling three-dimensional frequency charts (Figure 52).

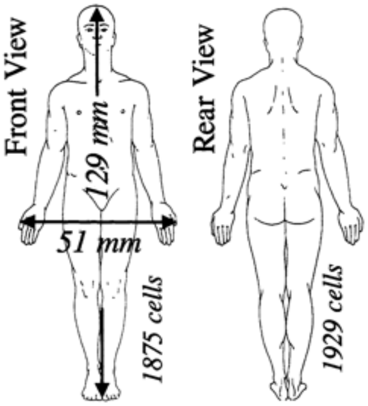


Figure 51: "Outline and dimensions of the sketches of the human body."
From Türp et al. (1998)
© SAGE Publications

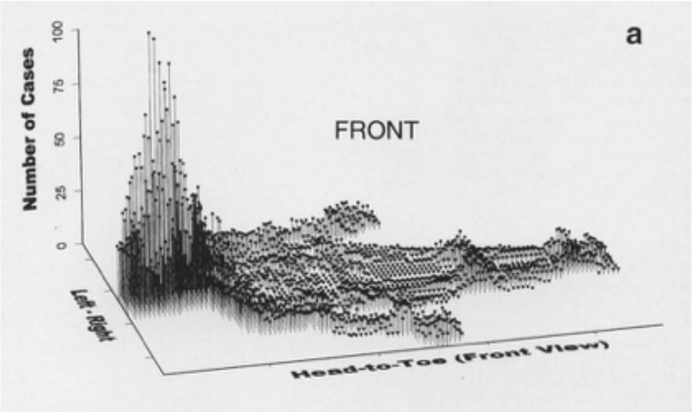


Figure 52: Three-dimensional graphical distribution of the reporting frequency of the cells (n = 200)."
from Türp et al. (1998)
© SAGE Publications

The idea that the body can be classified through measurement is not a new one. The aesthetic motifs present in the diagrams covered in this section, however, emerged alongside a designerly conceptualization of the ways that the quantified and measured body can and should be drawn. In the following section, I will present a number of important anthropometric antecedents to Palmer's diagrams and their derivatives. Once I have established that anthropometric visuals have the ability to shift how the body is understood culturally, I will focus in on a mid-twentieth century body drawn with what I call the language of drafting—done so in the same vein as products, buildings, and other objects designed and created as part of a rapidly expanding consumer-driven society. I do this in order to demonstrate how a flat, symmetrical, easily demarcated body diagram reifies a discourse that frames the pained body as another object that can be considered from an arm's length—adjusted to the whim of the researcher and designer, examined for validity.

Anthropometric Antecedents

A commonly cited antecedent to any work regarding anthropometric diagrams is Leonardo da Vinci's *Vitruvian Man*, the polymath's visualization of the meticulously proportioned human body as described by Roman architect Vitruvius in 15 BC. The diagram represents da Vinci's conceptualization of a natural world in good order—a goal to which to strive, according to Leonardo, in architecture and engineering as well. By fitting the man perfectly into both a circle and square in his 15th century illustration, Leonardo was declaring a belief in the ancients' proposition that the human body was a microcosm for the world. Per Toby Lester of *Smithsonian Magazine*, "The circle represented the cosmic and the divine; the square, the earthly and the secular" (2012). Perfectly encompassed by both, was man. Leonardo's efforts represented a belief in the existence of naturally governed proportions representative of a perfectly fit world—the man in the center of the diagram is symmetrical, he is normal.

It was an obsession with the abnormal, however, that characterizes anthropometric graphics in the late-18th and 19th centuries. In the preface to the 1800 English version of Johann Caspar Lavater's *Essays on Physiognomy,* the publisher declares that the essays "are now so universally known and celebrated that it is unnecessary to attempt their eulogium." By 1940—170 years after its original release in German—the work had been published 156 times in six languages. Among the second English edition's 418 engravings are portraits in side, front, and orthogonal views, matrices of multiple faces for comparison, and silhouettes—both shaded and outlined. The latter versions are often annotated to highlight the proportions of the nose, mouth, forehead, and other cranial protrusions (Figure 53).

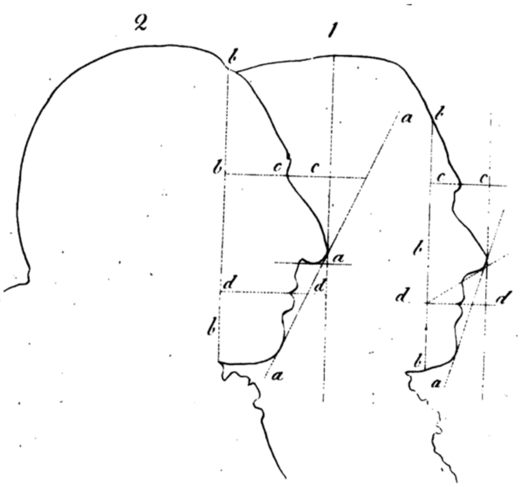


Figure 53: "Shades of two men of abilities and wisdom" from Lavater (1800)
Out of Copyright

Lavater was, by no means, the father of physiognomy—the pseudoscience of determining an individual's intelligence or capacity via their physical makeup has been practiced since antiquity (Waldorf 2012). His work is important, however, as it is exemplary of a time when Western Europe began to see the widespread proliferation of statistics employed in the service of organizing and classifying populations. Ian Hacking, in *The Taming of Chance*, documents thoroughly the adoption of statistics by both public and private actors in Prussia in the eighteenth century (see Hacking's Chapter 3, "Public amateurs, secret bureaucrats"), a practice that spread quickly to neighboring Belgium via Adolph Quetelet (innovator of the normal distribution and bell curve) and beyond: the tools developed by the Belgian were eventually celebrated and utilized by the father of eugenics, Francis Galton (Hacking 1990).

Throughout the nineteenth and into the early part of the twentieth centuries, scores of volumes on how the physical properties of a human being affected their intelligence, capacity for growth and learning, or viability as a member of society, were published in Europe and the United States. Often, the "research" in these works were accompanied by diagrammatic atlases of the head and body—as in the work of Franz

Joseph Gall and Johann Gaspar Spurzheim, whose 1835 *Outlines of the The Physiognomical System of Drs. Gall and Spurzheim* featured a frontispiece with the first published use of a head instead of a skull, annotated with 30 cranial "organs" (Figure 54; Wyhe), the positions and sizes of which could indicate an individual's "faculties." By the turn of the century, photography was being used, such as in Bernard Hollander's *Scientific phrenology: being a practical mental science and guide to human character*, published in 1902. Plate 50 (Figure 55) features the psychiatrist using a tape measure and large "outside" calipers to demonstrate the 16 principle cranial measurements necessary to garner consistent and translatable results.

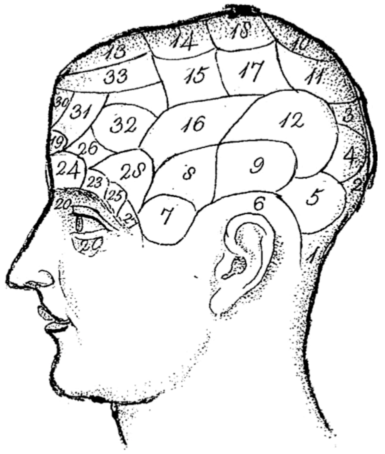


Figure 54: Frontispiece from Spurzheim (1815)
Out of Copyright

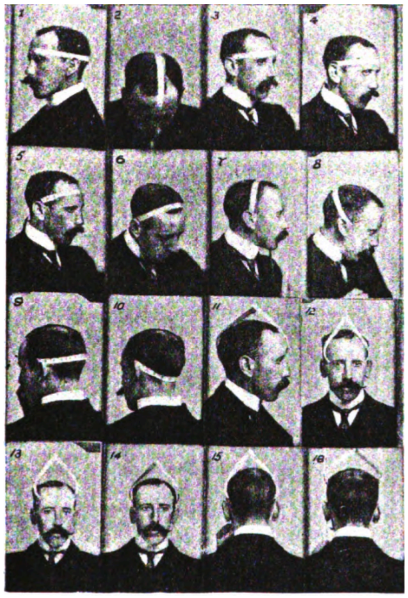


Figure 55: Plate 50 from Hollander (1902)
Out of Copyright

Today, scholars and researchers alike consider fields such as physiognomy and phrenology to be pseudoscientific (though it could be argued that their imprints can be found in many contemporary consumer and medical technologies; see Schaffzin 2017). Still, the sort of rational, empirical, and systematic thinking that characterizes the eugenics-adjacent fields presented above seems familiar when looking at modernist, anthropometrically driven design standardization movements of the first part of the twentieth century. In fact, before 1930, ASME (American Society of Mechanical Engineers; 1880), BSI

(British Standards Institution; 1901), DIN (*Deutsches Institut für Normung e.V.* or the German Institute for Standardization; 1917), ANSI (the American National Standards Institute; 1918), and ISA (the International Federation of the National Standardizing Associations, a precursor to the ISO; 1927) were all founded. This was occurring, of course, alongside a warring Europe, innovations in material and production capabilities, and the rapid development and proliferation of military technology.

One architect of the era, Ernst Neufert, published *Bauentwurfslehre* (*Architects' Data*) in 1936. Partially inspired by DIN's successful efforts to standardize paper size (A4, A3, etc.), Neufert wanted to enable fellow architects and designers to conceive more rapidly of work that was still comfortable for the human beings who would live, work, or otherwise utilize the space. This was, per Nader Vossoughian, part of an effort in the interwar period in Germany when "labor practices associated with Fordism, Taylorism, and energetics, their European equivalent, gained popular acceptance" (2014, 35). The first edition of Neufert's work, which has since been translated into over 20 languages and gone through at least 40 German editions, also includes 267 plates with 3600 drawings. Per Vossoughian:

> Illustrations resemble comic book-style caricatures, probably to make reading less taxing. Plans and elevations are of uniform dimensions (though not necessarily at uniform scale), which facilitates comparative analysis. … Graphic conventions (for drawings and page layouts both) are kept constant, assuring consistency. Human figures are included in many of the drawings to communicate scale and proportion. The drawings are all monochromatic, thus easing the reading of line weights. The entire text appears in a sans serif font, which, according to the prevailing wisdom of the time, was supposed to improve legibility. (2014, 42)

Flipping through the 1980 second English edition of *Architects' Data*, the level of detail included in this veritable encyclopedia of environmental measurements is overwhelming. To delve fully into either the diagrams or the cultural implications of their inclusion is well beyond the scope of this chapter. Critical to our current study, however, is the Vitruvian Man on page one, followed up by a golden ratio-inspired sketch of a human male, titled "The Universal Standard" (8). The rest of the book is filled with diagrams of everything space-related from a meticulously mapped rural school on the Welsh countryside (Figure 56) to the proper dimensions of a blender (Figure 57). Here, then, we see an attempt at establishing the "universal" and utilizing architectural illustrations in the service of doing so.

Figure 56: Rural school from Neufert (1980)
© Blackwell Science Ltd

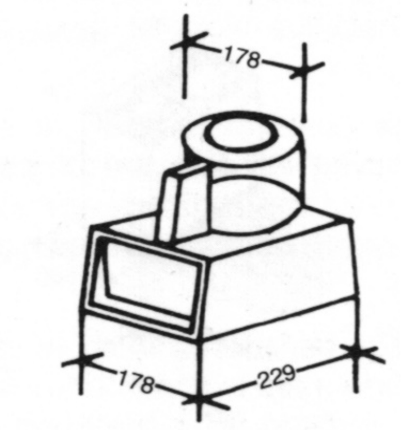


Figure 57: "Food mill" from Neufert (1980)
© Blackwell Science Ltd

Throughout, Neufert directs much of the architectural process: from how to draw a line properly to the size of the bricks used in construction. Driven by the goal of "rapid design", "Neufert's objective was to make architectural practice both more routine and more accessible" (Vossoughian 2014, 41). In the case of Neufert, it seems, his concern for accessibility may have been eclipsed by his drive for efficiency: between the 1936 version and its two post-war successors, Neufert reduced the amount of space necessary for a "standard man" to pass between two walls in order to accommodate his wish for a simpler and more efficient brick-sizing system based on octameters (Vossoughian 2014, 48–49). To what ends did Neufert seek a universal accessibility, then, if the human subject can be manipulated to fit the building materials, rather than vice versa?

Tracing Leonardo da Vinci's *Vitruvian Man* to Ernst Neufert's compendium of floor plans and appliance measurements reveals a long history of efforts to standardize conceptualizations of what the body looks like, how it measures in relation to the world that encompasses it, and what might be understood about the human contained therein. The history of visualized anthropometrics has enabled an episteme wherein a body can be drafted like a hubcap or a blender. Body parts are depicted according to a "golden ratio" that is said to govern much of the natural world. The size of the brain and face are meticulously documented in the name of correlating behavior and intelligence. Bricks are dimensioned, floor plans catalogued, appliances sketched for the sake of ensuring that the built world can be constructed quickly and efficiently. A set of visual standards is developed in order to establish a "universal language" through which the dimensions and positioning of any object on or off this planet can be communicated seamlessly. Eventually, an encyclopedia of bodies is constructed using this purportedly universal language.

It is impossible to consider these purported universalities without touching upon the material ramifications on those bodies excluded. As an example, Sarah Lochlann Jain has documented how the design of automobile airbags are disproportionately dangerous to bodies shorter than 5′11″, and even more so to bodies under 5′5″, thus resulting in the injury and death of more women than men upon airbag deflation (2006, 171n96). The statistical bounds of 5′6″–6′4″ as "safer" defines height as what Jain calls "a category of risk distribution" (11) and an imagined user dimensioned within that category will stand in for any actual users. "This funneling of risk toward shorter people," she writes, "coincides with the way in which people identified as female have been virtually defined, constituted, and subordinated as women through relentless cultural and material iterations of the car and its role over a century of American culture" (37). Institutional discourses—in this case, standard conventions for airbag design—obscure the coding of individual bodies done by the environment.

What elements of this language, then, are universal and to whom? Does the graphic form provide a universality in its resistance to the word-based—what designer and logical positivist Otto Neurath might call the graphic's power to "debabelize" (1936, 13)? After describing a mainstay in the field of anthropometrically-driven design, I will be able to hone in on where the use of standardized body diagrams becomes problematic. As I have demonstrated with the airbag example above, the standardizing works at hand are statistically exclusionary—that is, there are millions of bodies which they do not describe—and there is a real danger inherent. Delving deeper into the conditions of the construction and dissemination of body diagrams, however, it will become clear that they are designed with a very specific sort of language, one which builds upon the same sort of efforts towards universality that the projects reviewed in this section seek. Built into that language are layers of expertise and standardization that must be unpacked in order to recognize the inherent power and exclusion exercised through its use, especially in the context of pain measurement and localization.

The Measure of Man

The 1966 hardcover edition of *The Measure of Man: Human Factors in Design* is quite large—nearly 13.5 inches tall by eleven inches wide. Inside its library-clothed enclosure, one finds an informational booklet, 32 anthropometric charts, and two "life-sized" posters featuring the perfectly symmetrical outline of a man and a woman. On chart G2 (Figure 58), "Anthropometric Data — Adult Female Standing at Control Board," a woman, outlined in a thick black line, stands at a console. Josephine, as she is known, wears kitten heels, but nothing else. Her back is straight, right arm at a perfect 90-degree angle, and she stares straight ahead at another thick black line. Her hands rest on the presumed "Control Board," though on the diagram it is labeled as both "oven door" and "writing shelf." A straight line travels through the horizontal center of Josephine's body and is marked along the way with small circles at her shoulder, elbow, hip, knee, and ankle. Each circle has a horizontal line protruding, annotated with three numbers rounded to the tenth decimal. In front of Josephine, a series of lines delimit the range of what her "visual limit" is, including normal sight lines, the ranges in which emergency signals should be placed, and so forth. A height chart occupies the entire right side of the diagram, each foot delimited by alternating white and black, marked with average space requirements—from "min. toe space" to "min. ceiling ht."

The copyright on the diagram reads 1959, two years after the initial publication of *Y14.5-1957. American Drafting Standards Manual, Section 5: Dimensioning and Notes*, released by the American Standards Association. It is not difficult to recognize aesthetic similarities between Y14.5 (or its British and international cousins, BS8888 and ISO128), the charts in *Measure*, and the pain maps described above. The text used to annotate the diagram is set in a sans-serif, 3mm high. Hatched lines indicate that a feature is solid—the shelf, cabinet below, and wall behind Josephine, for instance. Dashes—rather than a solid contour—indicate lines that would not normally be visible, such as her scalp outline under her hair. Arrows cap lines that indicate distances (“16 min. clear. for stool”).

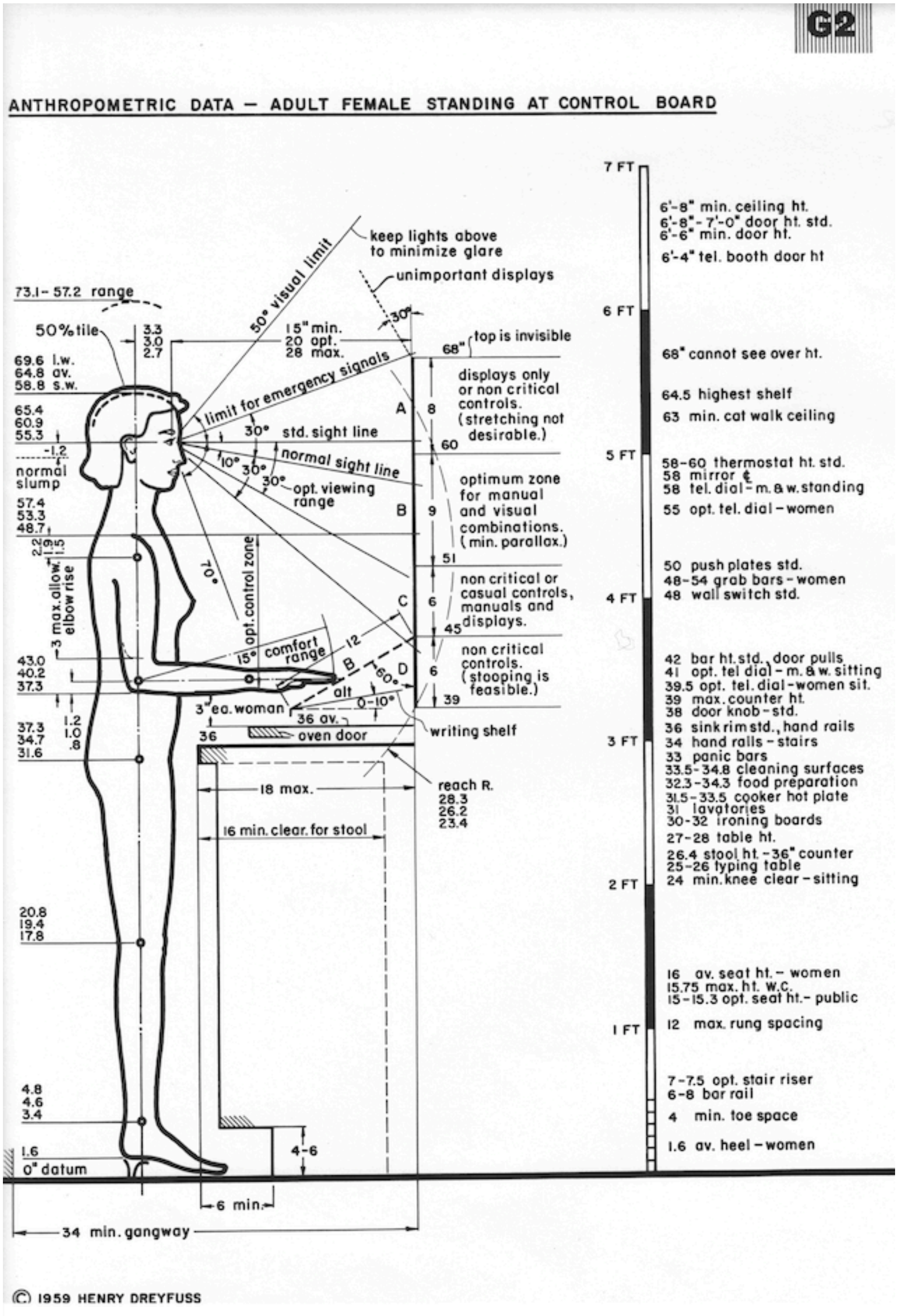


Figure 58: "Anthropometric Data — Adult Female Standing at Control Board"
from Dreyfuss (1959)
© Henry Dreyfuss

The Measure of Man was groundbreaking at the time of its release and has inspired a number of other anthropometric graphics projects, some that persist today. Viewing its sparse, line-drawn, perfectly proportioned bodies alongside Palmer's diagrams and their descendants indicates a clear conceptualization of the body as something that can be governed by the sorts of standards and expertise that is expressed through the mass production of consumer and industrial goods. As we have seen in the example of the Palmer diagram and its derivatives, wherein the physician is positioned as the expert able to interpret the aesthetic properties of sketches made by the patient on the pre-drawn body outline, expertise is an important element to professional gatekeeping. That is, where an examiner decides that the drawing is, for example, too symmetrical, they can pass the subject on to their psychology colleagues. Thinking about how expertise manifests in the visual and the resulting ramifications on the human body are both critical steps to this inquiry, one that begins by centering Dreyfuss's major work.

Soon after World War II, Henry Dreyfuss Associates was hired by the US Army to design the cockpit for a new tank. In order to best simulate the cockpit environment and contextualize what the designers were actually working on, employees at the firm—which had become famous creating industry standard designs for everything from a Bell Labs telephone handset to a New York Central Railroad locomotive engine—drew a life-size cross-section of the cockpit, complete with pilot. The pilot was annotated with measurements, culled from sets of previously recorded data about the sizes and ratios of various male bodies. "Without being aware of it," writes Dreyfuss in the 1966 edition of *The Measure of Man: Human Factors in Design*, "we had been putting together a dimensional chart of the average adult American male" (1966, 4).

Eventually, HDA named the figure Joe and began building on the dataset. Alvin Tilley drew the figure from different angles and added a female form, Josephine. Dreyfuss declares that, by 1959, they "were in sight of something we had dreamt of for years: a mini 'encyclopedia' of human factors data for the industrial designer, presented in graphic form" (1966, 4). HDA expanded many of the diagrams to include three figures: one based on 2.5th percentile data, one based on 50th percentile (median) data, and one at the 97.5th percentile. The firm's founder is quick to acknowledge that the diagrams "are intended as points of departure for your own thinking. Unless they are used with imagination, they are all but worthless" (1966, 4).

In his introduction, Dreyfuss explains that "Al Tilley methodically transferred hundreds of statistics from our library and files and plastered them all over the first rough charts" (1966, 4). The short booklet accompanying the charts does have a bibliography, though there is really no way to tie which data came from which source. Shortly after its 1960 publication, a client from Douglass Aircraft asked for a custom version of *Measure of Man* which included more specific citations. When James Connor, a partner at the firm, passed this request on to Tilley, the designer wrote back: "If reference sources were given for each piece of data the book would become so voluminous and complex as to be impractical; also we might receive criticism for taking material out of contest." (Flinchum 1997, 179).

Certainly, one might level a number of criticisms at a project that aggregates anthropometric data in the name of accommodation. For instance, in undertakings such as *Measure of Man* and it's *Humanscale Manual*, it is easy to jettison those bodies that are considered "out of proportion" or that are even closer to the margins of the bell-curve than the 97.5th and 2.5th percentiles, effectively excluding 3.5 million people in a world populated by 7 billion. Dreyfuss addresses this by declaring simply that there is no need to consider these individuals: "for the designer's purposes, it is not really necessary to work with data on all 100 percentiles" because people in the top and bottom percentiles "are extremely rare" (1966, 5). He then lets us know that while most "collections of human engineering data skip the first five and last five percentiles," his project will be "a bit more cautious" by including percentiles 2.5 through 97.5" (1966, 5). Despite his attempts at defending this relatively limiting methodology, Dreyfuss is, again, forthright about the limitations of the charts' use in actual product design. He reminds his reader that "the present charts are far from perfect" and that "the charts cannot be used 'raw' without serious trouble" (1966, 5–6).

As the diagrams evolved through multiple editions of *The Measure of Man*, the original *Humanscale*, and an eventual 2017 *Humanscale* reissue by the IA Collective, they became inclusive of more sets of data. The 1967 edition of *Measure of Man* lists 64 sources; the IA Collective reissue of

Humanscale contains at least four times that (it is worth noting, however, that the 2017 version of *Humanscale* uses sources that date as recently as 1981; it seems IA Collective did not supplement Tilley and Diffrient's research). Further, it seems that the authors began to consider gender inclusivity as cultural norms shifted: the original work became *The Measure of Man and Woman* in 1993 and 2017's *Humanscale* no longer separates male and female bodies, but presents aggregated data as simply "Adult." The latter version also includes extensive information for designing for accessibility (i.e. for disabled and elderly individuals), pregnant women, the color-blind, and other marginalized bodies.

Understanding body diagrams via the validity or inclusivity of the data used to draw and annotate the figures is a specific path of critique that could be legitimately leveled against pain maps. However, as we have seen, efforts to become more inclusive are evident in tracking the evolution of the works. As such, I wish to argue that the *ways* the data is presented itself establishes the sort of examiner-expert/subject-novice relationship upon which Palmer's technique and those who came after him so heavily rely. Perusing the Dreyfuss charts themselves, one may be overwhelmed with the amount of data fit into a relatively small space. Dozens, if not hundreds, of numbers accompany straight lines capped with arrows. The lines are part of what HDA termed a "dynamic linking system," wherein a viewer can aggregate a number of smaller measurements to determine a larger figure—for instance, to determine the distance from hip to ground on a man in the 97.5th percentile, combine foot height (3.8") with lower-leg length (17.5") and upper-leg (18.0") for the final metric, 39.3." Lines, arrows, link terminals, numbers, and the occasional text annotation fill the monochrome prints to the point of possible confusion for the novice eye.

To the industrial designer, engineer, fabricator, CAD operator, drafter, or architect, the aesthetic elements of *The Measure of Man* and *Humanscale* should seem familiar, however, as they use the same visual language as the engineering drawing or architectural blueprint. This language—what I will refer to going forward as the "language of drafting"—is predicated on representing three-dimensional objects on flat surfaces, ensuring that anyone fluent in the language can understand various properties of the object, and allowing for minute fluctuations in possible outcomes (known as tolerances). Becoming fluent in the language of drafting, however, is not a simple matter, as exemplified by the hundreds of pages of standards documents that establish its rules. These chimeric guidelines, governing everything from stroke width to type height, help establish a divisive culture of expertise while also purporting to be inherently "universal." I do not suggest that Palmer or others necessarily studied these guides in the construction of their pain diagrams. I do, however, intend to use them as exemplary of the sort of authoritative weight that the drafted aesthetic carries. That is, what sorts of gatekeeping occurs when a language becomes specialized and what ramifications might this have on the subject in pain? The following sections explore these questions.

The Language of Drafting

The authors of a 1954 publication by the American Technical Society[3] titled *Drafting*, make two points critical to understanding the cultural implications of the drafting profession. Firstly, the pair, J. W. Giachino and Henry J. Beukema (both of whom were, at the time of publication, faculty at Western Michigan College), emphasize the perceived universality of a graphic language, declaring that "Drafting is really a process of drawing pictures rather than saying something in words" (1954, 1). They go on: "drafting…is a 'universal language.' It is understood by everyone regardless of race or nationality. It is a language based on the use of a picture rather than on the spoken or written word" (2). Framing drafting as a language, then, is nothing new.

Secondly, Giachino and Beukema illustrate how this language is implemented and utilized differently by the various individuals who are involved in conceptualizing and bringing a new product to market. Beginning with "design sketches" done by automotive designers, they outline the lifecycle of hubcap plans for a new car. This designer "submits these sketches to the automotive engineers" who incorporate the hub cap designs into the overall design of the car. The engineer also considers "what changes must be made for [the hubcap's] production, and what material is to be used in manufacturing"

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3. A for-profit organization structured around vocational publishing, now known as American Technical Publishers

(1954, 4). At last, the drafters take the engineer's plans and create "finished drawing[s]" of the hubcap, which are then distributed widely for a variety of purposes: purchasing material, constructing tools and jigs, die making, plating preparation, and of course fabrication and assembly. Additionally, the marketing department will need to include drawings of the hubcap in promotional material and the consumer will need an operations manual with accurately drawn diagrams.

The language of drafting—that is, the combination of shapes, lines, and annotations that make up a technical drawing—is generally codified by the International Organization for Standardization in ISO 128, the British Standards Institution BS 8888, and American Society of Mechanical Engineers in Y14.5. These three standards together govern not only how to use shapes, lines, and annotations, but also what they look like. For instance, per *ISO 128 Part 24: Lines on mechanical engineering drawings*, "leader lines" should be between 0.13 and 1.0 millimeters in thickness. Leader lines are themselves governed by *ISO 128 Part 22: Basic conventions and applications for leader lines and reference lines* and are defined as, "continuous narrow line which establishes the connection between the features of a graphical representation and additional alphanumeric and/or written instructions (notes, technical requirements, item references, etc.) in an unambiguous manner."

The full 24-page ISO 128 document was initially published as ISO/R-128 in 1959—only one year before *Measure of Man*'s initial release—and went unrevised until 1982, presumably in response to the proliferation of CAD systems. Since then, it has undergone a dozen more revisions, most recently in 2003 (ISO documents are reviewed every five years and ISO-128:2003 was last reviewed and confirmed in 2015). ISO 128 covers only general principles of technical drawing and must be supplemented by a number of industry- or practice-specific guidelines, such as *ISO 3098 (all parts), Technical product documentation — Lettering* or *ISO 129 Technical product documentation*. At 164 pages, BS 8888 is effectively an index of all of the technical drawing-related documents from ISO (Macleod). Y14.5 is a 224-page volume covering "dimensioning and tolerancing " and which sees around a 70% overlap with ISO standards (*Process Capable Tolerancing*). Per the ASME website, Y14.5 is "considered the authoritative guideline for the design language of geometric dimensioning and tolerancing (*ASME* -

STANDARDS - Dimensioning and Tolerancing). Note here the chimeric nature of the language, requiring multiple check-points across hundreds of pages. This further entrenches drafting in those conventions learned after years of study and practice. Only then might one reach the level of, borrowing from the ASME, "authority" on the construction of drafted diagrams.

"Standards," then, seems a rather paradoxical term to use to categorize such a broad ecosystem of ever changing and sometimes conflicting guidelines. To help coalesce this ecosystem into a concept useful for our needs, we might understand the collection of individuals with an interest in or experience with creating and reading engineering diagrams as a "social world" defined by Rob Kling and Elihu Gerson as "a set of common or joint activities or concerns, bound together by a network of communication" (1978, 172) Kling and Gerson quote and extend Anselm Strauss's work to further delimit social worlds into social *subworlds*, wherein some members of the social world differentiate their interests and activities from others. Each individual in the hubcap example above comes to the scenario with different motives, experiences, contributions, and so on. In our example, however, the drafted diagram of the hubcap is the bridge, unifying these perspectives—each individual will look at an iteration of the original drawing. Here, we envision the chimera as extended into an assemblage: designed not only by referencing a plethora of documents and conventions, but also passing through a multitude of layers of corporate bureaucracy and market logistics.

As such, there are bound to be nuanced differences between each iteration. The industrial designer might request a certain size lug nut that the fabricator does not have the facilities to produce to an exact specification. The engineer, then, must adjust their drawings to accommodate a tolerance: an acknowledgement that variance is inevitable and acceptable. Further along the sales cycle, the customer has no interest in knowing the diameter of the finished lug nut; they may only care that it looks good on their hubcaps. The operation manual drawings, then, need not include any annotations for dimensions or any alternative views of the wheel. Along the way, translations occur—a specifically sized lug nut becomes dimensioned with tolerances and then loses all dimensional references. Through the discursive practices of the social world (one we might call "hubcap drawing stakeholders"), the drawing inevitably changes to the needs of each subworld ("hubcap designers", "hubcap engineers", "hubcap customers", etc.).

That drawing becomes the standard-bearer of the hubcap—even after the hubcap is manufactured, the drawing is depended upon to represent the object. As such, actions taken to establish the drawing's properties have great impact on decisions made further along in the object's lifecycle. In the introduction to the American Institute of Steel Construction's 1950 *Textbook of Structural Shop Drafting*, the role of the drafter is placed at the center of the entire design and manufacturing ecosystem, "the hub around which all operations turn is the structural drafting room in which the original concept shown by the architects' or engineers' design is expanded through the lines and dimensions of the shop drawings into the most minutely detailed instructions for the punching, assembling, bolting, riveting, welding and erecting of each of the thousands of component members making up the completed structure of steel." At the risk of utilizing too many engineering metaphors, the drawing produced by the drafters of the part is the lynchpin of the social world in which it exists. Replace, then, hubcap with body and consider how Palmer's diagrams have persisted for over 70 years as the de facto guiding visual to locating pain on the body. Subjects are asked to mark bodies drawn with solid outline in normative proportions on paper and to do so with hatches, x-es, and lines (see Ransford et al, Figure 43). Returning to Bourke, she refers to Palmer's diagrams as "schematic images" (24)—certainly apt terminology given how mid-century bodies were simultaneously conceptualized by technical artists.

We might look at a project done by Dreyfuss Associates outside of *Measure of Man* in order to see how the engineering ethos can proscribe the construction of a certain kind of body. David Serlin (2006) has written about the design of a prosthetic hand for veterans after World War II by the Dreyfuss firm. Rather than producing one built for farm or factory work, as other limb makers such as A. A. Marks did, the Dreyfuss hand "provided a 'civilized' alternative to the otherwise painful and traumatic representations of amputees and prosthesis wearers that were displayed in public, especially those doing blue-collar work" (61). It did so by encasing most of the mechanic hardware in stainless steel, ensuring no screws, seams, or joints were visible, producing it with no distracting colors or patterns, and photographing it for advertisements with a sharp Oxford-cloth cuff covering what few mechanics were necessarily visible (Serlin 2006, 61–62).

As the Dreyfuss team worked to develop the hand, members wore prosthetics on their own body. This is a problematic practice (upon which I will elaborate in the final chapter) wherein the engineer or designer declares their experience more important than that of the disabled person. Per Serlin, the Dreyfuss designers were concerned primarily with keeping up with the aesthetics of their time, following "the objectives of an industrial designer whose goal was to package all consumer objects according to the aesthetic criteria of beauty, harmony, and use-value" (62). This was an exemplary ramification of claiming expertise in the arrangement of the body, a practice they were already undertaking by literally constructing it in the language of drafting via the *Measure of Man*. Only while the hand was tangible, marketable, and three-dimensional, the diagrams were flat and utilitarian.

In *Screening the Body*, Lisa Cartwright notes that technologies such as microscopy and x-ray were responsible for effectively flattening the body through two-dimensional representations. Understanding the body diagram as another category of medical imagery, and recognizing its generalizing and flattening techniques, Cartwright's words become critical to our current analysis: "[microscopists] effectively dispensed with the complexity of the corporeal body by selecting as its representative segment a structure that virtually exists in two dimensions" (91). These actually two-dimensional bodies that make up the pain map are clean, simple, modernist depictions of subjects who may be writhing, limping, or perhaps hardly bothered—but always significantly more complex than the drawing they are being asked to mark, a drawing that has direct and material implications on how the in-pain subject is considered by the examiner. Per Palmer, if the subject marks their perfectly symmetrical body diagram in a similarly organized manner, then their pain is to be considered purely psychological (188) or, per Ransford et al, even hysterical (128). Türp et al demarcate the body using drafting-like arrows (fig 25), eventually using arbitrarily sized discrete units ("20 squares to the inch" on 129mm by 51mm diagrams (1466)) to track and compare pain across bodies that may have, in actuality, significant physical variations. The variation between actual bodies is something Palmer calls out when he laments the uncertainty of interpreting facial markings due to the “organic possibilities involved” (191), and yet the standard hairless and normally proportioned head persists across diagrams still today.

All of this occurs in the service of reifying the expertise held by those administering the examination. However, whereas early examples of the pain diagram were imbued with expertise via the heavily individualized or “realistic” representation of the human figure, the Palmer technique typifies a distrust in the patient, a standard through which an examiner tests the patient. By embracing similar aesthetic choices as those drawing the schematics and blueprints of industry, architecture, and design, researchers embracing the Palmer diagrams frame the body as another object that can be adjusted to the whim of the examiner.

The Visual Analog Scale and the body diagrams represent efforts to remove affect from the measurement of pain in study subjects and clinical patients. Joanna Bourke makes a direct connection between the introduction of anesthesia in the middle of the nineteenth century and the lack of grimace on the faces of early body diagrams (see Head Figure 29, for instance). The latter part of the twentieth century, however, saw the introduction of pain measurement graphics that were not just imbued with affect, but were predicated on decades worth of research into the ways that the human face expressed an individual’s feelings or mood at any given moment. This research, combined with specific elements of the sociopolitical climate of the West under Regan and Thatcher led to the development of one of today’s most widespread graphic pain charts, the face-based scale, which is the subject of my next chapter.

Chapter 3, in part, is a reprint of material as it appears as “The Drafted Body” in *Public 60*, March 2020. The dissertation author was the primary author of this article.

Chapter 4: Face-based Pain Scales

> "Cultural and philosophic differences, too, have tangible and intangible effects upon the way all peoples view, apprehend, accept, and alleviate pain…
>
> "Help is in the hands of the nurse, the professional nurse who has many sets of keys in addition to those metal ones that afford access to the medicine lockers—if she would only use them." – Virginia Jarratt, "The Keeper of The Keys" (1965)

In 1974, University of Iowa nursing student Jo Eland finished her master's thesis, entitled "Children's Communication of Pain," a work in which pictures were introduced as, precisely, a "key" to the management of pain in children. In her thesis, Eland argued that currently available pain scales were inadequate to evaluate the needs of children in pediatric settings, and proposed that nurses were both most knowledgeable and best positioned among pediatric medical professionals to develop a tool to address this problem. Though her thesis included no illustrations, it describes a method for using picture cards in place of abstract scales in work on pain assessment with individual children. This approach would prove influential in the development and implementation of some of the most prominent and widely used graphic tools in pain evaluation today. Although the thesis, written for a program in child nursing, remains unpublished, it established Eland as one of the field's central figures: "the mother of pediatric pain management" (Turner 2016, 352).

In this chapter, I position Eland's work with picture cards as a keystone in the evolution of the face-based pain scale, a tool many of us might recognize from the walls of our physician's offices today. I begin by establishing how it was from a professional nursing perspective that these tools were first deemed necessary to pediatrics and to clinical medicine more broadly. I situate the contribution of Eland and other nurses in the socio-political context of the women's movement, which was ongoing at the time of this thesis's development, proposing that the scope and focus of the nursing profession in the 1970s and 1980s were influenced by the broader women's self-health movement, in which images were used in ways that are, I will show, significant to an understanding of the emergence of visual pain scales. After a brief history of the major influences on the development of face-based scale illustrations and aesthetics, in most cases methods involving projective psychological techniques, I review each of the most prominently used face-based scales in late twentieth and early twenty-first century medical care and research. Tracing firsthand published accounts of the development of the scales and drawing on texts by historians and sociologists of science, this chapter presents an argument about how the face-based pain scale, with its simple, abstracted, universalized face, became “the right tool for the job” (Clarke and Fujimora, 1992) in its time and place. I then revisit a major theme from Chapter 2: that the design decisions embedded within these tools can work against a patient’s best interests. I explain that while the humanitarian goals of the nurses and clinical psychologists who developed these scales were ultimately achieved, these scales nonetheless play a critical part in conditioning the subject of a later neoliberal regime to look for pain in the face and body, effectively negating invisible or otherwise non-normative manifestations of suffering by privileging visuality, placing the burden of evidence on what can be seen and shown.

“Children's Communication of Pain”

Eland describes her experiment in terms that make it clear that while the thesis contains no reproduced images, her method involved pictorial graphics explicitly and centrally. Working with individual children, she used four picture cards, each with an illustration of a cartoon dog in a scenario representing an increasingly painful experience. The first card, meant to represent no pain, showed the dog resting on his doghouse. The last, representing the most pain, contained the dog with his hand caught in a car door. The two middle cards included the dog being hit in the nose with a swing and having fallen off his doghouse. Children were asked to identify how much pain the dog was in by placing the cards in a sequence from “no pain” to “most pain.” Then the child was presented with a picture card on which the dog appeared in a scenario similar to their own reason for being in the hospital—perhaps with an IV or catheter. Both alone and with their mother, the child would be directed to place “their” card along the continuum, indicating their level of pain in relation to the dog’s.

The experiment reinforced Eland’s hypothesis regarding the nurse’s critical role in affecting how the patient feels, evinced by the fact that nurses were only administering drugs to half of the patients for whom doctors had ordered pain medication. But it also showed that an illustration-based approach is, as she put it, “a valid method to measure pain in children in the 4- to 8-year-old age group” (48). Eland noted that although children did not agree on how the pictures of the dog should be ranked, individual children did rank them consistently between tests, indicating that they could properly communicate a change in pain from, for instance, pre- to post-analgesic.

Unfortunately, the dog illustrations appear neither in Eland’s typewritten thesis nor her subsequent publications. Besides the descriptions of the drawings themselves, she does reference that “the dog had short legs with no knees, short arms with no elbows, and a paw instead of a hand with fingers which made illustrating some of the children’s situations very difficult” (49). She suggests that new drawings should be done for any further studies, but never indicates whether she or another artist drew the figures.

In order to understand Eland’s use of pictures, we need to have a better sense of the theory behind her choices. In her master’s thesis, Eland wrote of an experiment she conducted in which she developed “a method by which children can communicate the intensity of their pain to nurses” (Eland 1974, 1). Arguing that nurses are specifically attuned to intervention—as opposed to a physician’s focus on pain as a symptom, for example, Eland laid out the three phases of nursing management of pain: assessment, active intervention, and evaluation. “Nursing assessment of pain,” she wrote, “is based on physiological, psychological, and sociological factors. The nurse assesses the amount of pain her patient is experiencing and bases her intervention upon that assessment” (2-3). The thesis provides a review of the state of the field of pediatric pain nursing, including theories of pain and the literature related to children’s pain in both medical and nursing texts. Eland included in this section a review of pediatric cognitive development research, highlighting the work of Jean Piaget, whose stage-based theories related to child development informed Eland’s understanding of the ways in which patient and nurse can communicate: “The preoperational child’s world is very ego centered. His view of the world is animistic and artificialistic and he cannot distinguish what is real from what is not real. The descriptions of pain made by the preoperational child reflect this developmental level. He may, for example, feel that the nurse is the cause of his pain because she was present at the time of a painful procedure" (10). The "preoperational" child referenced in this passage is, per Piaget, in most cases between four and seven years old. This specific child figure is critical to Eland, insofar as she proposes that even older patients tend to regress to earlier stages when they are in a hospital setting. "The energy that he [the adult patient] normally uses to cope with a developmental crisis," she explains, "is diverted to his struggle to deal with the demands of a new environment" (11). More broadly, Eland proposed that young children are incapable of communicating their pain. This is for two reasons: they do not understand the vocabulary or concept of pain to express how they feel; and nurses often confuse expressions of pain with expressions of sadness, anger, separation, or grief (7). In other words, pain is affective and psychological.

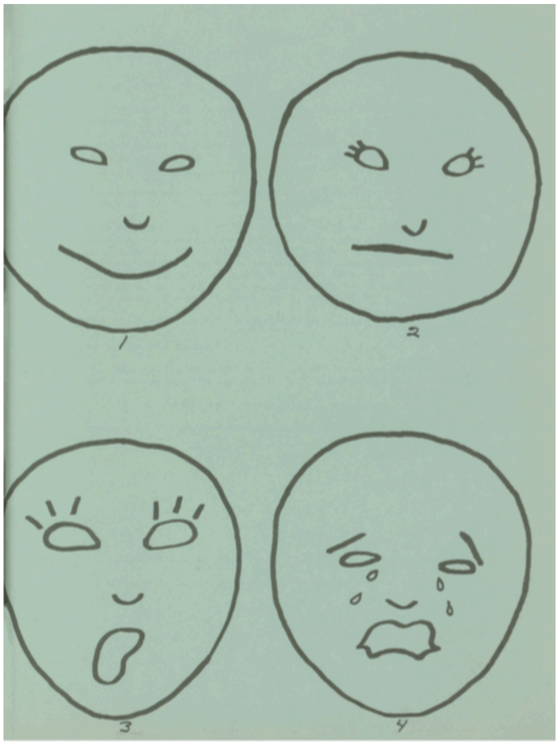

Figure 59: "Four Face Tool" from Alyea's "Child Pain Rating After Injection Preparation" (1978)
© Bertha Christensen Alyea

This orientation to affect and the psychological in nursing can be further understood through yet another nursing thesis of the period. In 1978, Bertha Alyea completed a nursing master's thesis titled "Child Pain Rating After Injection Preparation" at the University of Missouri-Columbia. Alyea, who cites

Eland, describes a set of experiments using four crudely drawn faces (Figure 59) conveying varying states of affect. Alyea asked patients to order the cards in much the same manner in which Eland performed her tests. Like Eland's thesis, Alyea's work was never published. Only two of the designers of scales reviewed further along in this chapter cite it. Elyea does, however, raise a number of critical points that echo themes which will be present for the rest of this chapter and, I propose, it is of considerable significance. The first point is related to how children see themselves—i.e., project themselves—in the scales. I will return to this theme in my review of the Thematic and Children's Apperception Tests, as well as my critique of what sorts of cultural conditioning to which face-based pain scales contribute. Secondly, Alyea notes that the drawings she made for the tests "have no age, sex, or race—giving them universality," a condition she regards as an "advantage" (2). Universality is a common theme throughout the greater project at hand, relating to the proposed reach and efficiency of tools used to measure pain—that is, a universal applicability of one scale means not having to customize for each patient when possible. In Chapter 1, reaching as many subjects as possible for analgesic studies was an important reason for the adoption of pain-quantifying scales. In the case of the face-based pain scales, it is critical to understand the labor conditions of nurses—professionals cited by both Eland and Alyea as instrumental in pain evaluation and management—in order to understand the proliferation of the face-based pain scale in the last decades of the 20th century.

The Nurse as Keyholder

Earlier in this chapter, I noted that the literature introducing and supporting each face-based scale reviewed below cites Jo Eland's unpublished master's thesis. As explained in the previous section, this thesis begins to identify why these scales look the way they do and introduces methodological underpinnings of the picture scale, bringing it from psychology to clinical pediatric medicine. Another important factor, however, is that each publication introducing a scale has at least one woman listed as a primary author. Here I briefly turn to the women's self-health movement as the context for the face-based pain scale in order to contextualize Eland's emphasis on the agency of nurses (a profession dominated by women at this time) and on pictures and graphics. The emergence of Eland's work in the mid-1970s, followed by the introduction of each pain scale in the 1980s, points to a critical moment in the advancement of women's health in the United States.

Recalling Eland's claims regarding the nurse's unique role in treating the patient in pain, I point to an essay cited by Elan, a 1965 piece by Virginia Jarratt, a nurse who in 1965 was a doctoral student, published in *The American Journal of Nursing.* Jarratt uses the metaphor of the keyholder to illustrate the immense responsibility placed on the nurse in the monitoring and care of patients, especially in the face of routinized care. "The history of nursing," writes Jarratt, "the very nature of nursing, rests upon the premise that there is need to relieve pain and suffering." She then poses a critical question to readers in the nursing profession: Have we guarded our emotions as closely as the medicine key and resolved the conflict by simply avoiding individual decisions?" (68). The essay is an emotional plea to her colleagues for the use of compassion alongside professionalized knowledge when working with patients in pain. She describes the experience of putting through a "PRN order"—"medicate as needed" in layman's terms—and asks what it means to decide who needs what and when. "In no area of nursing practice is there more opportunity for independent action based on sound application of knowledge than in discovering the patient's particular needs for pain relief, in revealing the measures that work best for him, and in solving the problem of pain" (69). Given the social environment in which Jarratt wrote (the years before second wave feminism), one can imagine the gravity of asking for "independent action" from nurses.

The feminist self-health movement of the 1970s responded to the inadequacies and dangers associated with a health field in which physicians were predominantly male and care was based largely on normative models informed by studies involving male research subjects. "How can we rescue ourselves from this dilemma that male supremacy has landed us in," asked lawyer, author, and women's rights activist Carol Downer in an address to the American Psychological Association in 1972 during which she also itemized the deplorable conditions endured by female patients (1972, 1; quoted in Ruzek 1978, 1). Downer's talk reinforced the message of *Our Bodies, Ourselves*, a Boston Women's Health Collective publication of 1970 that continues to be reissued (most recently in 2011). This canonical guide to anatomy, sexuality, care, and more was part of a groundbreaking movement for women to take their health into their own hands (Fee 1983, 19-21). The many graphics included in the publication, I propose, tell the story of activists doing what they can with what they had available—a collective interested more in the discussions and actions that might come out of the distribution of the work, rather than on a graphic style that is clean or life-like.

The work takes capitalist and patriarchal systems of healthcare head on, tearing down how the two structures work hand in hand to first objectify and then alienate women's bodies. Early on, the authors make it very clear how they feel about the doctor's role in these systems:

> Perhaps the most obvious indication of this ideology is the way that doctors treat us as women patients. We are considered stupid, mindless creatures, unable to follow instructions (known as orders). While men patients may also be treated this way, we fare worse because women are thought to be incapable of understanding or dealing with our own situation. Health is not something which belongs to a person, but is rather a precious item that the doctor doles out from his stores. (1970, 6)

They go on to highlight the ways that the medical academic structure, the "mystification" of medicine in order to own critical knowledge, and the paradoxical nature of a figure who knows little about female reproductive systems while claiming to be the true expert on "any sexual problem" undermine women's health on multiple levels (6-8).

The rest of the book includes ethnographies—both first and third person—from women who have experienced medical abortions, childbirth, and treatment for various gynecological conditions. In the first edition, their stories have clearly been tapped out on a typewriter and annotated by hand with underlines, page numbers, and various corrections. But most importantly for this chapter's purposes, the text is accompanied not only by photographs, but also by a number of hand-drawn illustrations of female and male anatomy (10; Figure 60). Line drawings are distributed throughout the book—illustrations that bear aesthetic similarity to the illustrated, simply rendered faces of Alyea's drawings (and, as I will demonstrate in a later section, the pain scales found in medical offices today). They are pen drawn in a single color, including only the visual details integral to the subject at hand.

The purpose of this paper is then to help us learn more about our own anatomy and physiology, to begin to conquer the ignorance that has crippled us in the past when we have felt we don't know what's happening to us. The information is a weapon without which we cannot begin the collective struggle for control over our own bodies and lives.

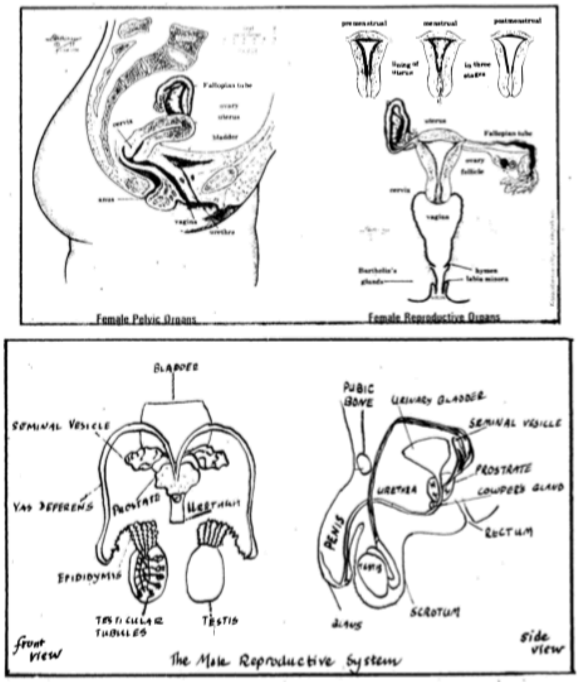

Figure 60: Female and male reproductive systems from *Our Bodies, Ourselves* (1970)
© Boston Women's Health Collective

The line-drawings in Figure 60 are indicative of the do-it-yourself nature of the original *Our Bodies Ourselves*, which is made up of many varying styles, layouts, and methods. The tables of contents is hand written, most of the body copy was produced via typewriter, some graphics are reproduced from major publications (see, for instance, the "Rhythm Method" table on page 83, via *Time-Life*), many images are photographic, and still a good number of others are hand-drawn, as in Figure 60's "The Male Reproductive System." The representation in this last example is two-dimensional, though presented in both front and side views, and also annotated by hand. Various organs, such as the testicles, are shown in both solid and cut-away views, allowing the illustrator to convey what is contained inside. The handwriting is legible, but by no means carefully penned. There is no obvious reason for the sparse nature of this drawing and others like it in the volume—perhaps the group did not have an illustrator or graphic artist involved, perhaps they did not have the time or finances to invest in a higher-fidelity graphic, or perhaps it was simply a matter of no one feeling it necessary to place any specific emphasis on the “cleanliness” of the graphic. As the members of the Boston Women’s Health Collective write in the introduction, “the papers in and of themselves are not very important” (4), but rather the discussions, teaching, and activism that they inspire.

The publication of *Our Bodies, Ourselves* coincided with second-wave feminism, a movement, underway from the early 1970s through the 1980s, during which was unleashed a storm of thinking, organizing, writing, and activism opposing patriarchy, sexual oppression, and gender inequality. In *Daring to Care: American Nursing and Second-Wave Feminism* (2007), Susan Gelfand Malka points to Carol Gilligan’s canonical *In A Different Voice* (2003) as a text that was instrumental to second-wave feminism’s methods and influenced structural changes. Primary to Malka’s investigation is the effect that feminist writing and activism had on the nursing industry. Specifically, she calls out the struggle that nurses experienced as they challenged inequitable work conditions, hours, status, and pay gaps while also striving to provide and maintain high standards of care. At the end of the twentieth century, she explains, many nurses began to ask: “What are the differences between nursing and [other professional categories in] medicine?” (9). That is, considering the toxic environment produced by medicine’s relationship with capital and patriarchy, circumstances outlined in *Our Bodies, Ourselves*, it made sense for nurses to ask how they might challenge and overturn the conditions of their subordination. Yet there was a paradox in this that came to inform their practice. They worked in a field predicated on the care of others. Their training and vocational commitment precluded the strategy of refusing care to patients as leverage for gaining improved conditions and pay from employers. Informed by the feminist emphasis on care and recognition that the personal is political, how the patient felt and experienced illness, and whether and how the caregiver listened and responded to their needs became a heightened locus of professional commitment at a time when workplace shortages and deficits escalated actual demands on their time and attention in the clinic and the hospital. “Nursing education,” Malka explains, “continued to adjust to reforms and shortages while a few educators called for a curriculum revolution, one immersed in feminist ideology” (9).

Malka points to works such as *Our Bodies, Ourselves* as having played a major role in changing how nurses approached their field throughout and after the era of second-wave feminism, a period also marked by deficits and organizational management reforms that ultimately offloaded labor to the lower paid, feminized professions (99). *Our Bodies, Ourselves* included "how to" diagrams and pictures, enlisting the patient in a graphics-supported and visually diagrammed dialog with (largely female) professionals intent on teaching them to engage and acquire knowledge about their bodily care as a personal form of power and resistance to patriarchal medicine. This strategy, which relied largely on female professionals (nurses, sociologists of medicine), made a central contribution to the subsequent development in pediatric nursing (a doubly feminized profession) of the face-based pain scale, an instrument that would be based precisely in this ethos of showing and telling, of empowerment of the powerless (child) patient through pictures.

But Malka also points to structural changes in the healthcare industry that may further help us understand how face-based pain scales came to proliferate in pediatrics. After the formation of the Nurses' Coalition of Action in Politics and increased membership in unions by nurses, the field saw the introduction of more specialized roles within the profession. New sub-areas such as Nurse Practitioner entailed the introduction within nursing of a range of more specialized professional categories and licenses, and with them a new spectrum of pay ranges. The institution of these new professional roles for the nurse were motivated in no small part by the demand for cost-effective organizational strategies in a field rapidly undergoing corporatization (this was the era of the rise of the HMO). But the system gave women in a feminized profession greater access to jobs in the field of nursing that offered more opportunities for workplace authority and semi-autonomous decision-making, Nurses soon began going beyond influencing and assisting, and could, in some cases, make relatively major medical decisions. Malka notes that giving nurses this kind of agency had been "unthinkable a decade earlier" (89). Thus, confronted with a child in pain, a nurse practitioner, with their relatively greater autonomy, would have had far more opportunity to exercise the kind of dialog, the kind of show and tell and listening, advocated in *Our Bodies, Ourselves*. It is easy to surmise that choices about how to diagnose, identify, and acknowledge a child who appears to be in pain, or who says they are in pain, and decision regarding whether and how to treat and medicate the child in pain, would certainly have fallen under the category of crucial activities performed by the nurse practitioner in this new period of nursing's hyper-specialization during the rise of the health management organization in the 1980s.

For the nurse to make an evaluation of pain and its treatment without hesitation, however, was not simply a matter of caring for a child expediently. Hyper-specialization also was put to the service of the new health management organization systems' pervasive concerns about how to keep down costs, As Malka points out, hospitals in the United States at the beginning of the 1980s saw the introduction of the "diagnosis-related group," or DRG. Implemented as a cost-control mechanism for the expanding Medicare program, the DRG, swiftly adopted by private insurers and in HMOs as well, functioned to assign medical diagnoses according to a system consisting, in its initial iteration, of 467 categories. This was largely for the purpose of billing, with each condition assigned a corresponding price cap. Thus hospitals could only charge so much to treat their patients. Avoiding inpatient care became a newly urgent financial priority, as discharging patients quickly meant a higher margin on the fee that the hospital could collect from Medicare or from private insurance companies (Malka 2007, 99). Efficient evaluation and treatment, then, meant that nurses were expected to see more patients, generate more revenue, and increase income margins (Sherman 1984, 922).

It is no surprise, then, that the vast majority of our face scales for children were created by nurses—women[1] who faced pediatric patients in pain on a regular basis and at an increasingly rapid rate through the 1980s, and who, newly inspired by the feminist self-health movement to encourage patients to show and tell their symptoms and experiences, were also newly invested with the authority to act with an increased degree of autonomy in diagnosis and certain forms and degrees of care. Making critical decisions regarding whether or not to ask, listen, see, and recognize pain, and diagnosing and offering

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[1] While there are a number of co-authors on the papers cited in the section below, some of whom are men, each paper introducing a pain scale lists a woman as the first author. For a complete list of authors, see the Works Cited.

patients any sort of relief for their symptoms became a more viable approach both in outpatient clinical medicine and in postoperative care. The scales that existed to this point—primarily based on numeric or color-based measurements of intensity—were not right for these young patients who, per Eland's research, could not comprehend the concept of pain, let alone its measurement (6–9). Fed up, perhaps, by a medical industry that ignored these children's pain, perhaps even inspired by the Boston Women's Health Collective, these nurses took matters into their own hands. They commissioned illustrators or photographers, applied (and were often rejected) for funding for major studies (see, for example, Wong and Baker 2000, 7), and sought out licensing agreements to protect their work from misuse or unauthorized distribution.

Graphic Descriptions

I return here to the subject of Chapter 2, the Visual Analog Scale. The VAS presents a relatively easy set of keys to trace historically. As noted, one only need follow the simple line. Find a few papers from different years that use successive adaptations of the Visual Analog Scale or the Graphic Rating Scale, and you may easily plot the progression of the method's evolving visual system on a timeline simply by noting similarities and changes in design between publications. At some point, around the mid-1980s, you would find that the simple line no longer seems to have fulfilled the researcher's or clinician's needs. It is replaced by other systems, pictorial systems. This is especially the case, as I will illustrate below, in pediatrics. This section reviews five different scales, produced between 1983 and 2001, created specifically for use with child patients. Each scale, as I will show, centers around a visual design featuring the human face. In the era of nursing's transition to health management and in the wake of the 1970s women's movement, nurses make a momentous contribution to medical graphic design: they give the pain scale a face. Nurses change the face of pain medicine with a structural contribution of a standard method for acquiring knowledge about and classifying patient pain.

Early Examples

Our first face-based scale exemplifies how the graphic pain scale made its way from the field of clinical psychology—where the Visual Analog Scale was by the 1980s rather commonplace—into the pediatric nursing field. The Children's Clinical Anxiety and Pain Scale (CAPS, Figure 61), introduced by clinical psychologists in 1983, is unique among our chosen designs here as it includes faces for both pain and anxiety. Two rows of illustrated faces, each with ear-length bowl-cut hair, express varied levels of the designated affect: the top row is labeled "Point to the face that shows how much hurt?" while the bottom reads "Point to the face that shows how scared you were?" The faces are drawn in black and white but are drawn with a relatively high level of fidelity, including a thin nose, philtrum on the upper lip, a tongue visible in the more affected faces, and the aforementioned hair. The first two faces on one scale looks about the same as the other scale. The middle "hurt" face is squinting, while its "scared" counterpart has eyes and mouth wide open. In the final two faces on the pain scale, tears come from the child's eyes, whereas high anxiety is demonstrated by an increased visibility of the whites in the figure's eyes and furrow-lines on the brows.

Figure 61: Children's Anxiety and Pain Scale from Kuttner and LePage (1983)
© Kutner and LePage

Leora Kuttner and Tony LePage, the originators of the scale, first wrote about it in an unpublished paper from 1983, "The Development of Pictorial Self-Report Scales of Pain and Anxiety Management." In this essay, they explain that while similar graphic scales had been developed, there was not yet one for pediatric use that had been "validated" by scientific investigation. The team attempted to run a study with younger children using a previously developed face-based scale by LeBaron and Zeltzer (1984, Figure 62), a five-step scale with an adolescent male face. This scale, which does not make any appearance after their 1984 paper, is a 1–5 scale with tears appearing at steps three through five—the only scale where tears appear as early as the half-way point. The affect in LeBaron and Zeltzer's drawn faces shifts rapidly from the first to second step, with a sly smile turning to a frown and the figure's hair becoming disheveled. Because the tears in step three appear so quickly, by step five, the figure is crying aggressively and their eyes and mouth indicate a great deal of discomfort. Perhaps because the scale is so out of balance, the faces read so distinctly male, or that they appear on the older side of adolescence, Kuttner and LePage eventually deemed LeBaron and Zeltzer's scale inadequate for their work: "the stimuli did not hold the younger children's attention adequately, nor were they easily comprehended by the younger group (4 to 6.11) years" (Kuttner and LePage 1983, 5).

Figure 62: From LeBaron and Zeltzer (1984)
© American Psychological Association, Inc

The two went on, instead, to hire a children's book illustrator[2] to "draw faces of a unisex child exhibiting a range of different degrees of happiness, pain and anxiety" (Kuttner and LePage 1983, 5). The artist provided the research team with sixteen faces representing varying affective states. Eventually, the final 10 images (described above and seen in Figure 61) were selected for final inclusion in the scale. The authors go on to suggest that having two dimensions—in this case, pain and fear—allowed them to understand the importance of keeping one affect per scale. They point to Ernest Katz's 1979 face scale (Figure 63) which was used for a study on distress behavior in pediatric cancer patients. Note how the figures drawn by Katz and his team share the same sort of hand-drawn informality as the illustrations from *Our Bodies, Ourselves*. The researchers note that the scale was an addendum to a second phase study (5), perhaps indicating that—just as with the Boston Women's Health Organization—the visual representations were not worthy of critical attention and, as such, few resources were dedicated to their production. As we will see, the simple, circular face makes a number of appearances in future scales, but with more attention given to their aesthetic cleanliness.

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2. Kuttner, in an email correspondence, noted that she does not remember who they hired

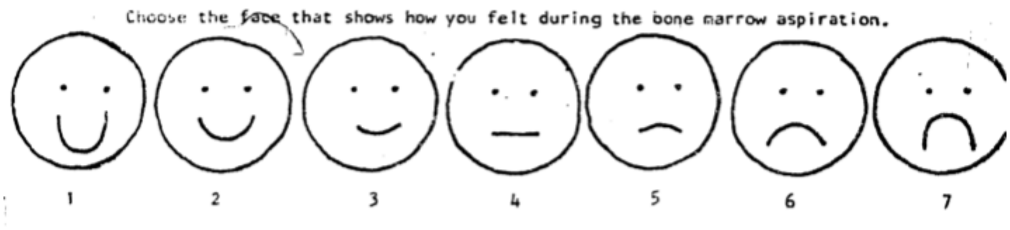

Figure 63: From Katz (1979)
© Katz

Kuttner and LePage took particular issue with how Katz's scale attempted to measure anxiety versus happiness, rather than a single dimension. They argue that asking for a general state from "feeling bad" to "feeling good" on a single scale (12) would eliminate the chance that, as in Katz's research, scores may be "unreliable for children under 7 years of age" (1983, 11). Here, affect is separated from pain, Kutner and LePage cite the "complexity of pain as a personal experience" and the "emotional immaturity" of a child as reasons for separating anxiety from pain into two separate scales (1983, 2).

In developing this single-dimension scale, Kuttner and LePage assign an equally stepped numerical value to the faces—that is, each face is assigned a consistently spaced integral value. Using a Visual Analog Scale (see Chapter 2) alongside illustrated faces, however, McGrath et al. (1984) worked to align each face with a specifically measured value, regardless of its proximity to the previous or next number. In their words, "the actual value of affect depicted by each face was determined from the children's own perspectives" (389). The result is the Affective Faces Scale (AFS, Figure 64**)**, a nine-step scale wherein each face is labeled with a letter rather than a numeral. The faces are perhaps the most crudely drawn of our collection here, though the circles which contain them are perfectly drawn. Each one features olive-leaf shaped eyes with an increasingly exaggerated squint as they move towards the final letter *I*. The mouths progress from a wide, open smile, to a narrow smirk, and on to an open-mouthed grimace with teeth and tongue visible. The brow becomes more pronounced, moving lower into the bridge of the nose as pain increases. The faces are placed in an arrangement that does not suggest a linear progression in pain levels. On the back of the subject-facing tests, each letter is associated with a "mean affective magnitude," a value determined by the researchers to be an average VAS rating of "the magnitude of negative or positive affect depicted by each face" (389).

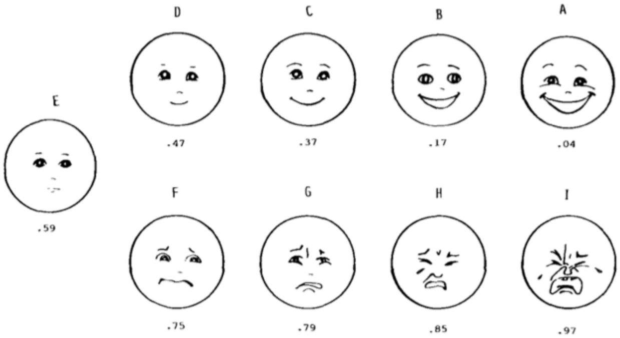

Figure 64: Affective Faces Scale from McGrath et al. (1984)
© Raven Press

The scale's first author, Patricia McGrath, worked in pediatric research centers and hospitals while her coauthors were in the clinical psychology field, indicating once again a transition from the psychological to the medical. While this scale is seldom used, it represents acknowledgement that pain intensity is neither linear nor, as the title of the scale recognizes, can it be measured without affect. And while Kutner and LePage's work is not cited by anyone else developing a scale, McGrath's work is cited by all of the researchers of the scales described below. As such, we should understand this scale, with its circular heads and crude facial features as an important signpost.

The Face Scale Becomes Mainstream

In the same year that the Affective Faces Scale was introduced, 10 years after Eland's groundbreaking thesis, Judith Beyer, a nurse and associate professor at the School of Nursing at the University of Colorado at the time, introduced the Oucher scale (Figure 65). Each of the five scales detailed in this chapter feature visual representations of the human face in various affective states. The Oucher, however, is the only of the five that includes photographs of faces, each one masked by a circle. The Oucher is also the only scale that is vertically arranged, with an 11-point (0 through 10) graduated scale to the left of the six photographs. At the bottom of the scale, or point 0, is a face of a child, apparently a boy, looking straight on at the camera with a seemingly affectless stoicism, his facial muscles appear relaxed, his lips and eyes neither smiling nor completely frowning. Every two notches further up on the scale, another image of his face is present, each showing a progressively more exaggerated frown meant to represent increasing pain. In the final face, at point 10, the child is crying with mouth wide open, eyes clenched, and tears streaming. In the original "Caucasian" scale shown here, frame 10's depiction of most extreme pain has the boy turned on his side, gripping what appears to be a toy truck, which he is also biting. His hair is tousled and he is burying half of his face in a pillow.

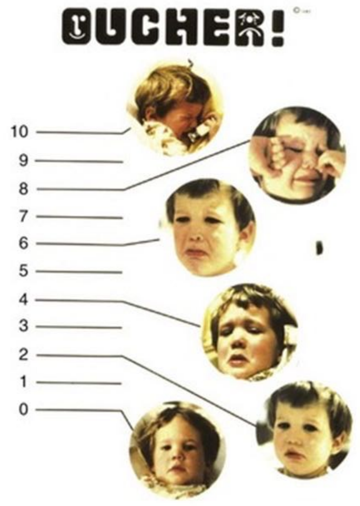

Figure 3: OUCHER Scale of Beyer and Wells

Figure 65: Ouncher scale in compact arrangement from Beyer et al. (1990)
© Judith E. Beyer, PhD, RN

Figure 66: Oucher scale in vertical arrangement from Knott et al. (1994)
© Judith E. Beyer, PhD, RN

Beyer introduced the tool with a 0–100 scale and a more compact arrangement (Figure 65) wherein the photographs are staggered to the right and left of the scale's center. Beyer originally conceived of the scale as a "Chips Scale," wherein a subject chooses a quantity of 1 to 100 white chips representing "pieces of hurt" that "would allow more sophisticated statistical analysis" (Beyer 2019), but found that her patients were often lying down and the chips system became unwieldy. Over the course of the scale's first decade or so, Beyer had to experiment with various formats to accommodate printing and shipping costs; after presenting her work at conferences, she received many requests for a laminated version for offices and research laboratories and partnered with a medical supply company which specialized in toys for pediatric patients (Beyer 2019). The first published instance of a perfectly vertical arrangement (Figure 66) is from a 1994 article (Knott et al). In 2000, per "The Oucher: User's Manual and Technical Report" (Beyer et al. 2009), two of the collaborators on the project suggested that the numeric scale be changed from 0–100 to 0–10 in order to be more consistent with other pain scales for children.

The general design of the scale available on oucher.org, a website dedicated to providing information on the scale, has not been updated since the scale was introduced in 1984, though Beyer notes (2019) that she has had to handle most of the work herself and has not had the financial nor technical resources to do much with it. The logotype at the top of the scale, reading "OUCHER!"— a name that stands in stark colloquial contrast to the likes of "Affective Face Scale" or "Faces Pain Scale," clearly designed to appeal to the pediatric patients more than the individual performing the measurement—is a proprietary design which features a smiling face in the center of the O and a frown in the R. The child, with his chubby cheeks and uneven hair, seems healthy and familiar, perhaps to better relate to the young patients for whom the scale would be used. His face is flush and, even in the images where he is grimacing, his skin shows no indication of anomalies. The circle-cropping of the photograph, much like the curvy letters of the logotype, soften the aesthetic and reinforce its child-like playfulness. Further, only when the child raises their hands to their face are we made privy to anything beyond the facial reaction. In the photograph for "10" on the Caucasian version, the child is crying and cuddling with their truck, assumed to be a comforting object. This cropping works to reinforce the face as the locus of the child's pain, a problematic into which I will delve deeper in a following section.

Significantly, this is the only self-reporting graphic scale that includes photographs of subjects in the scale. Beyer and her collaborators note that the face of a child was used for a number of reasons, including that subjects "would be attracted to the face of another child," as well as provide a more easily graspable concept for the scale (Beyer et al. 1992, 336). Soon after its introduction, two contemporaries of Beyer's, Toni Villarruel and Mary Denyes, raised concerns regarding its lack of cultural sensitivity in selecting an apparently white male child as its universal icon (Beyer 2019). Beyer et al. (2009) explain that while Beyer did not consider it necessary to customize the scale in any way, researchers external to the original project took it upon themselves to build scales with images of African American, Hispanic, Asian, and First Nations children. And while Beyer and others considered the Caucasian subject to appear androgynous, "boy" and "girl" versions were developed for the Asian and First Nations scales (Beyer et al. 2009).

Thanks to a nursing organization devoted to pain management, each version of the Oucher is currently available for free on oucher.org. Until 2009, Pain Associates in Nursing, the organization responsible for its distribution, reproduced printed posters of the scale and sold them online, a strategy used "in order to maintain the color and photographic quality of the tools" (Beyer et al. 2009, 15). In 2009, the group embraced technological advances in at-home printing, choosing to permit unlimited downloading and printing, and providing brief instructions in four languages (Beyer et al. 2009). In the 2010s, the number of ethnic- and gender-based variations grew as well.

Given the difficulty and expense related to printing quality color images at the time of the scale's introduction, the use of photographs here deserves more attention. As noted above, Beyer chose the face specifically for its relatability to the subject and notes that a photograph "would hold their attention better" than a more abstract visual (Beyer et al. 1992, 336). The necessity for multiple variations raises some considerations about the relatability of the scale, however; that is, would a simple illustration be more universally applicable to any subject? Further, the sorts of illustrations in other scales, while perhaps modeled after actual patients, do not represent specific individuals. In the same 1992 article, Beyer and her co-authors note that the boy in the original Oucher photographs is four years old and had been photographed before and after surgery for a hernia. These catalogued faces become the literal poster children for what a child in pain looks like. Here, we might consider how a widely distributed photograph of a child might take on an iconographic quality, especially given that there is no mention of compensation for any of the children included in these scales.[3]

The practice of providing a photographic reference to what a certain kind of person looks like—in this instance, what a person in a varying amount of pain looks like—might be traced back to the nineteenth century eugenicist practices of phrenology and craniology. The photography theorist Alan Sekula, in his landmark essay "The Body and the Archive" notes that the two major proponents of these practices, Francis Galton and Alphonse Bertillon, were "committed to technologies of demographic regulation" (1986, 19). Further, as Lisa Cartwright (2003) notes, making medical classifications based on differences in photographs of a child's face becomes problematic especially when considering the cultural conditioning that leads us to make such an interpretation. Cartwright gives the example of reading a child's philtrum for evidence of Fetal Alcohol Syndrome and, pointing to the ways that J. Langdon Down implicated an entire peoples in his classifications of "mongolism," wonders if "squeezing" an image for heavily refined levels of classification may conflate cultural and physiological phenotypes (103–102). What sorts of normative conceptualizations of pain do Beyer and her contemporaries lean on and establish by presenting photographs of "real" children in various stages of pain? Does going to the complete opposite direction in aesthetic styles—that is, from the photographic to the cartoonish—help combat or reinforce the biases of the observer?

The Wong-Baker FACES Scale (Figure 67) was developed by Donna Wong and Connie Baker, both of whom were working at the Hillcrest Medical Center in Tulsa, Oklahoma in 1981. Wong, a nurse and a PhD scholar and professor in child development who developed an influential nursing consultancy practice, and Baker, a child life specialist, felt that their patients, who were primarily pediatric burn victims, did not have an adequate tool with which to communicate the intensity of their pain. The team

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[3] In an email correspondence with Beyer (2019), she notes "I had to charge for the Ouchers to help me get enough money to produce and distribute them. Throughout my career, I was always living on a shoestring [sic] so that was hard. Nurse educators/researchers never have made much money! Now that there were three Ouchers and the production, advertising and distribution were expensive, I decided after websites became a thing that I would get a website and let people download them for free." She never mentions compensating the subject, though I did not ask about that specifically.

used stickers as rewards when working with children and noticed that many came with facial expressions. Baker eventually began asking patients and subjects to fill in blank circles with illustrations representative of the way they felt (Figure 68). Composites of the drawings were made for further testing (Figure 69) before a professional illustrator was hired to produce the final product (Wong and Baker 2000, 6). Wong and Baker cite Alyea, whose "Four Face Tool" (Figure 59) was based on Reitman's "Pin-Man" test, a projective technique organized around simple line-drawn stick figures. In developing their scale with their patients, the pair provided templates with the circles already drawn (Wong and Baker 2000, 6) and eventually pared down the illustrations to exclude hair and eyelashes—a transformation to which I will return below.

Among the five scales discussed in this chapter, the Wong-Baker is the most widely used and familiar (Tomlinson et al. 2010). It is a horizontally oriented set of cartoon faces representing varied states of affect. On the left, a broadly smiling face has wide circular eyes and arching eyebrows, suggestive of a cheerful countenance. Under the circular drawing is a zero, along with the label, "No Hurt" (Wong and Baker 2000, 2). Looking to the right of this initial, painless figure, the smile gradually turns down to become a frown, the eyes and eyebrows drop, and eventually the figure begins to cry. The six numerals, which originally increased by one-step units up to five, now skip by two and end at 10. Moving left to right from "No Hurt," the labels read "Hurts Little Bit," "Hurts Little More," "Hurts Even More," "Hurts Whole Lot," and "Hurts Worst" (2).

Figure 67: Wong-Baker FACES scale from wongbakerfaces.org
© WONG-BAKER FACES

Figure 68: Patient drawing during research from Wong and Baker (2000)
© WONG-BAKER FACES

Figure 69: Composite drawings after patient research from Wong and Baker (2000)
© WONG-BAKER FACES

Per Wong and Baker, the numbers on the scale were placed “primarily for our own ranking purposes” (Wong and Baker 2000, 5). The choice of six steps was based on observation of other scales (Wong and Baker 2000, 6); the transition from 0–5 to 0–10 was introduced in the late 1990s. Per Baker, ”using the numbers 0-2-4-6-8-10 is easier as it is more consistent with the numeric rating scale of 0-10,” and a paper published in the American Journal of Nursing in 1997 is the first to reference the 11-point version. The author of the same article argues that “to ensure uniformity in assessment and documentation and prevent confusion, an institution's Faces scale [sic] should have the same number range as its numerical pain scale” (Pasero 1997).

The initiative to design the tool began as a joint project between Wong and Baker, who cite both Eland and Alyea as inspiration for their work. Their specific use of the face is due to their observation that "children seemed to respond well to facial expressions" (2000, 5) and the aforementioned use of "smiley face" stickers with children. Whereas the authors of the Oucher note that pain would be more recognizable to subjects via the face (Beyer et al. 1992, 226), Wong and Baker seem to be concerned only with relatability of the face in general—not the face in pain, specifically. What does this mean, then, for those individuals who do not express their pain via the face (or even the body in general)? Further, given that the Wong-Baker scale is the most widely used it is important to note that the universality of the cartoon-like faces is actually based on fewer than 100 children in Tulsa in the 1980s; the pair sought funding for a wider-spread study, but were unable to secure it (Wong and Baker 2000, 7).

In a 1988 article, "Pain in Children: Comparison of Assessment Scales," Donna Wong and Connie Baker pit their FACES scale up against five other graphic tools for pain assessment in a study with pediatric patients. Aside from their own tool, they included: a "Simple Descriptive Scale" and "Numeric Scale"—both ostensibly graphic rating scales, one with textual labels along the horizontal axis, one with only numeric; a Chips Scale; a "Color Scale," based on another scale developed by Jo Eland that asks a subject to arrange six differently colored crayons in the same manner that Eland had her subjects arrange cards, subsequently pointing to the step along the spectrum at which their pain belongs; and a "Glasses Scale," effectively a bar graph with increasingly tall cylinders, each representing a higher pain step. The study was meant to determine the validity, reliability, and preference of each scale, though it only succeeded in declaring the last of the three (Wong and Baker's FACES scale won in that category, the other two were inconclusive).

Just about every study introducing a new scale, Eland's work included, has attempted to prove the *validity* of that tool—that the information being collected can be considered valuable for the task at hand. As we learned from Eland and Jarratt, that task is one that lies squarely with the intermediaries, the nurses or assistants on duty at the time. And even though they all cite Eland's work describing cartoon illustrations of animals, each of the women who developed these scales chose the human face to engage with their young subjects. A face can be the site of compassion, fear, anguish, anxiety, and more. It is where we look when we need confirmation from someone we trust that everything will be alright. These nurses interacted with young faces in pain on a regular basis and then were tasked with deciding whether or not those faces required relief from that pain.

Given the popularity of the Wong-Baker FACES Scale, it is critical that we consider the construction of the faces that guide the actual pain measurements. In the above section on the Oucher, I noted that the circular cropping on the photographs has a softening effect on the photographs contained within. Here, however, the circles have an almost dehumanizing effect, reinforcing the fact that these are abstractions upon abstractions—designed as composites of "the most frequently drawn features" during initial trials (Wong and Baker 2000, 6). Take note of Figure 68, wherein the child who filled out this particular template of six pre-drawn circles decided not to stay within the lines, but to draw hair on each face's head. The hair style does not seem to correspond in any way to the face's level of affect, but the fourth step from the right (this specific example was an instance where the patient increased pain right to left) has their (her?) hair pulled back tight or even shaved. This is also the first figure where the mouth begins to turn down. On the final, published version, the corresponding step—number 6, "Hurts Even More"—is also the first face with a turned-down mouth and the first to include eyelids and a nose demonstrating a change in affect as well. If you were to remove the mouth from steps 0 through 4 (remember that the steps jump by 2 in this version), other differences would be imperceptible, and even the mouths vary only slightly. It is step 6 that demarcates real pain on the face.

Trouble representing mid-scale faces does not seem to be unique to Wong-Baker. See, for example, faces 4 and 6 on the Oucher in Figure 65; reverse their order and you would not make any meaningful change to the progression of the scale (some might actually argue that the scale would benefit from this switch). Wong and Baker, however, mitigate this ambiguity by accompanying each step with text, the only scale designers to do so and, as such, the only ones making an implicit admission about all of the scales reviewed here: the face alone is not a strong enough signifier. Consider the *Mona Lisa* and the model's "enigmatic" smile as an example of the ways that the shape of a mouth can contain multitudes (Sturken and Cartwright 2017, 31). The progression of the Wong-Baker smile is similarly curious, especially in step 4's crooked line. Its ambiguity, combined with the use of text, speaks to how Wong and Baker prioritize the face's relatability rather than the pain contained therein, a pain that may, in the end, be too complicated and nebulous for a simple graphic scale.

Introduced around the same time as the Wong-Baker scale, the figures on the original Faces Pain Scale presents a similarly ambiguous affect. The FPS was developed by Daiva Bieri, a researcher in the Division of Paediatrics at The Prince of Wales Children's Hospital, Sydney, Australia and is referenced at times as "The Bieri Pain Scale" (Bieri et al. 1990). Bieri herself suffered from Myasthenia Gravis, a painful neuromuscular disease, was also an amputee after suffering from infection in her feet from her time in refugee camps after World War II. Due to the short supply of anesthetics, she was forced to undergo the amputation without any pain abatement (Bieri 2009).

The seven faces of the original Faces Pain Scale (FPS, Figure 70) are drawn in 6cm high oblong shapes resembling eggs that are tapered on the bottom end and flat on top. The progression of emotion, left to right, can be observed mostly in the brow, where more pronounced wrinkles appear, and in the eyebrows, which move more firmly down as the pain score increases. The eyes go from wide open to aggressively shut, while the mouth moves from a timid upturn to open, suggesting yelling out in pain. The nose stays generally the same while the chin becomes another downturned arc with the open-mouthed expression of most pain. There are no numerals on the patient-facing portion of the scale, though some versions include a fold-behind flap with instructions and numerical markers (Bieri et al. 1990). This is the only scale included here without a face featuring tears nor, as interpreted by Hicks et al., a smile. These faces do not, in any way, signal their development for pediatric contexts thanks mostly to their awkwardly elongated heads and highly nuanced affective cues. The lack of hair but presence of wrinkles on the brow lead to an uncanny sort of resemblance to an actual human, rather than an attempt at abstraction such as that in Wong-Baker.

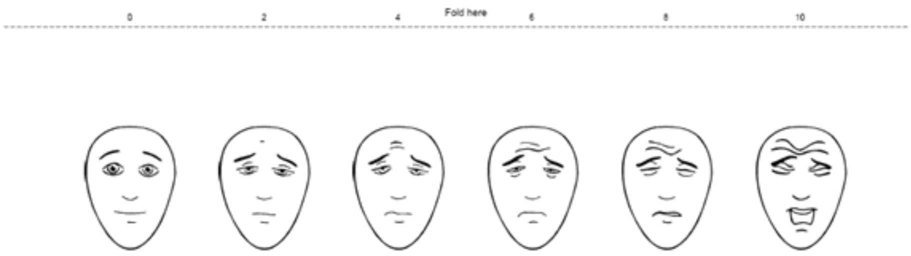

Figure 70: Faces Pain Scale from Bieri et al. (1990)
© Elsevier Science Publishers B.V.

In 2001, the second and third steps were combined to reduce the total number of faces to six in order to better align with 0–5 and 0–10 numeric scales. Carrie Hicks, the primary author on this paper, was a graduate student in clinical psychology when she and her co-authors introduced this Faces Pain Scale – Revised (FPS-R). They note that it was a strong candidate for revision because of its lack of tears and smiles (though one could argue that the first face is neither frowning nor completely neutral in affect), claiming that those elements might confound affective distress with pain intensity (Hicks et al. 2001, 174

That Hicks et al. argue that scales should not include affective distress, lest the subject confuse it with pain intensity is extremely telling here. It suggests that these particular researchers were not concerned with something Henry Beecher had argued over 30 years prior: that there was much more to a patient's suffering than simply the pain-causing trigger. Should a patient, crying with pain, be asked to stop crying and describe their pain, as if the pain was not, in fact, causing the crying? Here we see a blatant disregard for the affective qualities of pain in the name of separating body from mind in an effort to get to the "true" pain level of the subject.

Reading the Wong-Baker and Faces Pain scales one after another highlights the complexities related to capturing the nuanced changes in facial expressions as signposts for varying levels of pain and affect. Perhaps it even indicates the futility of the task. The weight of interpreting affect in the face lies heavy on the practitioner or researcher responsible for responding to requests for medication or care, but in the use of the scale, that weight transfers. Cartwright (2008) suggests that empathy is a "radically intersubjective process" (2) that requires identification of the other rather than knowledge of the other. There is a force at the point at which the examiner recognizes the affect present in the examined—at which point the examiner feels that they know how the examined feels. In the case of the scale, the nurse points to the drawings or photograph and asks, "which face do you think best represents your pain?" Suddenly the patient becomes the examiner and must project their own affect onto the faces, deciding which one best catalyzes an empathic force. What sorts of cultural conditioning is required to make these identifications? What sorts of "default" knowledge must the patient rely on?

To be sure, the paper-colored face does not read without ethnicity or race simply because it has not been colored in. Take, for example, the yellow default emoji face that was, until 2014, the only one available until the Unicode Consortium released sets of emojis with varied skin tones and is still the default until a user selects a preferred skin tone. Yellow may have been intended by its designers as an all-encompassing skin tone thanks to its rather unnatural and "non-realistic" hue, but as Miriam Sweeney and Kelsea Whaley have pointed out (2019, Figure 71), "Rather than a shift away from whiteness, the designation of the 'default' yellow emoji can be read as a proxy that retains the cultural signifiers of whiteness in its presumptions of universality, while denying that skin-tone modifiers signify racial social categorization because it remains a 'non-realistic' color" (para 23). Wong and Baker chose the cartoon face because "it avoids gender, age, and racial biases" (2000, 8), but the attempt to universalize the iconography of the face in these scales is betrayed by the necessity to choose defaults for the sake of efficiency and applicability.

Figure 71: Emoji skin-tone modifiers from macOS 10.15.4
© Apple, Inc.

The faces on these scales, however, exist in a unique space—both literally and figuratively. Whereas the work of an artist might sit in a museum or gallery, these faces are designed specifically for use in hospitals and doctors' offices, where a patient's condition must be evaluated quickly and efficiently. These faces mediate the transfer of a patient's pain levels to their caregiver—the patient projects their pain onto the faces and asks the caregiver to believe them. The caregiver then translates their understanding of pain—which they have already projected onto the scales as well—and decides if and how to treat the patient. Governing these projections are culturally conditioned understandings of what a pained individual's face looks like.

The cartoon-like aesthetic may be more recognizable or welcome by a young patient, but these tools are no different from the highly detailed medical illustrations one might find in a textbook. Physician and artist Ian Williams, founder of the "Graphics Medicine" website, writes (2015) about "official" versus "unofficial" medical iconography. The latter, he argues, opens up the opportunity for subjective interpretations full of "the raw veracity of lived experience" (129). The former, however, is a mechanism of a language "sanctioned by authority, peer reviewed, and packed with 'objective' and 'evidence-based' propositions" (129). Power, he argues, is exerted through these official avenues, reifying the normal/abnormal dichotomy and further defining what a sick person looks like.

Looking back at the graphic pain scales reviewed in this section, it is not difficult to recognize those pain tropes which represent normative pain expression: contorting the face, furrowing the brow, tears, opening the mouth. And while these tools are not meant as guides for the observer, but references for the subject—that is, an evaluator of pain should not be comparing a patient's face to the expressions on the scale—the subject is expected to use the representative faces as just that: a representation of their own pain. In fact, in their 2010 study on face-based pain scales, Tomlinson et al. note that the Wong-Baker FACES scale can problematize pain evaluation when "Children who do not cry with intense pain, especially older boys, may be reluctant to pick the face scored 10 of 10 because it shows tears" (1187). The authors of this study are expressing here a concern with the way that their subjects are being conditioned to limit their understanding of pain through a very specific visual representation of that pain (e.g., "If tears exist for a pain score of 10, and I do not cry, then I must not feel a 10").

Arrangement, illustrative quality, and number of steps are only a few of the ways that scale designers attempted to accommodate those needs which they felt most critical for their respective signs—specifically the relatability of the scales to the subject in order that the subject might better place themselves along the continuum of affect and measure their pain accordingly. Projective techniques featuring ambiguous figures with whom the subjects can identify provide broad applicability along with the promise of a more accurate picture of a subject's pain. But of what value was it to allow a subject to see themselves in the visuals? In the next section and beyond, I will look at the history of projective techniques, cited by Eland as critical to her work. Eventually, it will become clear that, aesthetically, the face-based pain scales—all of which cite Eland's unpublished thesis—bear no resemblance to Eland's inspiration, the Children's Apperception Test with its pictorial imagery and characters placed in highly suggestive social contexts. Still, the CAT and its predecessor, the Thematic Apperception Test, are worthy of our attention, as we prepare to unpack what sorts of cultural impact face-based pain scales might have.

Projective Techniques: Imagery and consciousness

Showing subjects imagery with limited or no explanation of a scene and asking them to fill in whatever blanks are left is considered a "projective technique" as originally coined by the psychologist Lawrence K. Frank in his 1939 essay, "Projective Methods for the Study of Personality." In it, Frank argues that understanding personality is a matter of individual evaluation, not something that can be done on a grand scale. He uses the so-called "hard" sciences—physics, biology, chemistry—as a metaphor, arguing that until the early 1900s, aggregate observation of a scenario was the only generally acceptable method: "with our traditional preoccupation with uniformities we have preferred to emphasize the uniformity of statistical aggregates of all activities as the real" (391).

By framing the uniform and aggregate in the pejorative, Frank rejects non-conformity as a deviation to be ignored—a phenomenon which he blames on an emphasis on the quantitative in science: "The need for quantitative data has led to the use of the culturally standardized, socially sanctioned norms of speech and belief and attitudes in and through which the individual has been asked to express his personality, as in questionnaires, inventories, rating scales, etc." (394). Instead, Frank suggests that the introduction of the concept of the "field" in the hard sciences—a recent turn at the time—should be adopted by psychology as well. "Instead of a whole that dominates the parts," he writes, "which have to be organized by some mysterious process into a whole, we begin to think of an aggregate of individuals which constitute, by their interaction, a field that operates to pattern these individuals" (396). Situating "culture" as the field and the individual subject as a specific molecule or chemical compound, Frank extends his metaphor to interrogate the "private world" of the subject—a world that is individualized by one's own experiences and interactions which are still influenced by necessary socialization. Projective methods, Frank eventually explains, are ways in which a researcher might be able to interrogate directly an individual's personality. This is done by presenting the subject with a field containing "objects, materials, experiences" (403) and asking them to organize those pieces. In doing so, a "projection" of the subject's private world comes into view for the researcher—one that, per Frank, would not be influenced by the biases of that researcher.

There is, in Frank's work and elsewhere, an undertone to projective methods of helping a researcher get to the "real" or "true" self of the subject. In *Research Methods in Social Relations* (1959), Selltiz et al., write that "the assumption is made that the individual's organization of the relatively unstructured stimulus situation is indicative of basic trends in his perception of the world and in his response to it" (280). That is, the subject's responses will provide their view of the world without that view being explicitly stated. To get to this implicit understanding, however, the researcher must have expertise allowing them to be capable of such interpretation—either via extensive training, a written guide, or a combination of the two, "interpreted in terms of some pre-established psychological conceptualization of what his responses to the specific test situation mean" (282).

Even then, the researcher's knowledge of the subject must be inferred from the subject's responses. In some cases, the technique might be used to validate personality sketches made externally to the test. Selltiz et al. cite a 1944 study by an anthropologist who used Rorschach tests to independently validate a psychoanalytic sketch of a population (1959, 284–5). And successful tests might also require the subject be kept in the dark about what the test is attempting to reveal for the researcher. In that case, a researcher could present the test under false pretenses and also include "neutral" material that would avoid tipping the subject off to the test's purpose (286). All of this is in the service of getting to the true personality of the subject: after all, “with the best intensions in the world, the subject may be unable to describe his feelings and attitudes as accurately as they may be discerned in the projective test situation” (Selltiz et al. 1961, 287).

Projective methods and specifically Selltiz et al.’s and Frank’s work were widely under discussion in the 1970s and played a role in Eland’s thesis. In the 1970s, Eland had a number of psychological tests from which to choose in selecting tools to use as a key to unlocking pain assessment in pediatric nursing. The Rorschach Test was the most widely used of the period, and artistic methods (i.e., subjects drawing, painting, or sculpting) had been introduced in child psychology and psychiatry well before this time. Her eventual choice was the Thematic Apperception Test. In the next sections, I will review the history, properties, and benefits of the Thematic Apperception Test and explain why it was a technique appropriate for the time and space in which Eland and other child pain researchers were working.

Pictorial Imagery in the Thematic Apperception Test

Eland adapted her cartoon animals directly from the Children’s Apperception Test, a modified version of the Thematic Apperception Test (TAT; Eland 1976, 16) developed originally by Christina Morgan and Henry Murray at the Harvard Psychological Clinic. The test, which went through a number of revisions until the still-in-use “Series D” was published in 1943, features a set of 10 standard and four “alternate” cards. On each card is an illustrated scenario depicting human characters in various scenarios (Morgan 2002). Patients or subjects are shown a card and asked to describe what is going on. In so doing, the thinking behind the test goes, subjects will reveal one or more significant details about their own personality to the researcher or clinician (Tomkins 1947).

Even though a number of comparable antecedents existed prior to the TAT’s publication—most notably, the Rorschach inkblot test—Silvan Tomkins suggests that the science was not “ready” for their consistent implementation (1947, 2). He goes as far back as Francis Galton’s self-administered free-association experiments from 1879 through to Louis Schwartz’s Social-Situation Picture Test, utilized at the Clinic for Juvenile Research in Detroit in the early 1930s. Beyond the enigmatic explanation about the readiness of science, Tomkins also notes that, in his experience, the TAT seemed to extract "stories suggestive of a very rich inner life" (12), especially when compared to the Rorschach—though he then hedges this argument, noting that he had seen the inverse occur as well.

Understanding the perceived benefit of the Rorschach over the TAT/CAT is important here as Eland—who references both—does not provide any clue as to why she chose the latter over the former. Leopold Bellak, the co-creator of the Children's Apperception Test, never explicitly states why his and Murray's tests might be chosen over the Rorschach, a test he notes is more popular than the TAT in 1953 (1975, 39). He does suggest, however, that the Rorschach may be more susceptible to unreasonable exaggeration—that is, taking a small shape on a presented card and building a grand narrative around it, or, in Bellak's word, "transform[ing it] into a confabulated whole, disregarding the actual configurations of the rest of the blot" (36). He eventually concludes that the two tests "can hardly be considered competitive or mutually exclusive techniques" (42) and that the Rorschach, better than any other test, demonstrates a subject's thought process.

Still, Eland chose the Children's Apperception Test, created by Bellak and his wife, Sonya, in 1949. Comprised of 10 illustrations of animals in various situations, the test was designed to help researchers or clinicians understand how a child relates to important figures and drives in their life. The authors list "oral problems," "sibling rivalry," "attitude toward parental figures," "oedipal complex" and other targets of psychoanalytic treatment in their description of what the test was designed to interrogate (Bellak 1975, 173). They argue that the use of animals for the illustrated figures will help children more readily identify with the subject matter—this, they claim, is based on previous psychoanalytic research (179), and so they employed the services of a children's book illustrator, Violet Lamont, for the original test.[4]

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[4] When a number of studies revealed that some children responded better to human figures, the Bellaks issued a human version, the CAT-H in 1965. As Eland never references it and chooses to implement an animal-based scale, the CAT-H is of little consequence to this work.

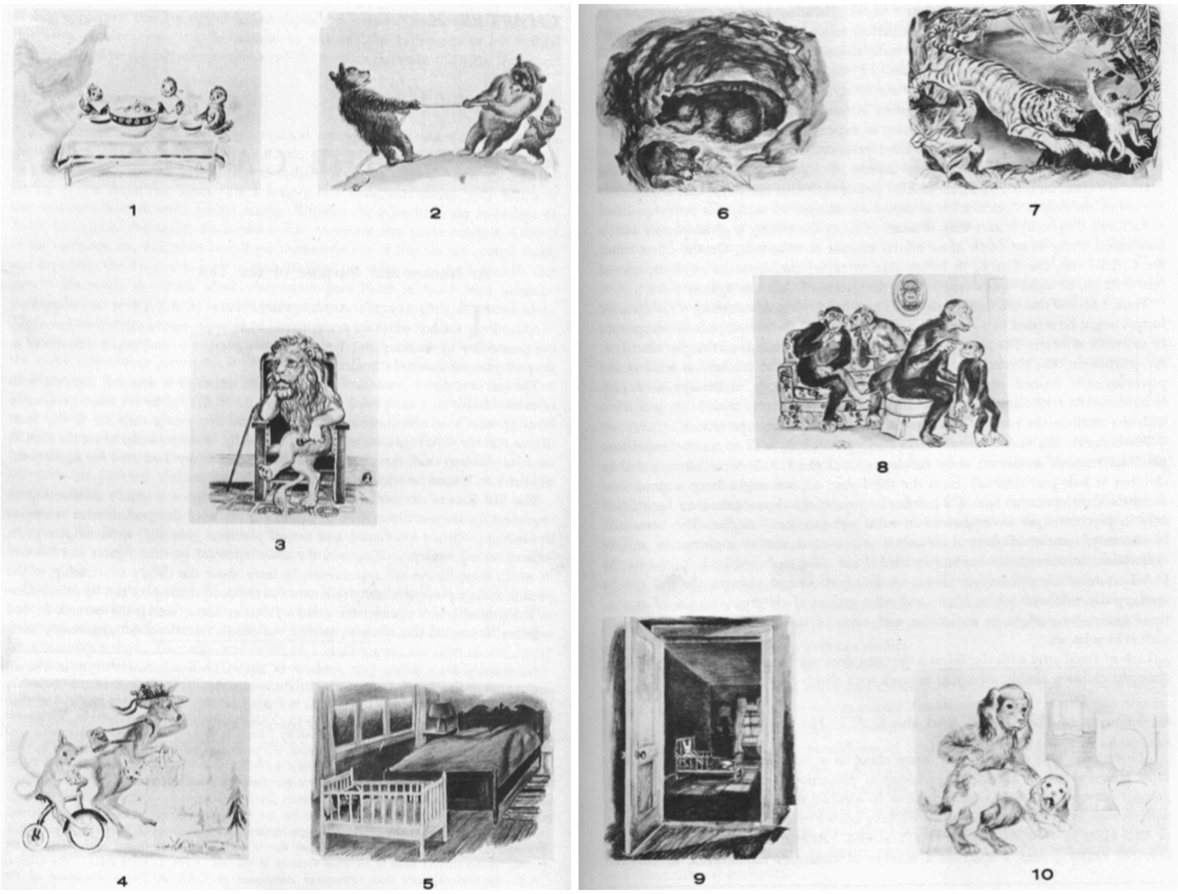

Figure 72: Children's Apperception Test
© L. Bellak

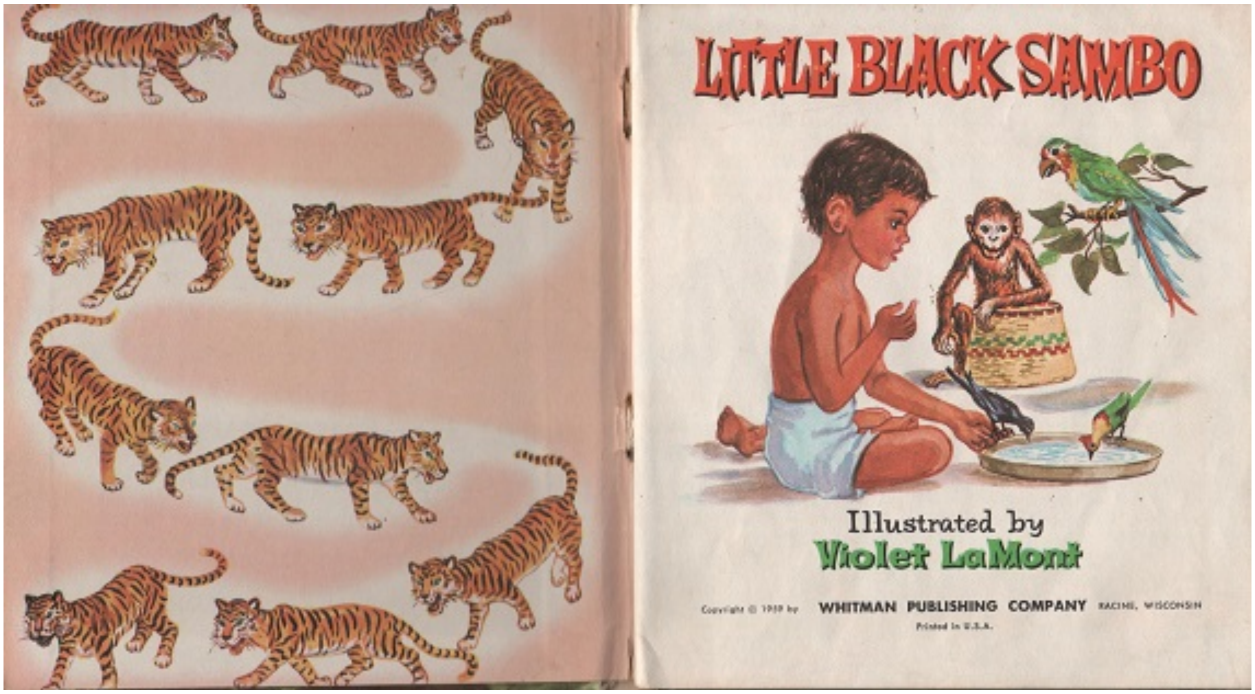

Figure 73: *Little Black Sambo,* illustrated by Violet LaMont (1959)
© Whitman Publishing Company

The Children's Apperception Test

The illustrations in the original CAT (Figure 72) are intricate and—as much as illustrations of monkeys in living rooms and bears in cribs can be—true to nature. Reviewing the pages from the 1959 edition of Little Black Sambo (Figure 73) also illustrated by Lamont, it is clear that the same artist worked on both. Specifically, note the similarities between the tigers on the endpaper of the book and those on Card 7 of the CAT: the styles of their stripes, general mannerisms, and the mischievous look on their faces all match. The monkey on the title page of the illustrated story sits in the same manner as the gossiping apes in Card 8, elbows bent, weight placed on the arms in a very human manner. The Children's Apperception Test animals exist in environments full of light and shadow. Some of the black and white cards convey an action scene, such as Card 7, wherein a tiger lunges at a monkey, claws extended. Most are generally lighthearted, featuring bears playing tug-of-war or a kangaroo jumping along on a windy day. Others, such as Card 10's father figure disciplining a young pup by placing him over his lap and spanking him, are sure to elicit more downcast narratives from the majority of subjects.

In most of the cards, the figures' faces are fully visible and drawn with great affect: the lion in Card 3 is quite clearly in a solemn mood, the gossiping monkeys in Card 8 are certainly enjoying themselves.

As I noted above, using animals was a technique chosen by the Bellaks for the sake of helping their young subjects better identify with the content on the cards. Leopold explains that children more readily form relationships with animals and that they could portray "smaller than adult" figures in a way that does not explicitly include adults in the scenario. He also points to the high occurrence of references to animals in Rorschach results with children, especially in younger age groups (1973, 179). Most important to our current investigation, however, comes from what Bellak calls "the technical standpoint of a projective test" (179), specifically that the animals, lacking in explicit sex, class, and ethnic identification, provide a "disguise" for the child. Some of this is evident in the cultural adaptations of the test, which require very few adjustments to the look of the characters: the gossiping monkeys of the Japanese version (Figure 74) are sitting on simple benches, low to the ground, instead of couches, but their bodies and faces go unchanged; in the Indian adaptation, the jumping kangaroo is the same kangaroo, but is no longer wearing a hat (Figure 75). "Since we deal with animal pictures," writes Bellak, "the test can be used equally well with white, black, and other groups of children" (176). Compare this to versions of the TAT where men and women change roles, skin colors are adjusted, and entire cards must be removed for their non-translatable qualities (Morgan 2002, 428).

Figure 74: Japanese version of the Children's Apperception Test
© Samiko Marui

Figure 75: Indian version of the Children's Apperception Test
© Uma Chowdhury

The detailed illustrations of the Thematic and Children's Apperception Tests stand in stark contrast to the pared-down face graphics of the Wong-Baker scale and its other line-drawn contemporaries. Speculating about the significant gap in visual fidelity between the two styles might take us down a number of paths. Firstly, we might revisit the do-it-yourself nature of the line-drawn diagrams in the first edition of *Our Bodies, Ourselves* (Figure 60) and consider them next to the more complex illustrations that came in later editions. Anatomies are understood by Lisa Jean Moore and Adele E. Clarke (herself a contributor to the 1990s versions of *Our Bodies, Ourselves*) to "matter to feminists and others because anatomies create shared images which become key elements in repertoires of bodily understanding toted around by all those who have seen them" (1995, 256). In their essay, "Clitoral Conventions and Transgressions: Graphic Representations in Anatomy Texts, c1900-1991," Moore and Clarke look at nearly two-dozen representations of female and male anatomy and consider the natural/social co-constructive ramifications of those images. As one example, they highlight the unique ways that labels are used in the anatomies depicted in the 1976 edition of *Our Bodies, Ourselves* (Figure 76) to "radically" expand and redefine the clitoris (277). Specifically, they place this diagram in contrast to the "Normalization, universalization, and simplification strategies" from other anatomic illustrations that have the effect of reinforcing difference. That is, by paring down diagrams to their simplest elements, there will be fewer opportunities for similarities. They argue, however, that feminist movements—they cite the Boston Women's Health Collective as well as the Federation of Feminist Women's Health Centers, the publishers of *New View of a Women's Body*—challenge this construction by specifically highlighting the complexity in female anatomies. In doing so, these complex representations reinforce sameness across general populations but individuality among each specific example. This includes the inherent anatomical similarities between the penis and clitoris (Moore and Clarke 1995, 280, 291). Applying Moore and Clarke's framing to our pain scales, we might recognize the (problematic) universalizing nature of simplistic line-drawings done at the service of reinforcing the differences between each step.

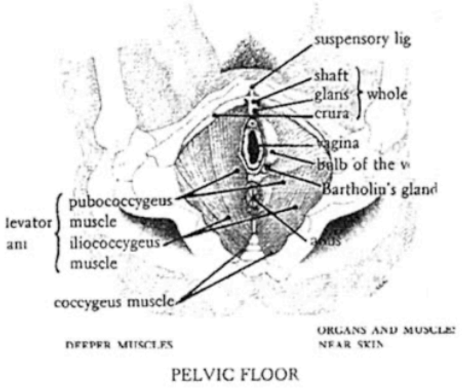

Figure 76: "PELVIC FLOOR" from Our Bodies, Ourselves (1976)
© Boston Women's Health Collective

Another way to think about the pared down scale illustrations as opposed to the complex drawings above, consider how Beyer's high production costs hampered her ability to distribute the Oucher widely (Beyer 2019). Further, we might also point to a problem that Eland identifies in her thesis: "The dog had short legs with no knees, short arms with no elbows, and a paw instead of a hand with fingers which made illustrating some of the children's situations very difficult" (49). In trying to relate to her subjects with an animal, Eland found she could not make the dog's body match her patients'. Rather than overcomplicating their illustrations, then, our scale inventors may have wanted to go the opposite route and over-simplify, removing opportunities for confusion. Still, a third possibility related to the practical implementation of the pain scales in clinical and research situations asks us to consider the pain scales in practice. Whereas the Thematic and Children's Apperception Tests were meant to inspire a narrative from their subjects—one that might be considered more valuable the more complicated it was—pain scales are used in scenarios where a singular, numerical answer is needed. Remember the "Reitman Pin-Man Test" cited by Alyea as inspiration for her simple line drawings. On that subject, D.A. Black writes,

> When all is said and done in the perennial argument over projective techniques, there is still one consideration which may yet do more than any other to put the projective test out of business, where psychological investigation is concerned. This is the simple economic factor of time. When it takes upwards of an hour to give a test, and another hour or two to mark and interpret, the psychologist in the field, under pressure to cope with increasing

> numbers of cases, looks always for more brief and objective measures. When they can do without them, most clinical psychologists will breathe a sigh of relief to discard the Rorschach, the T.A.T., and even the more systematic M.A.P.S. This is one reason for the Reitman meriting further attention—most subjects complete it in 5 minutes, and marking can be accomplished in 10. (1966, 285)

The simple line drawings of the pain scales do little to inspire similarly complex narratives, and this benefits the caretaker or researcher who must record and either act on or move on from the pain measurement. By paring down the details on the face scale, the designer signals to the viewer that their answer should be stark as well. This in turn reinforces the efficient nature of the scales and makes them even more valuable in medical and pharmaceutical fields demanding higher throughput of their practitioners in the same decades during which the scales' use proliferated. And yet these simple line drawings can still be understood as having material implications on the ways that the pained patient or study participant is heard, trusted, and treated. In the next section, I wish to return to the relationship between affect and the image and suggest that the efficiency, applicability, and validity promised by the face-based pain scales during their development in the latter part of the twentieth century creates a two-way street, simultaneously facilitating the communication of pain's qualities and conditioning our culturally mediated view of what pain looks like.

Pain and Empathy

Consider here the many and varied ways in which pain manifests itself, especially those moments during which an observer is presented with an opportunity for empathy. It is within these opportunities where the existence and experience of pain is transformed from a physical occurrence in the pained subject to an interpersonal message—what Anthony McCosker calls an "affective force" (2012, 2). McCosker, in "Pain Sense: Nociception, Affect and the Visual Encounter," conceptualizes the ways that the pained and pain-observing subjects act in relation to one another as part of an assemblage, wherein this affective force traverses through its different media: i.e., the face, the voice, a limp, etc.

McCosker leans on a combination of pain science and media theory to resolve the question of where an other's pain exists and how imagery of pain might affect its specific locale. He notes that Elaine

Scarry and Susan Sontag "lament the failure of language and image for the sufferer," while Judith Butler points to the photograph as able to "carry affect beyond the time and place of its production to achieve apprehension, and even recognition" (2). Susan Buck-Morss, however, extending Benjamin's argument that certain media can absorb the shock with which the modern urban media landscape attacks the subject, points to the synesthetic nature of modern media itself: able to traverse the visual and aural into the physical. The image of pain, then, is a synesthetic conduit through which to bond the patient and observer—a critical piece connecting parts of the assemblage otherwise considered disparate by a biomedical conceptualization of the autopoietic body (McCosker 3–5).

As a caregiver evaluates a subject's pain via the graphic pain scale, the patient's pain traverses a multitude of transactional points. First, the patient must feel the pain, a phenomenon understood by researchers today to be a result of the flow of signals (in the form of bursts of electricity) through specific neurotransmitters and receptors in a body's nervous system (Julius and Basbaum 2001). This begins with an initiation of the pain sensation—a needle, for example, inserted through the skin. The patient grimaces, pulls away, cries, makes an exclamation, or a combination of some or none of the above. Whether present at the time of injury or not, the caretaker attempts to understand the pain by looking at and listening to the patient. A graphic scale mediates this understanding and configures the caretaker's reference point. The observer acts or empathizes accordingly.

By arguing that the best way to mediate the transfer of the affective force of pain is through the image of the face, the designers of the scales discussed in this chapter are conditioning participants in the assemblage to concentrate on the face as the primary locus for this affect. And here, we might extend the image of the face to representing the body in general; any patient who has been asked to walk around an examination room while the caretaker observes their gait should understand the ways that the visible demonstration of pain is privileged in the biomedical context. This, in turn, diminishes the focus on non-bodily expressions of pain, thus erasing the possibility that the individual who does not visibly grimace or limp is not, in fact, in pain. By conditioning the subject and observer to relate pain back to the body, we are erasing the possibility that pain affect exists elsewhere within these assemblages. We do not, for instance, insist that a nurse watch an incision or injection before determining how many milligrams of painkiller to administer, nor that a doctor view photographic or videographic footage of a car crash to determine how much pain a patient might be feeling.

Affect, aesthetics, and empathy, then, are intricately intertwined. As Susan Schweik has argued in *Ugly Laws: Disability in Public* (2009), how an individual looks and acts have long been closely tied to the history of ensuring that normativity is reinforced in both de facto and de jure modes relating to the ways in which society is organized. Schweik's work provides a thorough account of individuals being banished from public spaces for not appearing normatively healthy. I suggest, however, that we might take the inverse of these ugly laws to consider how a normative expression of pain might be used against those who are unable or choose not to make their pain seen in the ways we have been conditioned to see it. That is, whereas bodies that *look* sick were once banished to the prison or sanitarium, bodies that do not look in pain are today treated with skepticism and distrust.

By conditioning the individual to look for observable pain in the body, neoliberal governmentalities further empower their citizens to police one another, making sure that those without a visible disability are not parking in the accessible spots, holding the welfare queen up as an abuser of systems for social support. Consider, for example, how the Oucher scale, effectively an index of pain in the face of children of varying ethnicities, mirrors the efforts of Galton and Bertillon to create photographic references for the perfectly shaped head or the face of a criminal. The Wong-Baker, Faces Pain Scale, or even the earlier, lesser known examples of the Children's Affective Pain Scale and Affective Faces Scale are all after the effect: acting as a visual reference which both subject and interrogator can reference as the former seeks to explain how they feel. The specific use of mouth shape, eye formation, tears, brow lines, and other affect-indicating facial contortions has a direct effect on what a patient's caretaker believes or what a lab researcher marks down.

By interrogating both the inspiration and implementation of face-based pain scales we can understand a contradiction native to methods of pain measurement which I have reviewed in this chapter: whereas the faces are designed to extract a "truth" from the subject, it is simultaneously projecting a truth *onto* those in pain. After all, on the one hand, progenitors of projective methods like the Thematic Apperception Test were after a subconscious admission of a feeling or personality trait. On the other, when we consider how facial and other bodily manifestations of pain become the primary indicator of someone's disability, it seems that the subconscious may not actually be the end-goal here. How might we resolve this embodied contradiction?

Situating this pursuit in the 1980s helps us do so. Not only does viewing the emergence of face-based pain scales during this time contextualize the work at the tail end of second wave feminist problematics regarding the role of the nurse, but it also reframes the efforts to measure one's pain in the context of Reagan-era neoliberalism. Remember from Chapter 1, Keith Wailoo's review of the Reagan administration's aggressive and vicious efforts to redefine disability away from—in the words of White House advisor Peter Ferrara—the "vague" definitions towards "medical grounds" (quoted in Wailoo 2014, 99). Regan-era regulations become even more pressing here as children are put to the test. The nurse, who is at the heart of our case study, is held accountable for the valid implementation of care by the laws and regulations of neoliberal austerity measures. Schweik argues that ugly laws "speak the language of regulatory care" (64)—and I would argue that face-based pain scales do the same. At once, they invite and gate-keep, asking patients to find a face with which to identify, to feel comfortable, only to insist that the performance of the declared state is commensurable with what our cultural understanding of that state should be.

Schweik uses Foucauldian understandings of discipline and punishment, positioning the target of ugly laws as a victim of a care/erasure dualism—simultaneously being told that those laws to remove them from the public eye are for their own good. Citing the French theorist's dichotomous description in *History of Sexuality, Volume I*, of the ways that the leper and the plague victim were excluded and surveilled, respectively, Schweik notes that "…paradoxically, as the mechanisms for 'altering' the 'diseased, maimed, and deformed' multiply and disperse across a society fully invested in the seemingly kindler and gentler medical disciplining of disability, the punitive 'branding' of the ugly 'leper' is left to stand alone, without mitigation, in the police codes" (67). In turn, I wish to use the same sort of framework, offering that the face-based pain scales construct another sort of dualism between providing care and demanding performativity. The projective technique provides for a “truth,” but the subject had better be able to back it up with their body.

Some of the scales reviewed here, such as the Wong-Baker FACES and the Faces Pain Scale-Revised, are still popular, thirty years after their introduction (Tomlinson et al. 2010). The former has been translated into over 50 languages and still sees widespread distribution. Others, for reasons related perhaps to the lack of effort on the part of their inventors, licensors, or distributors, are no longer utilized in clinical or research environments. But they all emerged at a time when the culture in which they were being introduced questioned not only the validity of the pain they were meant to measure, but also the occupation they were meant to aid. Claire Fagin was dean of the School of Nursing at the University of Pennsylvania in 1987 when she wrote that, “nursing seems threatened by the new restrictions women are placing on themselves or are being influenced to place on themselves by society” (121). The technology of the pain scales discussed in this chapter, like so many other technologies, was developed with care in mind, but ultimately makes demands of its users. The proliferation of the face-based scale came at a time when questioning the validity of one’s claimed disability was engrained in the core values of those providing care and welfare. Hospitals, increasingly privatizing under conglomerate healthcare providers, and under pressure from the government, prioritized speed, efficiency, and proof over what might have been an otherwise more caring governance. The faces on the scales played into this shift, conditioning our understanding of pain as present on the body, not something that might exist in an assemblage of affect and empathy.

In the conclusion to his 1994 work, *Picture Theory*, W.J.T. Mitchell argues that “there would be no meaning to the notion of ‘responsible representation’ if this were a tautology, if representations were automatically responsible, if responsibilities could be confirmed, affirmed by representations alone” (421). The authors and designers of the scales reviewed in this chapter were after representations that would responsibly facilitate the communication of pain levels between the in-pain and the caretaker. As

Mitchell points out, as soon as representation is the goal, responsibility is problematized. The case of the face-based pain scale so perfectly highlights the ramifications of privileging the visual in the name of the efficient, valid, and applicable. In the next chapter, I suggest that those are, perhaps, not the goals we should be striving towards if we are to conceptualize and create a pain scale that is, in fact, responsible.

Chapter 5: Conclusion

> "Given that pain hides behind the physiological gesture and the anatomical structure, the escape from perspective does not consist of renouncing what is most ours in order to adopt the point of view of God, but rather accepting the point of view of others." – Javier Moscoso, *Pain: A Cultural History* (2012)

In this dissertation, I have used the histories of three graphic pain scales to trace how pain has become a measurable, quantifiable, and classifiable quality. This shift—from representational to informational—has accompanied a concurrent emergence of graphic design within the medical fields, coalescing as a set of standardized graphical instruments. The project, whose main history begins in the middle of the twentieth century, but which also reaches back to visual examples from the end of the nineteenth, leans heavily on visual science and technology studies (Visual STS) to establish a framework of graphic medicine and graphic pain to which theories from disability studies and design studies contribute throughout. By building genealogical histories of each version of graphic scale—the Visual Analog Scale, the pain map, and the face-based pain scale—I have established that the graphic pain scale is an old tool layered with decades of socially, politically, and economically motivated decisions. Theories of the collective and the self, affect and empathy, inclusion and exclusion, representation and information, and pictures and graphics all work to demonstrate what sorts of material implications the decisions made in the design and implementation of each scale may have on the subject in pain.

In the first chapter, I began and ended with Foucault as I worked to establish what sorts of theories of power and control might best inform how the graphic pain scale works as a medical instrument. The primary history in this chapter was that of Henry Beecher's work to establish a twentieth century pain science that still informs the field in the beginning of the twenty-first. Beecher's research during, and after his time as a front-line doctor during World War II inspired major shifts in how pain was observed and tested in the subject. A simultaneous growth in the private pharmaceutical industry—thanks primarily to the invention of synthetic analgesics during the war—meant that large-n studies were both possible and required efficient, valid, and applicable testing. I supplemented this medico-scientific shift with a cultural one via the [re]emergence of *pathosfomel*, suggesting that the way we understand pain today is inherently transactional, based upon relationships between examiner and examined. The disabled person is established here as an exceptional case study—both as a body that is often considered an exception to normative design efforts and as an individual who provides the perfect foil to conceptualizations of the ways that pain "should" work.

My case studies work chronologically, albeit with a number of timeline overlaps, beginning with the Visual Analog Scale, a tool that was not used in pain medicine until the 1960s, but which has roots going back to the 1920s as the Graphic Rating Scale. The GRS, a tool developed for the rapid and reliable evaluation of students and workers, offered a perceived "freedom" to the evaluator by providing them with a nearly blank line upon which to rate an individual on any given metric. As the line was further stripped of its ornaments and graduations during its transformation into the Visual Analog (as opposed to "digital") Scale, the tool offered more possibilities to its users—no dots, notches, labels, or numerals offered any sort of guidance along the scale. Through Vivian Sobchack and Wassily Kandinsky, the line gains momentum and begins to shape the subject. Decisions are made, but the ramifications of them are unknown as only the examiner (or judge) can measure where the patient placed their mark, ultimately converting its location to numerical data. The VAS then empowers the pained patient by suggesting there are no set delineations of pain, only to apply those delineations on top of (and in defiance of) the patient's answer as soon as it is given.

Chapter 3 continues to find industrial roots in graphic pain scales, but this time that influence does not make its mark until half-way through the tool's history. In its earliest iterations, the body diagram or pain map demonstrates how a researcher or physician staked their claim to expertise by drawing on their subjects' bodies—either on the page or on the subject's actual skin. Emerging alongside a number of medical imaging technologies (including the x-ray and innovations in medical photography), the original pain maps were rarely generalized, often representing subjects in their "true to nature" state—that is, as portraits. By the middle of the twentieth century, however, the design of the pain map became highly simplified and universalized in an effort to challenge the subject's sincerity. Harold Palmer's attempts to classify his patients' pain as either physiological or psychological included pseudoscientific litmus tests wherein certain types of marks on the body diagram indicated one result or the other. Again, the examiner reinforces their expertise through the diagram. The body outline used by Palmer in 1949 strongly resembles body diagrams that were being drawn and distributed at the same time via the engineering and architecture industry. Thus, I theorize this scale design—still in use in the early twenty-first century—via the heavily influential anthropometric guides produced by Henry Dreyfuss Associates, used for decades to advise the dimensions and proportions of our built world. By using the language of drafting to draw their model humans, Joe and Josephine, HDA argued that the human body could be constructed to the specifications of a designer or engineer. By generalizing the body in pain in the service of "testing" our distrusted subject, I argue, the patient is implicated in reifying the examiner—analogous to the engineer—as expert.

Finally, the face-based pain scale moves from the blank slate of the body diagram to the heavily affected face of the child. Here, we see a theme that had been present, but not terribly explicit in the chapters preceding—neoliberal governmentality's heavy emphasis on efficiency at the service of austerity—percolating to the surface in the Regan administration and HMOs of the 1980s and 1990s. Here, we trace the relatively rapid development of graphic scales featuring photographed or illustrated faces back to the work of "the mother of pediatric pain management," Jo Eland (Turner 2016, 352). Eland's 1974 nursing master's thesis, "Children's Communication of Pain," is cited by nearly every paper which introduces a new face-based pediatric scale throughout the 1980s, 1990s, and into the 2000s. These scales were all developed by either practicing pediatric nurses themselves or researchers adjacent to that field. Eland cites the influence of the Children's Apperception Test, drawing a line from projective techniques in pediatric psychology—wherein children are asked to identify with and provide narratives to various cartoonish scenes—through to the ways that the affective force of pain might be visible on sparsely drawn faces. Eventually, I argue that the projective techniques and cartoon drawings were chosen, just as the bare VAS line and simple body diagram outline, for their universalizing properties. This is especially salient when contextualizing the role of the nurse at the end of second-wave feminism and beginning of neoliberal austerity. Focusing on the images themselves, I also argue that we might understand their possible effect on our overall cultural understanding of pain through the “ugly laws” that governed the disappearance, incarceration, and institutionalization of the disabled body throughout the West’s history.

Even though each of these scales came to the fore of pain medicine in vastly different socio-political environments, each one was predicated on the quantification and measurement of pain intensity or location at the service of three primary values: efficiency, validity, and applicability. Efficiency, understood as being able to accommodate high throughput, requires that the scales demand very little in terms of learning curve and steps to use. Thus, simplistic designs with few visual elements result in pared down graphics that emphasize utility over ornamentation. High throughput, however, does not prioritize the subject, as in the factory worker being watched from the catwalk by a manager with a clipboard and GRS-based evaluation form. Nor does it leave room for “the raw veracity of lived experiences” (Williams 2015, 129) that other forms of medical imagery might provide. Pain tropes are simplified and the numerical is prioritized in the service of validity.

Validity comes in the form of the numerical data produced by the scale’s use. As Ian Hacking (1990) and Theodore Porter (1986, 1996) have documented extensively, the cultural and medico-scientific reliance on statistical mechanisms to gain knowledge was long established before the emergence of the quantifying graphic pain scale. However, measuring pain in the ways that Henry Beecher proposed meant comparing sets of patient responses with one another. He writes (1959), “within-patient difference scores may display proper magnitudes even if the groups of patients to whom the drugs are administered are not quite comparable,” an expectation that “might be summarized as ‘validity’” (77–78). Numbers here act as the great equalizer and, visually, provide for both graphic interfaces for collection and presentation. Take, for instance, the “Three-dimensional graphical distribution of the reporting frequency of the cells” from Türp et al. (1998; Figure 77). Numbers provide opportunity for a universal baseline of comparison, even if that requires shaping all 200 of the subjects from Figure 77 into the same body.

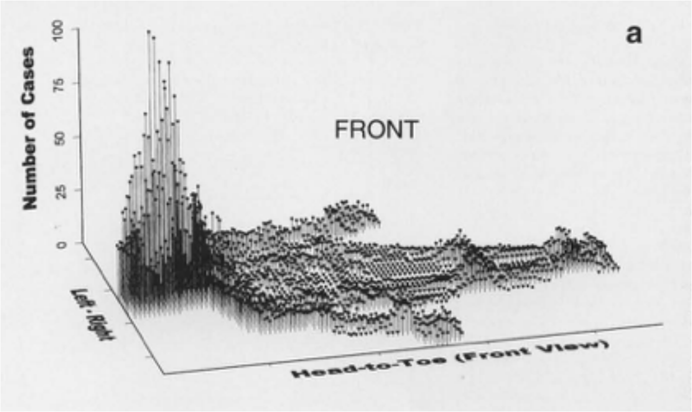

Figure 77: Three-dimensional graphical distribution of the reporting frequency of the cells (n = 200)."
from Türp et al. (1998)
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Universality is another common theme that problematizes the graphic pain scale and I wish to understand it here through the concept of applicability. That is, the designers of each scale promoted their intentions to be able to use the tool on as many patients as possible. Certainly a close cousin to efficiency, applicability also means stripping the tool down to its basic properties at the service of being usable by the most common bodies and experiences. Children's faces, then, are drawn in perfect circles without hair or any cosmetic marks. But these efforts to universalize for the sake of applicability also risk highlighting difference instead of similarities (Moore and Clarke 1995) or jettisoning the bodies at the margins that may not fit the design—to the great detriment of that body (Jain 2006).

In this final chapter, then, I wish to propose a way forward. In order to do this, I will first demonstrate how these three values—efficiency, validity, and applicability—serve inherently capitalist motives. In breaking down the scales this way, I will then be able to suggest the steps we might take to construct an anti-capitalist pain scale, one that foregrounds justice and equity instead. Before I delve into this analysis, however, I would like to take a moment and share some of my own experiences as someone living with a chronic and painful condition, one which falls under the umbrella of Ehlers-Danlos Syndromes (EDS). Unlike a disease, which is regarded as a more or less singular condition with a distinct etiology, a syndrome is in itself highly plural, characterized by a distinctive grouping of on-going symptoms. Until quite recently, EDS was considered a single condition, a syndrome characterized by hypermobility and general tissue fragility. Today, it is classified as not just one, but a group of syndromes comprised of thirteen subtypes. The syndromes that make up EDS vary in specific and overlapping combinations of symptoms and characterizations, and are responded to with a variety of testing protocols, from phenotypical to molecular/genetic ("What Are the Ehlers-Danlos Syndromes?"). By infusing my personal narrative into this work at its conclusion, I hope to make more concrete the implications of the pained subject's experience with pain scales.

My Pain

In the middle of writing this dissertation, my first child was born. He arrived six and a half weeks early, which meant for the first weeks of his life he was rather underweight. He quickly caught up, however, and I, accordingly, had to figure out how to be as present as possible in helping with caring for him alongside my wife. This took a physical toll on my body. My lower spine fell out of alignment on a relatively regular basis (i.e., every few weeks) in the months after he came home. Due to my particular type of Ehlers-Danlos Syndrome, my ligamentous structures are weak. My muscles have to step in to support my joints. These overworked muscles give out on occasion, severely diminishing my ability to stand straight, lift objects of any meaningful weight, and walk quickly. After one episode, my wife asked that I see a doctor. I was hesitant; there is not much to be done in the way of treatment for an EDS body. I felt awful for being unable to attend to our child as often as she needed and I wanted, however, and so I called my student health center.

The receptionist on the phone asked me the question I knew I would hear: What is my pain on a scale of 1 to 10? After I noted that the pain was spiking to a 9, she would not make me an appointment, but instead told me to go straight to an urgent care center. At urgent care, I was given a shot of ibuprofen in the backside and sent on my way. When the pain returned soon after, I was able to negotiate an appointment with a nurse practitioner at the student health center. They authorized a referral for a chiropractic specialist (official diagnosis: "chronic bilateral low back pain without sciatica").

This was a typical experience for me, both as a sufferer of chronic pain and as an American. Navigating the health insurance system in this country has always required that I go through incremental steps to "prove" my pain, each one including the same inquiry: "on a scale of one to ten…" My official diagnosis, "lower back pain," means that the physical therapist at my chiropractor must spend most of his time focused on that area, even as my pain radiates through my upper spine, neck, hips, and knees. He readily admits that each part is connected: "When one area loosens up another has to step in to do the extra work that your ligaments cannot." But if he were to write in his report about treating my neck, I might not receive the necessary insurance coverage.

Anyone who has worked on a long writing project knows that it becomes very easy to see their own work in their daily lives. But from my first step into the chiropractor's offices I recognized how the history of the tools elucidated in the preceding chapters guide how specialists discuss my pain. When I am asked to quantify my pain, I want to spend time explaining how it is inconsistent and extremely relative to the day or time. But the rote manner in which I am asked "one to ten?" is representative of the impatience I will encounter upon responding with anything outside a single unidimensional and quantitative value. My physical therapist is shocked to learn of my age: Surely someone bent at the hip without the ability to tie his own shoes cannot be so young. The body diagram on my internally used chart is hastily marked on the posterior lower back, corresponding to the insurance-legible diagnosis. I come home from my appointments and explain to my wife, "this is what I'm writing about!" But I am left wondering, what would I prefer? How would I, a pained subject, rather express my pain in a way that the receptionist, nurse practitioner, doctor, physical therapist, and insurance representative can also find legible to their specific needs? The answers to those questions are only valuable and valid when taken into consideration as part of a communal effort towards a new type of pain scale. The next sections explore how that might happen.

Capitalist Pain Scales

Above, I unpacked three properties common to the arguments supporting the design and implementation of three of the most widely used graphic pain scales: efficiency, validity, and applicability. It is not difficult to make connections between the design and implementation of the scales covered in the preceding chapters and their market-based implications. The pharmaceutical industry relies heavily on large-n studies, for instance. Having scales that can be used quickly and across large groups is partly a matter of staying true to assertions, such as those based in Henry Beecher's work, about the subjective qualities of pain (discussed in Chapter 4). But they are also a means of representing cost-control measures on the side of corporate actors. As elucidated in both the chapter on face-based scales and my own personal narrative, direct lines can be drawn as well between the implementation and use of scales and the motives of and decisions made by insurance companies regarding coverage.

Considering how the graphic pain scales used today are structurally coupled to capitalism in a variety of ways, however, allows us to realize how difficult it would be to uncouple said scales. That is, in taking on the project of redesigning the pain scale, if we are not acutely aware of these structural ties, we will simply reify them in their next iteration. Using Marx as a guide to the foundations of capitalism, I will make it clear that, in considering what a more just and equitable graphic pain scale might look like, we must adopt an anti-capitalist lens, the properties of which I will establish in the section following.

Given the scales which have proliferated since the middle of the twentieth century, I suggest that the three qualities of widely used scales that I summarize above represent the most valuable to the pain measurement and treatment process. What is "value" here, however? Marx defined value as the amount of "socially necessary labor time" required to create a commodity. In this case, I want to consider the laborer to be the subject whose pain is being measured and the measurement itself as the commodity. In that sense, the scales aid in the production of the measurement/commodity, but without the work of the pained individual to translate their felt experiences to the parameters of the presented scale, there is no value in said measurement. David Harvey, whose *Companion to Marx's Capital* (2018) I will be using to read Marx throughout this chapter, notes that for the philosopher, "Value is 'abstract human labour…objectified…or materialized' in the commodity" (21). Within a measurement, the pain expressed by the subject is objectified and made valuable to the researcher or caretaker. recall Elaine Scarry's argument that the expression of pain is also the objectification of that pain (Scarry 1985, 13).

Let us then unpack each of the three aforementioned properties and how they must be understood as manifestations of capitalist motives towards value. As we do, it is important to remember that Marx was, at his core, a materialist. As such, much of his writing was about the material conditions of factory commodity production in the nineteenth century, certainly a far cry from the twentieth century examination room. The transposition from laborer-machine-commodity to patient-scale-measurement is not perfect. Harvey notes that "Marx declares that his aim is to uncover the rules of operation of a capitalist mode of production" (2018, 27). I propose to test the rules of graphic pain scales, a process that will demonstrate their participation in medicine as a capitalist mode of production. The current mode of pain measurement, I will show, is inherently capitalist.

Efficiency

In Chapter 1, I noted how the large-n studies initiated by Beecher's research were the sorts of events that would have an effect on what Bowker and Star call "the situated temporal biography of the patient" (2000, 168). In the chapters that followed, I was able to demonstrate a sort of genealogy of research—wherein one design begat another and so on. Take, for instance, the Affective Faces Scale (McGrath et al. 1984), cited by Bieri et al. (1990) in the development of their Face Pain Scale which, in turn, was updated by Hicks et al. (2001). Each of the studies supporting the development and implementation of these scales used sets of data that influenced the development and implementation of the scale's next iteration. This chain effect is not just about medical knowledge transfer but also about the graphic design of pain scales, a history that is oriented around and also shows the chain of impact that the biographies of many thousands of patients have had upon one another over many decades. In the McGrath-Bieri-Hicks (et al.) scenario listed above, for instance, across only three published papers, with a total of 759 subjects, were involved in the research.

Marx explains that the industrial factory was arranged with worker cooperation in mind, not thanks to any altruistic ideals by capitalists around the ways that workers should interact, but with efficiency as the top priority. Summarizing Marx, Harvey writes, "Productivity and efficiency depend not on the individual worker but on the proper organization of the collective work" (2018, 180). If we consider patients or subjects as laborers who produce measurement data, then we might understand the sought-after efficiency of the scales as an indication and perhaps even a measure of the ways that the capitalist class organized workers for cooperative action. By designing scales with efficiency as a primary goal, the originators of these tools were producing what we might call scalar subjects, subjects constituted according to the needs of a given study (e.g., migraine abatement as a result of a specific analgesic) or medical practice (e.g., back-pain treatment at the expense of an HMO). These scalar subjects are in effect laborers in that they produce a commodity, in this case pain data, in what Harvey calls "the cooperative regime of the production space" (179). The individual laborer, the subject in pain, is blended with their "co-laborers" (medical professionals, technicians) in our ever more efficient scales as they move toward a culture of data as commodity.

Validity

Remember my proposal in Chapter 1 that, when read alongside Elaine Scarry's *The Body in Pain*, the scale represents graphically the ways that pain is, by its nature, transactional. Validity, determined by comparable data across multiple subjects or patients (Beecher 1959, 78), is a stand-in for the believability of the pain being communicated. In other words, the question being asked is not only "does the scale help the researcher or caretaker understand how much pain the subject is in," but also "is the pain real." Should the subject come to the examiner and withhold their measurement, they are, in effect, withholding access. Citing Harvey, N. Katherine Hayles (2010) writes that, "in late capitalism, durable goods yield pride of place to information. A Significant difference between information and durable goods is replicability. Information is not a conserved quantity. If I give you information, you have it and I do too. With information, the constraining factor separating the haves from the have-nots is not so much possession as access" (39). Understanding the pain scales as informational throughout this dissertation allows us here to recognize how the laborer—the subject in pain—is forced to provide access to their pain in order to be believed or trusted. Marx suggests that technology and the machine devalued the laborer by supplanting the socially necessary time to produce through skill. The scale, by demanding access for the examiner, devalues the subject by precluding them from withholding information. How might our new scales work if they were to center the patient as primary stakeholder, rather than the examiner?

Applicability

Finally, I propose to show how applicability is a core capitalist value built into pain scales. I indicate how the work (i.e., data) extracted from our unwittingly cooperative pained laborers, who have now been effectively sidestepped, is recursively redistributed as broadly as possible. Made evident by the wide range of fields to which the VAS has been applied (see Chapter 2), the generalized body of the pain map (see Chapter 3), and the efforts to test a pediatric pain scale with adults (see Chapter 4), scales are designed with widespread applicability in mind. Applicability might be understood as an extension of both pain scale efficiency and the commodity-like qualities of the measurements themselves.

Harvey states that the act of exchange "presupposes that all commodities have something in common that makes them comparable and commensurable" (Harvey 2018, 27). Laborers, our workers in the pain-scale process that produces measurement as reproducible pain data, are de-individualized by the measurement process itself, which I have proposed to be precisely an "act of exchange." Pain is compared to pain. For the data to become valuable, the system requires accumulation of data sets, which may be classified and compared. It is not hard to imagine that the measured pain of two different individuals would be difficult to compare, but this goes for the pain of a single subject measured multiple times as well—the sheer complexity of the full-length McGill Pain Questionnaire (Figure 78) is indicative of the multitude of possibilities when it comes to a single description of pain. In taking a humanist view to how designers have approached the design of pain scales, as Elizabeth Guffey suggests we do (2018, 4; see

Chapter 1), we can highlight the capitalist drive to reach as many individuals with as little effort as possible.

What Does Your Pain Feel Like?

Some of the words I will read to you describe your present pain. Tell me which words best describe it. Leave out any word-group that is not suitable. Use only a single word in each appropriate group--the one that applies best.

1	2	3	4
1 Flickering	1 Jumping	1 Pricking	1 Sharp
2 Quivering	2 Flashing	2 Boring	2 Cutting
3 Pulsing	3 Shooting	3 Drilling	3 Lacerating
4 Throbbing		4 Stabbing	
5 Beating		5 Lancinating	
6 Pounding			

5	6	7	8
1 Pinching	1 Tugging	1 Hot	1 Tingling
2 Pressing	2 Pulling	2 Burning	2 Itchy
3 Gnawing	3 Wrenching	3 Scalding	3 Smarting
4 Cramping		4 Searing	4 Stinging
5 Crushing			

9	10	11	12
1 Dull	1 Tender	1 Tiring	1 Sickening
2 Sore	2 Taut	2 Exhausting	2 Suffocating
3 Hurting	3 Rasping		
4 Aching	4 Splitting		
5 Heavy			

13	14	15	16
1 Fearful	1 Punishing	1 Wretched	1 Annoying
2 Frightful	2 Gruelling	2 Blinding	2 Troublesome
3 Terrifying	3 Cruel		3 Miserable
	4 Vicious		4 Intense
	5 Killing		5 Unbearable

17	18	19	20
1 Spreading	1 Tight	1 Cool	1 Nagging
2 Radiating	2 Numb	2 Cold	2 Nauseating
3 Penetrating	3 Drawing	3 Freezing	3 Agonizing
4 Piercing	4 Squeezing		4 Dreadful
	5 Tearing		5 Torturing

Figure 78: McGill Pain Questionnaire from Melzack (1975)
© Ronald Melzack

For Marx, the commodity is the material manifestation of exchange value. “What makes [the commodity] exchangeable must be something else, and that something else is discoverable only when the commodity is being exchanged” (Harvey 2018, 19). In Chapter 1 I raised the question: For whom is pain measurement performed? I asked who the exchange of pain measurements benefits and spent the next three chapters tracing each scale’s history in order to demonstrate how the design of a pain scale affects those in pain. In doing so, it should be readily apparent that those two individuals—the beneficiary of pain measurements and the individual in pain—may be the same, but are never necessarily so. That is to say, when we share our pain, we are not always doing so at the service of feeling better. There are a multitude of stakeholders along the way who will take that measurement and use it to extract as much value of it as possible. This value might be financial—a pharmaceutical company or insurance company. Or it may be in the name of learning about a condition or disease for further knowledge production. Perhaps it is in aid of training a new nurse or physician.

Regardless, the histories and analyses in the preceding three chapters document how the extraction of our pain data is done via the visual interface—it is not a purely informational transaction. Rather, it is mediated via a graphic tool purported to facilitate the representation of what we feel. The mechanics involved in extracting our labor/data are graphically designed and, as such, deserve a redesign. What I propose next is an approach to designing the next pain scales that incorporates anti-capitalist methodologies. In the next section, I will outline three concepts that Erik Olin Wright puts forward as "the bases for the formation of collective actors" (2019, 127): identities, interests, and values. Those concepts alone will not lead to the design of an anti-capitalist pain scale, but establishing all three as foundational bases upon which to develop our methodology may point us in the right direction.

Anti-Capitalist Pain Scales

Having established that the graphic scales in widespread use today are inseparable from capitalist motives and touching upon the myriad ways that can be damaging to the user-as-patient, I now turn my attention to the question of the ways in which we might construct a tool that does not center efficiency, validity, and applicability. In short, I propose that we work towards an anti-capitalist pain scale. I turn to Erik Olin Wright's *How to Be an Anticapitalist in the 21st Century* (2019) for its coherence and accessibility. Wright's specific goal for this work was to answer quickly and as simply as possible the question of the way to enact an alternative to capitalism (xi).

Simply put does not mean simply enacted, of course, and Wright's answer to the question is not easily implemented. Still, he proposes a variety of possibilities when it comes to eroding capitalism: resisting, escaping, taming, and dismantling, eventually revealing that it will take a combination of a few or all of these in order to make real change happen from both the top-down and bottom-up. "The pivotal logic of eroding capitalism," he writes, "is that these changes in the rules of the game from above can expand the space for building alternatives to capitalist economic relations from below in ways that, over time, encroach on the dominance of capitalism" (120–21). He goes on to explain that collective action will be essential to this encroachment.

Thinking about collective action in the context of the individual pain patient may seem paradoxical. But these are structural changes that we will attempt to take on with our new pain scales. Wright's framework is predicated on a solidarity that works towards the structural in the name of the individual. Wright lays down three concepts as the foundation to this methodology: identities, interests, and values. In what follows, I will unpack each of these concepts in the context of our project at hand, hopefully laying the groundwork for approaches to designing for disability that put anti-capitalist solidarity at the fore.

Identities

As Wright makes clear, identities are both foundational to solidarity movements and highly complex to define. Their nebulous nature, however, provides opportunity for solidarity as it forces us to suss out not just the defining features of our bonding identity, but the words we want to use to describe it. Description of our current condition, after all, is so tightly bound to the design of the scales discussed throughout this book, scales that seek to supplement words ("I hurt a lot," "it's in my lower back") and numbers with imagery. Given the necessarily transactional nature of graphic pain scales, it would follow that our collective might be heavily defined by the ways that our pain is understood by those performing the measurements. On the other hand, it may be a primary goal of the collective to reclaim our identity through, among other actions, the design of a new scale.

Still, if we are to consider that our collective identity can be, at least at the outset, defined by how our pain is understood and treated, then we cannot ignore the intersectional considerations that must be made. By now commonplace in discussions of identity politics, the concept of intersectionality was originally developed by legal scholar Kimberlé Crenshaw (1990) as she was trying to describe the problematics involved in deciding discrimination lawsuits wherein the plaintiffs were black women and the law only provided protection along singular racial or gender-based vectors. My aforementioned physical therapist was refreshingly honest when he told me that I looked like I could be "perfectly healthy"; often, physicians take a quick look at my seemingly able body and simply tell me I am not in need of treatment. As a white male, my experience pales in comparison to the systemic biases affecting women and people of color and, taking Crenshaw's work into consideration, the compounded misdiagnoses and lack of trust in black women presenting with pain (see Hoffman et al, 2016 and Ruau et al, 2012).

Our collective of pained subjects is a complex and amorphous one. There will be overlaps, exclusions, and contestations. As Wright argues, this is especially valuable to the construction of an emancipatory movement: "…social structures are characterized by multiple forms of intersecting inequality, domination, exclusion and exploitation. These generate experiences of real harms in the lives of people—disrespect, deprivations, disempowerment, bodily insecurity and abuse. These experiences get transformed into shared identities through cultural interpretations, which, of course, are themselves objects of contestation" (128–29). Contestation, in turn, provides the space for productive movement building. Disability studies provides insight into the ways that identity labels shape discourse, even via the contestation of the term "disability studies" itself. Alison Kafer, Robert McRuer, and Carrie Sandahl have all made important contributions to the how and why around the term "crip" versus "disability". Kafer, citing the other two, notes that "disability studies and crip theory differ in orientation and aim: crip theory is more contestatory than disability studies, more willing to explore the potential risks and exclusions of identity politics while simultaneously and 'perhaps paradoxically' recognizing 'the generative role identity has played in the disability rights movement" (Kafer 2013, 15). McRuer specifically uses the term "flamboyant defiance," illustrating the way that "crip" and "queer" are similarly reclaimed by a marginalized community in the name of discomforting the normative. It is this "normal" that is explored by the differentiation of "person first" versus "identity first" language within the disability community as well. Jim Sinclair (1999), one of the earliest to write about this distinction, notes that "Nobody objects to using adjectives to refer to characteristics of a person that are considered positive or neutral." That is, referring to a disabled person as "a person with a disability" suggests that the disability is something to be overcome or sympathized, further promoting the so-called "medical model," wherein the body can be adjusted to fit a society unwilling to accommodate the non-normative.

Contestation without alienation or silencing any one individual is critical. Incorporating the lessons from disability studies' struggles to define and label the self, then, would strongly inform the sorts of identity building necessary to move forward with our project. Following Wright's recommendations, if determining the labels and language around the varied intricacies of assembling an anti-capitalist collective to design our new pain scale helps us define who is being represented by this new tool, we must next consider the "what" of the scale's implementation or, in other words, the interests and values of the collective.

Interests & Values

For Wright, "interests refer to things that would make a person's life go better along some dimension important to that person" (129), while values represent "the beliefs people hold about what is good, both in terms of how people should behave in the world and how our social institutions should function" (131). Both interests and values, then, relate to the motivation to seek change and deciding what change to seek, but the former represents the individualized and the latter a more global or universalized view. Wright suggests that interests help triage what can or should be attempted, while values provide a higher-level guidance and motivation. For our project, it will become critical to determine the goals to which our collective energy should be spent—that is, what should our new pain scale actually do? Of course, to declare here what the interests and values of our collective movement towards an anti-capitalist pain scale should be would be to defeat the purpose of the collective to begin with. Instead, I want to explore a number of critiques regarding the way that disabled voices have been erased from previous efforts to design and develop tools for the disabled. By understanding how interests and values may be incorporated or excluded in our efforts, we can hopefully avoid making the same mistakes made by these sorts of projects.

For better or worse, there are many examples of designs for accessibility and disability that have failed, and I will not be able to review each one here. Instead, I want to build on the work done by disability design thinkers in recent years who have recognized and written about patterns within the practical output (that is, as opposed to purely theoretical work) of the field. To begin with, Ashley Shew (2019) has written about technoableism, a certain kind of techno-optimism that looks to overcome the body through technological innovation. This sort of approach reinforces the "medical model" of disability.

Liz Jackson has identified a similarly techno-fetishist movement that she has termed the "Disability Dongle" in blog posts and on Twitter. Specifically, she notes that "A Disability Dongle is a well-intended elegant, yet useless solution to a problem we never knew we had" (2019, para 1). Jackson suggests that Disability Dongles are often the product of the sorts of work done in the design academy and high-end design consultancy firms (she gives the example of IDEO, one of whose founders is the originator of the "design thinking" movement[1]). Here we see a dangerous combination of ignoring the interests and values of the disabled community while also adhering to what the technology critic and historian of science Evgeny Morozov has termed "solutionism" (see Morozov 2013). By assuming at the outset that technology provides the answer, before even fully understanding what problem will be considered or how it might be framed, solutionists infuse the process with their own interests and values, irrespective of the community for whom the problem may be front and center. Here, too, we find twenty-first century examples of the sort of research done by Henry Dreyfuss Associates when otherwise non-disabled individuals wore prosthetics in the name of knowing how the amputee felt (Serlin 2006, 62). As an alternative, these designers might consider speaking directly with amputees or, better yet, hiring them (Nario-Redmond et al. 2017).

Finally, though perhaps most widely recognized both within and outside of the design community, Universal Design is an approach that, while seemingly predicated on inclusivity, may be a sort of Disability Dongle-enabling framework. Universal Design is a term coined by disabled architect Ronald Mace in pre-ADA 1985 as a response to the "retrofit" approach taken by designers and architects who would design for the normative body and then adjust where necessary for specific accessibility

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1. Typically neoliberal and marginalizing in nature, design thinking is a movement wherein the methodologies of the traditional design studio are applied to any sort of "problem". These processes may include creative brainstorming techniques, low-fidelity prototyping, and role-playing activities. By embracing the values of the traditional design studio as well, design thinking reifies the market-based capitalist thinking that governs who is considered a user, etc.

needs, for example, by fitting a building with an awkwardly placed or inconvenient ramp in addition to its main staircase. In recent years, as Universal Design has received attention through mainstream and popular design discourse (see, for example, Hall 2018), it has simultaneously been recognized by disability design scholars as not serving its original goals. Whereas Mace, who passed in 1990, suggested that designing environments that were accessible to "every" user would accommodate both disabled and non-disabled bodies, it eventually became clear how complex and difficult it is to suss out who "everyone" is (Hamraie 2017, 11).

Critically, what disability design scholar Aimi Hamraie calls "the niche marketization of disability" (2017, 240) has led to a disability design movement that has been coopted by marketing departments in the name of selling more products. She writes of journalists and manufacturers who "used slick and insubstantial language, characterizing accessibility as one of the hottest markets for the immediate future. … The language of Universal Design itself became flexible in the post-ADA world as it grew to capitalize on rights discourses, market trends, and new legal landscapes. An inevitable outcome of this flexibility was that the language of accessibility became a neoliberal commodity" (211–12). Hamraie traces the history not only of Universal Design as a marketing tactic, but also introduces what they call "critical access studies," the interrogation of access as something that is socially situated and constructed. They suggest that "access-knowledge," the specific arrangement of knowledge and making through which the world has been built since the late-twentieth century (5), is a phenomenon that might help us better understand the accessibly built world as constructed from varied perspectives. This concept—that the individuals designing the world come from different backgrounds—is not in itself groundbreaking. But where Hamraie's work is so important is the assertion that it is concepts such as Universal Design, frameworks put forth as overarching philosophies to be followed in every design by every designer for every user, which leave significant space for interpretation. Within that interpretation we find, to borrow an example from Elizabeth Guffey, curb cuts that accommodate mobility aids, but which have rubber grooves that catch and destabilize wayfinding tools for the blind, negating the use of certain devices, and certain travelers, as they attempt to traverse areas of the sidewalk designed to be "universally accessible" (Guffey forthcoming).

All of these approaches to disability design are inspired by or contain an element of "cripwashing," a term coined by Melania Moscoso Pérez (2016) as a way to describe using one access-enabling feature to conceal other inaccessible features of a design and larger societal detriments. Take, for instance, the major corporate bank with a long history of injustices and illegal dealings (see Mattera 2020) boasting of its accessibility features ("Accessibility | Wells Fargo"). When design for accessibility becomes a checkmark, then ramps are present but inaccessible. This is exactly what Cassandra Hartblay, a cultural anthropologist, found when she spoke with disabled individuals in Petrozavodsk, Russia: ramps that were too steep, ramps that had large lips at their base that were not traversable by many assistive devices, ramps that left no room for maneuvering into or out of a building, and more (Hartblay 2017; Figure 79). She aligns with Hamraie's "access-knowledge" (Hamraie 2018, 5) when she writes: "Asking about ramps and paying attention to how people talked about them offered an opportunity to theorize access as a global discourse, a design practice with specific local implications, and a normative concept that people with disabilities use to describe the nexus of public infrastructure, mobility, and social participation in their daily lives" (Hartblay 2017, 10). Setting standards, she eventually argues, still leaves significant room for interpretation—a space within which designers can represent, reify, or combat centralized hierarchies and personal moral systems.

Figure 79: “A ramp in front of a neighborhood grocery store in Petrozavodsk, Russia."
from Hartblay (2017)
Photo © Cassandra Hartblay

Scholars working through questions of identity, interests, and values in the disability and disability design communities make calls for collaborative efforts that include input, if not complete control of a process by the constituencies for whom it is being pursued. The field of design is ripe for this sort of collaboration not only during the inquiry phase, but also in the material steps taken to envision and make real the output of a project. The next section, then, focuses on a number of frameworks for collaborative, pluralist, and justice-focused design methodologies that would provide important guidance to designing our new pain scales.

Design Justice and Transition Design

There are countless design frameworks available for us as we consider how our collective might move forward with conceptualizing, visualizing, producing, and implementing our new anti-capitalist pain scale. If you think back to the previous chapters, however, you may have noted that while there was mention of hiring professional illustrators for some of the projects (Wong-Baker, for instance), there was never mention of collaboration with traditional designers or design firms. Perhaps this is due to the fact that our youngest pain scale example is already 30 years old. It was neither common practice nor financially feasible to hire a professional designer at the time that these projects were initiated.

But the reach of the design field is much further today. There are more designers,[2] more design firms, and more post-secondary design programs at the time of this writing. Whereas a celebrity designer in the 1960s would be known for an iconic poster (see, for instance Milton Glaser's *Dylan* (Figure 80)) designers today are more commonly (willingly?) forward about their work on system-level projects. For example, IDEO prides itself on having helped Bank of America develop a program to round up their customers' debit charges and put the difference into their savings accounts (Garza 2017; Figure 81). David Kelley, the firm's founder, is also known for promoting "design thinking," a deliberately named framework for problem solving that Cameron Tonkinwise has called "primarily 'design for non-designers'" (2011, 534). The fanfare surrounding Stanford's "d.school," a business curriculum that may be described as ostensibly masquerading as a design program, indicates the academy's propensity to be colonized by the sheen of the design moniker.

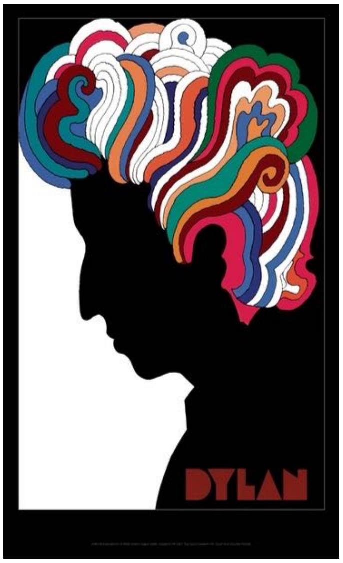

Figure 80: *Dylan Reproduction* by Milton Glaser (2008)
© Milton Glaser

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[2] In 1990, there was no formally designated "graphic design" industry. However, per the Bureau of Labor Statistics, in 1990 the number of "Designers, Except Interior" across all industries was estimated to be 31,710. By May 2019, "Graphic Designers" was its own category (not including self-employed) and listed at 215,930. For Occupational Employment Statistics 1988–1995 see https://www.bls.gov/oes/estimates_88_95.htm. For 2019 data, see https://www.bls.gov/oes/current/oes271024.htm

Figure 81: Keep the Change by IDEO from Garza (2017)
© Bank of America

If we are going to design an anti-capitalist pain scale, we need to find frameworks that are not inherently tied to capitalist structures such as the design studio and, increasingly, the design academy. In the following, I bring together a number of design frameworks that will provide the general guidance to our new pain scale's collective designers. As with the previous section, I do this not for the sake of proscribing what the output should look like or how it should operate, but as a way to ensure the process stays focused on the practices necessary to create a just and inclusive tool.

Of the sources referenced in this chapter, certainly the most tactical is Sasha Costanza-Chock's *Design Justice: Community-Led Practice to Build the Worlds We Need* (2020). The author cautions that the book "is not a how-to manual" (29) but breaks down a design justice framework into chapters on values, practices, narratives, sites, and pedagogies. Costanza-Chock explains, "Design justice urges us to (1) consider how design (affordances and disaffordances, objects and environments, services, systems, and processes) distributes both penalty and privileges to individuals based on their location within the matrix of domination and (2) attend to the ways that this operates at various scales" (Costanza-Chock 2020, 20). The most important takeaway from Costanza-Chock's book for the project at hand is that for design initiatives to be just, it is necessary that the individuals participating in—if not leading—the project must also be those for whom the output is being designed. This goes well beyond a "user-centered" or" human-centered" design practice that asks constituents to come to a round-table discussion or focus-group or be the subject of an observation by the "real" designers on the team.

Certainly, this raises questions of expertise and imagines perhaps a design field that is not professionalized in the manner we see it today—and that is no accident on my part. Per the design-focused career site, Coroflot ("Industrial Design salaries"), only 19% of designers in the United States are women. According to the U.S. Bureau of Labor and Statistics, commercial and industrial design jobs are highly concentrated in major metropolitan areas such as New York and San Francisco, as well as industry-driven locales such as automobile-centric Detroit and its surrounding metros ("Commercial and Industrial Designers"). And in 2014, the American Institute of Graphic Artists noted that around 86% of professional designers identify as Caucasian ("Diversity & Inclusion in Design"). Design professionalization is exercised before a designer can even join a studio—both in the academy and beyond, through unpaid or low paying internships. As Costanza Chock writes, "particular insights about the nature of power, oppression, and resistance come from those who occupy subjugated standpoints" (22)—these insights will go forever unrecognized if the design field cannot readily welcome those individuals in a manner that goes beyond a study subject or interviewee.

In her chapter on design practices, Costanza-Chock notes that design justice practitioners can differentiate themselves from traditional designers by working in solidarity with and amplifying the voices of communities and community-based organizations. She provides the example of Sins Invalid, a performance collective dedicated to disability justice, especially for individuals who identify as queer or trans and people of color. Costanza-Chock specifically points to Sins Invalid's intersectional principles and how they enable an inherently anti-capitalist politic within the group.

Sins Invalid is not a design organization. It is important here to consider, however, the performative nature of pain and the ways in which the in-pained subject is expected to act in order to convince their interrogator that they do or do not hurt a certain way. As historian Javier Moscoso writes, "For those who are in pain, the probability that their experience will be culturally meaningful increases depending on whether it can be imitated or represented" (2012, 8). In this sense, Sins Invalid has a liberating effect on the experiences of both the disabled individuals participating in their performances, as well as the audiences watching, thanks to the emphasis on representation.

Obviously, the performances of Sins Invalid can at best inform the politics of a new pain scale, though cannot provide much in the way of specific design and usability. As a bridge between the performative and the concrete object, I point to the work of Krzysztof Wodiczko, the Polish designer and artist who sees many of the objects he creates as “special performative instruments” (1999, xiv). His *Homeless Vehicle* (1988) is an over-sized shopping cart with an expandable sleeping capsule on top. It includes space to store belongings and cans that the user has collected, as well as rearview mirrors, emergency signals, and a hazard orange flag high enough to be seen above traffic. Wodiczko conceptualized the piece soon after he arrived in America for the first time, shocked to find countless numbers of individuals sleeping on the streets of the cities in the richest country in the world.

The vehicle itself was not intended to be a mass-market product. But the artist worked directly with homeless individuals in New York City and Philadelphia to design and test the piece. Wodiczko readily acknowledges that he probably could have gone further to incorporate the community for whom he was designing—perhaps by even hiring underhoused or underemployed individuals to help him construct the piece:

> Both parties will have to play roles in the design and production of future versions of the vehicle, with continued adaptations in the design made in response to the survival needs of users and additional strategies devised by designers. Though such a collaborative relationship may sound unlikely or even impossible, it is the key to the project’s success. Only through such cooperation can the vehicle function usefully. Direct participation of users in the construction of the vehicle is the key to developing a vehicle that belongs to its users, rather than merely being appropriated by them. (1999, 82)

Wodiczko notes that the piece is not put forth as a finished product but as a starting point or catalyst for discourse. Therein lies a seeming paradox in proposing projects like this: the piece should not be produced if it can’t be done the “right” way, but does that stop the idea from coming to fruition to begin with? This is a struggle that Costanza-Chock recognizes in the conclusion to her work, arguing that ”if resource constraints become an excuse to avoid examining the root of the problem area, then designers will almost always end up, at best, providing Band-Aids for deep wounds and, at worst, actively serving existing power structures” (219). Where might we look, then, to see how design justice or adjacent frameworks have been implemented?

Costanza-Chock cites Arturo Escobar's *Designs for the pluriverse: radical interdependence, autonomy, and the making of worlds*, a 2018 work that pulls heavily from the traditions and philosophies of indigenous peoples in the Global South in order to consider what a design methodology inspired by degrowth and postdevelopment[3] movements might look like. Two concepts he explains are particularly salient for our current project: transition discourses and Buen Vivir. The former, which Escobar argues go back to the 1970s and Ivan Illich's visions of a convivial—as opposed to industrial—society, take as a basic tenet the recognition that "the contemporary ecological and social crises are inseparable from the model of social life that has become dominant over the past few centuries" (139). The transition discourse helps us move past this model—be it labeled neoliberalism, modernity, capitalism, or the like—by encouraging us to "step outside existing institutional and epistemic boundaries" (139).

When considering the anti-capitalist pain scale, there is no question that we must step outside those assumptions which have shaped the design and proliferation of the scales we have at our disposal today: the efficiency to reach as many patients in as little time as necessary, a validity that only "objective" representations allow for, and widespread applicability in order to serve the bulk of the population in the middle of the bell curve. This is where the Andean concept of Buen Vivir becomes helpful as a way to conceptualize life beyond the market. "Buen Vivir," writes Escobar (148), "subordinates economic objectives to the criteria of human dignity, social justice, and ecology." Ratified into the Ecuadorian and Bolivian constitutions in the late 2000s, Buen Vivir guides cultural, social, and infrastructural decisions by the recognition that nature is a separate constituent, one that is allowing humans to exist on its land and in its air, neither of which can be owned by people (Gudynas 2011).

Transition discourses and Buen Vivir are both critical elements to transition design—a term for projects that look to make major cultural shifts. Primarily, the work being done in the name of transition design is predicated on the goal of averting or, at the very least, delaying total ecological collapse—for

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[3] Per Escobar, "While the age to come is described in the North as being postgrowth, postmaterialist, posteconomic, postcapitalist, and posthuman, for the South it is expressed in terms of being postdevelopment, nonliberal, postcapitalist/noncapitalist, biocentric, and postextractivist" (140).

instance, the Transition Town Initiative in southern England is applying the framework to compile a concrete plan to move beyond fossil fuels.[4] For our purposes, however, it might act as a guiding principle for our new pain scale as we envision one driven not by how efficiently it can be implemented, but by who owns what. Transition design is particularly helpful here as it requires that we situate our work in the commons, a place for the self-governance of resources. Javier Moscoso argues, "those who express their pain make it, in accordance with learned rhetorical forms, at the same time patent and public" (7). Given this inevitable public-making, shouldn't the decisions regarding how it is measured be done somewhere other than the research lab, design studio, or medical school?

The implementation of a commons-based, transition-ushering design process will not be easy, and Escobar makes no allusions to the contrary:

> While each social group, or socionatural assemblage, needs to broach this process out of its own resources and historical circumstances, no single social formation has the complete onto-epsitemic architecture necessary to deal with the hydra of global capitalism, as the Zapatista call it. In some instances, designers can build on, and help catalyze, the emergent transitions in their own locations through situated transition design practices. (203)

Looping back to Costanza-Chock, then, we must ensure that every participant in our design process is not only a direct stakeholder, but someone who is ready to acknowledge how their perspective will affect the output. For instance, to say "we must work with people who experience pain" opens us up to including nearly every human on earth in our process. By beginning with the guiding principles from the previous section—identity, interests, and values—we can hopefully inspire a transition discourse that moves beyond conventional biomedical definitions of "in pain." Is our pain scale designed for widespread quantification of subjective experiences, or does it consider what an individual's relationship to their pain might be in that moment? As I have made reference to throughout the book, "to classify is human," and to quantify is no different. But what other sorts of human behaviors can supplement or accompany the classification and quantification in order to make the pain measurement experience more humane?

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[4] See https://transitionnetwork.org/

The Glitch

Both Costanza-Chock and Escobar leave space towards the end of their respective works to address the "what about…" questions. Costanza-Chock argues that pragmatics can only get us so far when we are trying to tackle power structures that are "not only unjust but also steadily leading humanity down an unsustainable path that ends in planetary ecological collapse and species death" (219). Escobar addresses possible objections in a bit more granular manner, addressing issues of modernity, the university, and more. In one section, "Rationality, Technoscience, and the Real," the author envisions his reader asking, "Is technoscience even partially adaptable or reversible, as all transition narratives implicitly assume?" (211), eventually acknowledging that if we only consider relational living from the theoretical perspective, we have failed—we must eventually shift "to the terrain of practice" (213). In the previous section, I attempted to provide a number of "real world" examples that might help us understand a path towards the practical from the theoretical, especially in the context of overcoming capitalist structures of thought and production. I have not, however, done very much in the way of recognizing and addressing the question posed by Escobar's theoretical reader: *is technoscience adaptable?*

Javier Moscoso is rather clear in his recognition that biomedicine is at least partially in a dichotomous relationship to the subjective experience of the patient. "The scientific and cultural colonization of harmful experience—the entrance of the clinical gaze into the sphere of subjectivity—neither obeyed nor can be explained through a teleological sequence which made the medicine of pain the logical conclusion of the entire suffering of humanity" (210). The idea that biomedical and technoscience has "colonized" the experience of the subject is fascinating and complex, though not something I will be unpacking here. Still, I have indicated throughout this book that a cultural preference for perceived objectivity—be it inspired by capital, science, or the relationship between the two—has played a significant role in the design and implementation of pain scales that have material implications on the experience and subjectivity of the pained patient.

No matter how smooth a line may be or how many variations of a body may be presented on a pain map, a boundary must be set. This boundary might be spatial, requiring that a specific area of the body be marked before treatment can be approved. Or it might be purely quantitative, guiding the approval of a pharmaceutical based on the collective values from a VAS-based pain study. But if our new pain scale is to be just and inclusive while still accommodating our human intuition to classify and quantify, we must recognize the amorphous properties of pain—that is, pain as a multidimensional spectrum. Remember back to Chapter 2, the Visual Analog Scale is so-named in an attempt to differentiate it from digital scales—not electronic, but discrete and explicitly delineated—even as the eventual take-away for a researcher or caretaker is inherently discrete. I cited Elizabeth Wilson: "When relatedness…between digital and analog…is obstructed, there is a high price to pay" (108). In the three chapters that precede, I have demonstrated how problematic the pained body is to these discrete measurement systems—all of which attempt to obstruct the relatedness between the digital and the analog.

The first decade and a half of the twenty-first century saw the emergence of the so-called "glitch" aesthetic among artists who use digital media in their work. Part found-art, part deliberate manipulation of already-existing works, the glitch movement consisted of artists, designers, and performers putting on display what might otherwise be considered mistakes, bugs, or corrupt files (Figure 82 and Figure 83). As a stand-alone aesthetic movement, glitch feels rather shallow; there are only so many versions of static-infused imagery you can observe before they all start looking the same. As a cultural critique, however, the glitch provides an important mechanism with which to break through the digital/analog dichotomy.

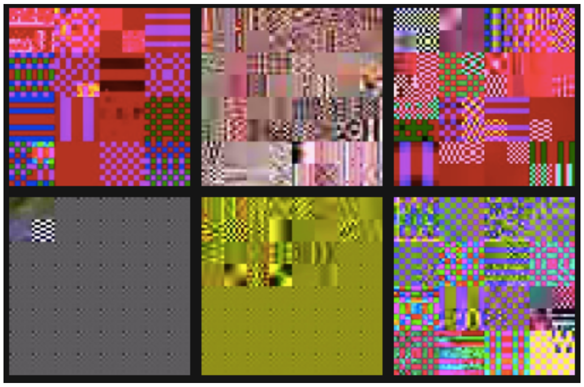

Figure 82: "Macroblock Study (64x64 pixel selections)"
by Phillip Stearns (2012)
© Phillip Stearns

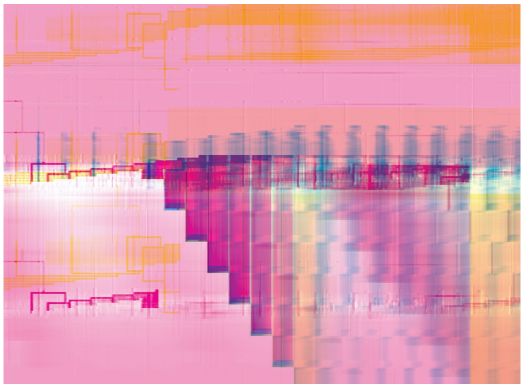

Figure 83: "Glitchometry #20"
by Daniel Temkin (2012)
© Daniel Temkin

Art critic Legacy Russell has put forth the glitch as a "a much-needed erratum" in an otherwise discomfort-averse society. She has coined the term Glitch Feminism to describe a movement that embraces a slippage out of and back into the normative (she points to the Yiddish etymological roots of the word glitch). "A Glitch Feminist acknowledges the value of visuality, and the revolutionary role that digital practice has in expanding the construction, deconstruction, and re-presentation of the female-identifying corpus" (Russell 2012, para 10). The glitch, she argues, facilitates and encourages slippage beyond and through the stereotypical.

For our purposes, I want to consider the ways that the glitch literally interrupts the orderly nature of binary or discrete systems and thinking. In order to do so, I put forth three examples of my own projects that explicitly react to the ways that digital systems organize and classify our bodies. These works, some of which were done in collaboration with other artists, were all inspired by my own experiences with chronic pain and illness. None of the pieces were explicitly done in the name of "glitch art," but all take into consideration the sorts of slippage that Russell writes about and imbue the visual output with both the cultural and aesthetic properties of glitch.

Firstly, *Find Your Fit* (2016–ongoing; Figure 84 and Figure 85)[5] is an interactive and multimodal experience that uses the proprietary and encrypted translation algorithms built into the Fitbit self-tracking device to visualize a participant's movement. Fitbits and similarly engineered activity trackers use digital accelerometers that sense movement, interpolating it into various biometrics such as steps taken or calories burned. These metrics are transmitted via encrypted hexadecimal values to software on a PC or smartphone, which then transmits the data to a company's servers. When a user logs in to their "dashboard," they are presented with the data as interpreted by the company's proprietary algorithms, as useful information. *Find Your Fit* intercepts this biometric data before it is uploaded to Fitbit's servers, uses it in its raw form—sets of base-16 numbers—and arranges it in a way that any computer might understand as a bitmap image. While the resulting images are "true" to the data, there is no way to reverse engineer them and, say, control what colors appear based on how you move: the translation algorithm is proprietary and encrypting—every image made by *Find Your Fit* will be different.

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[5] See https://utopia-dystopia.com/#/a-find-your-fit/

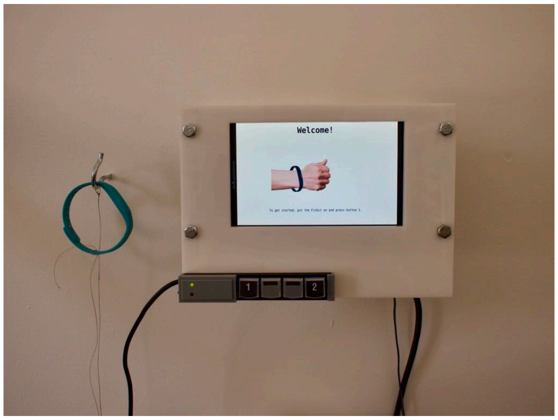

Figure 84: Gallery photo of *Find Your Fit*
by Gabriel Schaffzin (2016–ongoing)
© Gabriel Schaffzin

Figure 85: Gallery photo of *Find Your Fit*
by Gabriel Schaffzin (2016–ongoing)
© Gabriel Schaffzin

The second piece is *The Dr. Powel Norway Dream Machine* (2016–2017; Figure 86 and Figure 87; in collaboration with Sofie Hodara and Zachary Kaiser),[6] a hybrid performance/exhibition which was installed at both UC San Diego and the Crane Arts Icebox Project Space in Philadelphia. The work tells of a fictional figure from the mid-19th century, Dr. Pawel Norway, who experimented with illustrating the dream content of his subjects using physiological data. *The Dr. Pawel Norway Dream Machine* is a reconstruction of these experiments adapted for both contemporary technologies as well as the gallery setting. The Dream Machine transforms user's biometric data into unique video compositions, which are

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[6] See http://cultureindustry.club/pndm/

then projected into the public space of the gallery. Gathered in the privacy of the three custom Data Confessionals, or while the subject lays on a physician's examination table in front of a live audience, the biometric data is used to gather personalized videos from Twitter—which we, albeit ironically, suggest is a dynamic archive of the collective unconscious, producing visual artifacts that embody the most popular symbols and metaphors of our times.

Figure 86: Performance photo of *The Dr. Pawel Norway Dream Machine*
by Sofie Hodara, Zachary Kaiser, and Gabriel Schaffzin (2016–2017)
Artwork © with the artists
Photo © calit2

Figure 87: Gallery photo of *The Dr. Pawel Norway Dream Machine* by
Sofie Hodara, Zachary Kaiser, and Gabriel Schaffzin (2016–2017)
Artwork © with the artists
Photo © Sofie Hodara

Finally, in February 2019, I exhibited *Pen to Paper* (Figure 88 and Figure 89),[7] another interactive piece that takes on what it means to be understood by binary/digital systems. Inspired heavily

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[7] See https://utopia-dystopia.com/#/a-pen-to-paper/

by my research into Henry Dreyfuss and his firm's work (see Chapter 3), *Pen to Paper* asks subjects to submit anthropometric data via photographic capture, and thus implicate them in the deconstruction and recontextualization of the human body. Using a combination of computer vision and machine learning, along with the relatively antiquated pen plotter, this work argues that projects such as Henry Dreyfuss's *Measure of Man* fetishize an aesthetic governed and proliferated by a small group of standards-making organizations.

Figure 88: Process photo of *Pen to Paper*
by Gabriel Schaffzin (2019)
© Gabriel Schaffzin

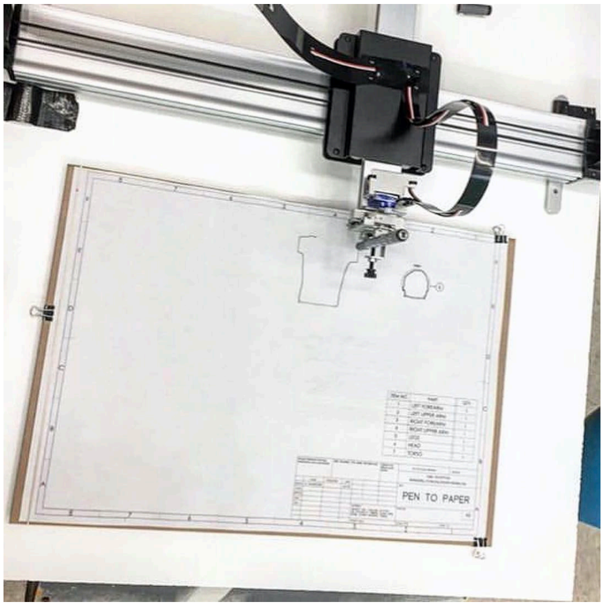

Figure 89: Process photo of *Pen to Paper*
by Gabriel Schaffzin (2019)
© Gabriel Schaffzin

All three of these pieces take on the analog-to-digital translations necessary to make systems of organization, classification, and quantification work—even those that were put in place long before the widespread proliferation of the consumer devices and technologies utilized in the projects. In *Find Your*

Fit, we might understand the byte data making up your daily activities in the same way that the Visual Analog Scale guides the conversion of affective information—that is, levels of pain between “none” and “worst ever“—into statistical data. The *Dream Machine*’s algorithms, which use programmed associations to turn heart-rate or brain-wave data into imagery might be understood as a reverse-engineering of the face-based pain scale, wherein the reaction on a child’s face is catalogued and turned into a quantity of pain. And the rigid, sometimes absurdly detected outlines of our subjects’ figures in *Pen to Paper* (Figure 90) stand in for the unintelligible pain that must still be drawn and evaluated for “validity” on the body diagram. Across all three projects, my user/viewers wanted to know if it was “real”—if what they were seeing was a true translation from the data. The answer was always the same: “none of the data used in these projects is fabricated or pre-arranged, but what do you mean by ‘real’ and why, in the first place, do you want it?”

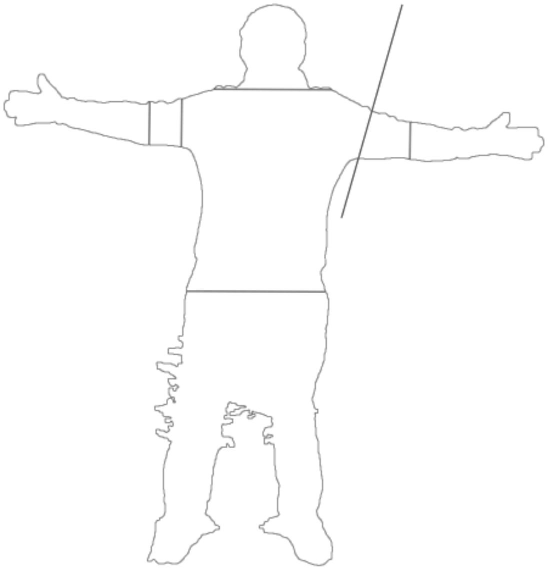

Figure 90: Intermediary output from *Pen to Paper* by Gabriel Schaffzin (2019)
© Gabriel Schaffzin

Throughout, the glitch, the slipping between analog and digital states, the erratum that disrupts otherwise tightly designed systems of evaluation, quantification, and classification, is brought to the fore in order to ask my viewer/user to take pause and look beyond the smooth sheen of the well-designed device or tool. Moscoso again:

> The relationship between pain and consciousness depends on the most sophisticated form of conviction—certainty—that vindicates the most ancient form of correspondence—truth. In a similar way, it is also necessary that the realm of scientific knowledge, which pretends to have the monopoly of truth, claim for itself the universe of certainties, not through mechanisms of objectification, but through the appropriation of the patient's testimony. (2012, 170)

In these works, I attempt to break the spell of technoscientific certainty and biomedical conviction. As Russell writes, "The glitch is the catalyst, not the error" (2012, para 5). The goal now becomes: can we, the collective, design a pain scale that avoids the "appropriation of the patient's testimony"? Can we impart a catalyst where others might see breakage?

AFTERWORD

Optimism of the Will

"Given that pain hides behind the physiological gesture and the anatomical structure, the escape from perspective does not consist of renouncing what is most ours in order to adopt the point of view of God, but rather accepting the point of view of others" (Moscoso 2012, 110). I chose this line from Moscoso for the epigraph to the concluding chapter because it perfectly captures the ineffability of what I feel on a daily basis. Most people in my life want to know what my pain feels like, how bad it is, what can be done to fix it. Waking up on a daily basis, unsure of the ways in which the past week's actions will manifest themselves in my joints or ligaments, wary of which of my steps during the day will be the next catalyst for the necessity to walk with a limp or wear a back brace—this is what the pain feels like. The actual shocks through my nervous system brought on by a pinched nerve or overused muscle, they are simply something else to overcome, a reason to hold my son differently or look for the ramp or elevator when the stairs are going to be too much.

When I step into a physician's office and am shown a pain scale or body diagram, I recognize the social, political, and economic considerations embedded within. I hope that the combination of histories and theories I have presented in this work bring you a similar awareness to the material implications of graphic pain scale design decisions on the subject in pain. There are, to be sure, much larger questions to be addressed before a wholesale change to the measurement of pain can be enacted. The political economy of healthcare, the marginalization of disabled individuals, how the quantifiable is privileged over alternatives, the pharmaceutical industry—all of these are built into the ways that pain scales are designed and implemented. Moving beyond inherently capitalist pain scales will take reimagining these and so many more deep-seeded cultural norms.

As I write this conclusion to the first full draft of my dissertation, I am "sheltering-in-place" due to the rapidly spreading coronavirus pandemic. It is entirely unclear what the world will look like on the other side of this. State surveillance apparatuses are ramping up (McDonald 2020) as disabled bodies are being offered as sacrifices in the name of herd immunity ("NICE publishes first rapid COVID-19 guidelines") and making room for the non-disabled at hospitals (Jones 2020). Famously, Antonio Gramsci wrote, "pessimism of the intellect, optimism of the will" (Antonini 2019). As an historian, I find inspiration for both my pessimism and optimism in this work—the former because of level to which our current situation is ingrained in immovable institutions, the latter because of the speed with which our collective understanding or approach can change.

Sometimes, being an historian means seeing the longer game. It has only been 30 years since the signing into law of the Americans with Disability Act, but it has also already been 30 years. Ask any disability rights activist and they will tell you that not enough has been done in the way of actually implementing and enforcing the ADA. Businesses use financial impact as a justification to avoid upgrading their space to be truly accessible (Anderson n.d.),[1] no doubt leaning on statistical data that supports a cost-benefit analysis. Perhaps, however, the current crisis will bring out the humanist in more individuals. Maybe the academy will fill up with students who want to ensure that the sort of cruelty they saw exercised leading up to and during the pandemic does not happen again. These will be the individuals ready to build anti-capitalist collectives that re-center the subject as the primary stakeholder in a more just and equitable system.

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1. Per attorney Matt Anderson: "a business must only bring its premises into compliance when 'readily achievable' to do so. The ADA defines readily achievable as easily accomplishable and able to be carried out without much difficulty or expense (relative to the size of the business)" (Anderson n.d.).

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