Visible
Language
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Factors Affecting Interpretation of Diagnostic Images as a Decision Process: Ecological Psychology, Visual Heuristics, and Design

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This article presents an empirical investigation into interpreters' decision-making criteria, personality characteristics, and emotion-laden experiences as factors affecting interpretation of images that were created for diagnostic assessment. Specifically, it seeks to examine (1) heuristic strategies as interpretive tools, which are both cognitive and experience-based, (2) the relationship between the decision criteria and accuracy of the judgments, and (3) the relationship between interpreters' experiences of abuse as victims and the judgments about the meaning of images. The study used a sample of 196 self-representational drawings created by college students and 60 independent interpreters who were asked to identify drawings that were created by individuals who experienced interpersonal abuse.

This study identified six visual heuristics that were reported independently by 60 percent of the interpreters and were associated with marginally higher accuracy of the interpretive judgments. Thirty-eight percent of participants reported making judgments about the meaning of drawings based on direct or secondhand experiences with interpersonal abuse. The study found that the trauma of interpersonal abuse can profoundly bias interpretive judgments. This result has been particularly robust among female interpreters. Women who self-identified as survivors of abuse saw indicators of abuse up to 90 percent of the time, whereas male interpreters who have been abused saw indicators of abuse up to 65 percent of the time, whether or not those purported indicators were correct. Implications of the findings for design are discussed.

An overarching goal of this article is to address interpretation of images as a decision process. The study situated the factors affecting interpretation of images within the framework of the naturalistic/ecological psychology (Brunswik, 1952, 1955) and the fast and frugal heuristic model of decision-making (Gigerenzer, 2007) vis-à-vis a model of conscious and nonconscious information processing. This study also recognized that certain personality characteristics and emotion-laden experiences can influence the quality of interpretive judgments. The frameworks, methods, and findings from psychology have been used with an intent to inform future research and practice of image construction and interpretation in visual studies and design.

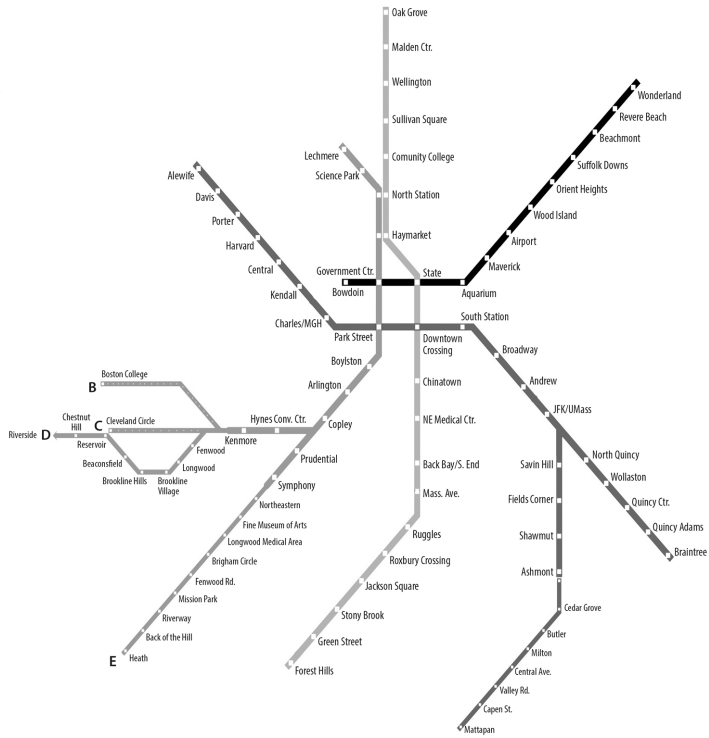
One limitation of this study is that it relied on participants' introspection and reflection on the decision process. There is a risk, then, that interpreters' explanations of how they arrived with judgments were translations rather than representations of the decision process. Even though this study has not cracked the black box of meaning-making inside the mind, it offers an analytical framework for studies of visual interpretation as a decision process that combines cognitive, personality, and experiential factors as influencing the quality of interpretations. The article translates the findings of the study into practical guidelines for applications in visual communication design and human-centered design research and practice.

Introduction

The fundamental expectation of visual communication design is to construct artifacts that different users can interpret as having the same meaning or function. The reliability of visual communications in evoking replicable interpretations is particularly important in risk-laden information domains such as way-finding, severe weather warning systems, complex machinery operations, medical disciplines, and so forth. In such high-stakes situations, interpretation is not the end goal but an essential means to guide judgments, decisions, and actions (Dreyfus, 1980; Frutiger, 1978; Neurath, 1936; Patton et al., 2015). Subway information systems are a prime example of such use in information design (see Figure 1).

Figure 1

Boston subway map based on map by Urban Rail from 2006 (E. Kazmierczak & P. Storkerson).



Clinical psychologists and counselors use diagnostic images in their practice to make interpretations and predictions about patients' social-emotional states and behaviors. Radiologists interpret findings in radiological images to make judgments about the state of patients' body parts—that is, whether they are within or outside the norm for healthy individuals. In those disciplines, images are used because they can provide information that cannot be obtained through other means.

Radiological images are mechanically derived. In clinical practice and counseling, images are generated by hand for the purpose of assessment through such techniques as drawing, painting, and collaging. In design, free-hand drawings are often used for ideation, and the communication and development of ideas. Again here, images are not the end goal, but the means for guiding decisions and actions.

In some areas, domain-specific expertise is necessary to generate reliable judgments about the meanings of images. Only experts in radiology, for example, can dependably inspect, interpret, and classify findings in radiological images. Despite the specialized training, however, the error rate in radiology has been reported as 33 percent, and efforts to reduce it have been hindered by the lack of adequate knowledge about the mechanisms of perceptual expertise (Waite et al., 2019). With respect to diagnostic drawings in clinical practice, studies have shown that domain-specific expert knowledge is not a necessary condition for making reliable interpretations. Laypersons have been shown to perform as well as clinicians who had been trained in the interpretation of diagnostic drawing tests (Albee & Hamlin, 1949; Handler, 1985; Levy & Ulman, 1967; Schmidt & McGowan, 1959). Hiler and Nesvig (1965) demonstrated that expert clinicians accurately assessed 65 percent of such drawings, whereas non-psychologists accurately assessed 64 percent of them. Like in radiology, efforts to reduce the error rate for diagnostic drawing tests have been unsuccessful in part due to the lack of knowledge about the mechanisms that guide the development of perceptual expertise and in part due to the misguided attempts to formalize the drawing process.

Studies of expertise in varied disciplines indicate that reproducible and reliable expertise cannot be developed through the accumulation of knowledge alone. It requires an acquisition of criteria and methods that enable monitoring of one's performance (Almendra & Christiaans, 2009; Ericsson, 2005). In other words, a combination of exposure to numerous exemplar cases, along with an awareness of the criteria that can yield successful evaluations, has been indicated as a factor in developing perceptual expertise.

There is a caveat here. To advance and empirically study perceptual competencies and subsequent decisions requires an interpretive lens that affords a way of understanding both cognition-based and culture-based regularities and differences. This article introduces such a lens by presenting a study that combines theoretical frameworks, findings, and methodology from psychology to investigate how interpreters' decision criteria, personality characteristics, and emotion-laden experiences can affect what they see in images when they are asked to make judgments about the makers of the images.

Several reasons led to this methodological move. First, it simulates a condition of a high-stakes decision environment, in

which interpretive judgments determine the subsequent course of action. Second, psychology has a rich history of systematic research devoted to finding reliable methods of interpretation of images that have been created for the purpose of evaluation of social-emotional states and the prediction of behaviors. Third, the accuracy of such interpretations can be objectively evaluated based on a specific criterion or criteria. In the case of the study presented in this article, the criterion was the self-reported abuse status of the individuals who created the stimulus drawings and of the interpreters who judged the drawings. Fourth, the results can be translated into immediate practical applications. Last, the results can inform research and practice in visual studies and visual communication design, especially in the area of human-centered design.

Conceptual Framework

First, the study presented in this article assumes a naturalistic or ecological lens and methodology as best suited to investigations into the perceptual judgments that underlie interpretation of images. Second, this methodology conceptualizes interpretation as a decision process and extends the ecological lens through Gigerenzer's (2007) theory of fast and frugal heuristic judgments. Third, the framework situates the decision process within the model of the mind as a complex system that processes information on a continuum between conscious and nonconscious levels (Damasio, 2012). This move accounts for the complexity of design thinking as a decision process. Fourth, the framework addresses personality and emotion-laden experiences as factors that influence interpretation of images. This move brings us closer to a model of interpretation that focuses on interpreters and subjective factors that have been shown to affect judgment of images.

An ecological or naturalistic framework and methodology have been developed by psychologist Egon Brunswik. Brunswik (1955) criticized the traditional psychological experiments that test one or two variables at a time in highly controlled experimental conditions. His ecological lens called for experiments that simulate natural world environments in which people make decisions. Brunswik's (1952) model takes into account the complexity of the environment and assumes both a selective nature of perception and that people have the skills and knowledge to make sense of the world. Hence, this methodology investigates many selected variables simultaneously to study people's perceptual judgments in experimental conditions that simulate the natural world conditions (Kirlik and Storkerson, 2010; Storkerson, 2001, 2003, 2009, 2010).

Gigerenzer's (2007) studies of judgment in naturalistic or ecological settings build upon Brunswik's (1952) model of perceptual

judgments and theory of the inherent complexity and equivocality of naturalistic environments. In Gigerenzer's (2007) model, naturalistic environments can be understood neither by increasing information nor by reductive elimination of variables in laboratory experiments. A key assumption in the naturalistic model of decision-making is that professionals are not the only experts; laypersons, too, are highly competent in the decision process. Laypersons are recognized as "capable decision-makers" (Keller et al., 2010, p. 258). Humans are perfectly adapted to navigate through complex environments, so according to Keller and his colleagues (2010), "Laypeople can also be well attuned to the environments through which they interact" (p. 258). Specifically, the fast and frugal heuristic decision model is concerned with decisions in taxing natural environments rather than with highly domain-specific expert decisions. Gigerenzer (2007) has shown that people make decisions spontaneously by developing ad hoc, experience-based heuristics—that is, rules of thumb—which ease mental effort and speed up the process of making satisfactory decisions. The study presented in this article has tested Gigerenzer's stronger claim that heuristics can improve accuracy (Gigerenzer & Brighton, 2009; Gigerenzer & Gaissmaier, 201; Gigerenzer, Todd, & the ABC Research Group, 1999).

There is a caveat here. Neither the naturalistic perceptual judgment model nor the fast and frugal decision model can adequately explain the complexity of the decision process in interpretation of images and in the design practice. To account for the judgments that involve both heuristic decisions and deliberate decisions, as is the case in design, this study situates the decision process within a model of the mind as a complex system that processes information on a continuum between conscious and nonconscious levels (Damasio, 2012). Moreover, to account for genetic predispositions and experiential factors that affect interpretation of images, the study has expanded the framework to include (1) research on personality characteristics that have been shown to influence judgments about the meaning of diagnostic drawings in psychotherapy, and (2) trauma literature that indicates that emotion-laden experiences can permanently affect worldviews, which in turn can influence subsequent judgments.

Design Thinking and Naturalistic Decision Process

Design thinking is different from thinking in other fields. It operates between sciences and humanities because design starts and ends with problems and possibilities in the everyday, natural world. In sum, design thinking consists of three phases: naturalistic, analytic or deliberate, and naturalistic again. That is because designers are called when people have problems and opportunities that they wish to solve or take advantage of and do not know how to do it. Hence, designers' tasks are to understand the nature of these problems or opportunities and imagine how

they can be handled so that problems are fixed and opportunities can be created. This stage of design thinking is naturalistic. It is a phase of perceptual judgments, abductive reasoning,[1] and creativity. The view of design thinking as dependent on abductive reasoning is not new; it has been postulated by Almendra and Christiaans (2009) in an insightful study on decision-making in product design.

Then, designers apply formal analyses and deliberate decisions, which are based on rules, technical specifications, and established procedures, rather than on abductions and heuristics, to competently realize final design solutions. At the end of this process, the goal is a design solution that works. When the design is finalized, it functions in the natural world of users. Good design thinking is based on an understanding of how people think and use things that fit the natural world.[2] Hence, useful insights can be derived from the research about how people make decisions when they interpret images and utilize them to make subsequent judgments.

Conscious and Nonconscious Judgments

There is a broad agreement in varied branches of psychology that people make judgments and decisions by relying on two integrated processing systems that are often labeled *intuitive* (or *tacit*) and *deliberate* (or *analytic* or *formal*) (Hogarth, 2002). Neuroscientist Antonio Damasio (2012) refers to those systems as *unconscious* and *conscious cognition*, respectively. Intuitive cognition—or in his words, "cognitive unconscious"—is a system to which the conscious mind delegates functions that initially have been acquired through repetition and deliberate learning. After the rules of execution, planning, reasoning, and evaluation of high levels of performance have been internalized, they are executed without involvement of consciously deliberate decisions. Once acquired and internalized, nonconscious judgments appear effortlessly, as though intuitively. In Damasio's (2012) words, "There is an important reasoning process going on nonconsciously, in the subterranean mind, and the reasoning produces results without intervening steps ever being known" (p. 293).

Designers know this process all too well; they make decisions and solve problems competently but often do not know why or how they have arrived at their decisions. That is not to say that self-awareness of one's thinking cannot be achieved. According to Damasio (2012) and others, nonconscious judgments can be subject to review by the

1 Abduction or abductive reasoning, according to Peirce (1903), is a mode of reasoning inference by which one studies facts and devises a theory, that is, a hypothesis or an insight to explain them. "Its only justification is that, if we are ever to understand things at all, it must be in that way" (1903, CP 5.144–45). This process can be both intuitive/unconscious and analytical. ***Dictionary of Philosophy of Mind*** defines "abduction" as inferences to the best explanation (Eliasmith, 2004).

2 P. Storkerson, personal communication, May 1, 2010.

conscious cognition (Hogarth, 2002). This view of the mind and the decision process as a reciprocal communication between nonconscious and conscious cognition provide a neurologically based framework for studies that utilize methods of verbal protocol analysis, such as the think-aloud method or introspection, among others.

Personality Factors and the Decision Process

Experimental studies of the naturalistic interpretation of diagnostic drawings in psychotherapy have found that some people are consistently better than others at making accurate inferences from drawings, regardless of their professional affiliations. Those studies indicated that positive attitudes toward the self and others and positive attitudes toward nondiscursive experiences were associated with higher diagnostic accuracy. Specifically, better interpreters had in common the following personality characteristics regarding the self and others: self-acceptance, empathy, openness toward others, a nonjudgmental approach to others, and interest in others. In respect to nondiscursive experiences, they shared creativity, intuition, self-reflection, and introspection (Burley & Handler, 1997; Hiler & Nesvig, 1965; Scribner, 1989).

The studies of personality factors in relation to psychodiagnostic skills have also revealed a positive association between certain aspects of interpreters' personalities and the frequency with which indicators of those aspects of personality occur in the drawings (Scribner & Handler, 1987). Hammer and Piotrowski (1997) discovered positive correlations between higher levels of hostility in interpreters and a higher number of signs of hostility or aggression they found in one type of drawing test in comparison with interpreters with lower levels of hostility. The study presented in this article examined attitudes toward the self and others through the measures of the diversity of professional involvement, special skills, and volunteer work.

Emotion-Laden Experiences and the Decision Process

Trauma literature and the findings that indicate a correspondence between higher levels of hostility in interpreters and higher frequency with which interpreters saw indicators of hostility in the drawings have motivated an inclusion of emotion-laden experiences as factors that can affect what people see in images. It is well accepted in psychological sciences that memories, decisions, and choices can be biased by emotions. Tacit or nonconscious processes are especially prone to emotional bias (Damasio, 2012; Hogarth, 2002). Trauma literature indicates that emotion-laden experiences, such as the trauma of abuse, can permanently affect

worldviews, which in turn can influence subsequent judgments. Victims of abuse are robbed of the sense of safety and see the outside world as a hostile and dangerous place that calls for vigilance (Figley, 1985; Finkelhor & Browne, 1985; Herman, 1992).

Thus, it was hypothesized for this study that interpreters who had experienced abuse as victims would be sensitized to those issues and would classify more drawings as created by abused drawers than would interpreters who did not experience abuse as victims.

Purpose and Research Questions

The process of visual interpretation depends, on the one hand, on the types and quality of the images and the state of mind of the drawers. On the other hand, it depends on who is doing the interpreting and how. The study presented in this article is concerned with the interpreters' side of the equation and with interpretation as a decision process. It does so by querying the interpreters' decision criteria, the accuracy of their judgments, and their emotion-laden experiences as applied to the identification of interpersonal abuse from self-representational drawings that were created by adults who were nonartists. The research questions guiding the study presented in this paper were these: What classification criteria and heuristics can be identified on the basis of interpreters' reports? Can heuristics improve the accuracy of judgments? And how do the interpreters' emotion-laden experiences relate to the quality of interpretive judgments? Considering the specifics of the study, the last question has been customized: How does the interpreters' self-reported abuse status relate to the quality of interpretive judgments?

Method

Design

The study deployed an experimental design that was *ecological* and *representative* of real-life situations. It utilized mixed methods (quantitative and qualitative) of data collection and analysis (Greene, Caracelli, and Graham 1989). Methods and the timing of the implementation of the methods were sequenced so that the results from the quantitative data analyses informed the qualitative analyses and, in turn, served the quantitative analyses that followed. Although the timing sequence of the implementation of each method indicated the linearity of the design, the reasoning process was not linear and involved going back and forth between the quantitative and

qualitative data and results to advance the integration of the findings from both phases and from researchers' progressive understanding of the subject.

Recruitment and Participants

Theory-based, stratified purposeful sampling techniques[3] (Miles & Huberman, 1994) were used to recruit sixty participants who were nonexperts in the interpretation of drawings and were from varied student and nonstudent populations. The process was guided by the goal of recruiting participants representing diverse social worlds and experiences concerning gender, ethnicity, age, known abuse histories, education level, and professional and occupational expertise. Participants from varied disciplines were sought because no previous study had evaluated performance of individuals other than trained interpreters of drawing tests, clinical psychologists, students of psychology, professional artists, and secretaries at the clinics in which the studies were conducted.

Before the recruitment, approval from the Institutional Review Board was obtained. Recruiting materials introduced this research as a study of the identification of abuse from self-representational drawings. The methods of recruitment included in-person invitations and general calls for participation with snowball sampling[4] permitted. Targeted invitations were issued to individuals in the local community and to groups with known abuse histories and professional expertise. Calls for participation were sent to local and out-of-state domestic violence shelters and sexual assault service agencies. Calls that were disseminated through the mailing lists of a large midwestern university were focused on groups that were potentially interested in the results of the study. The lists included academic advisors; those interested in women's studies; those involved in the women's resources center; students in education, art and design students; and a student organization with an interest in the healing aspect of visual arts. The participants were recruited in waves until at least five participants were recruited for each known category of professional expertise and saturation was achieved in the qualitative interview data. Saturation was a

3 Theory-based sampling is the process selecting "incidents, slices of life, time periods, or people on the basis of their potential manifestation or representation of important theoretical constructs" (Patton, 1990, p. 238). Stratified purposeful sampling is the process of selecting particular cases that vary according to key dimensions (strata). The purpose "is to capture major variations rather than to identify a common core" (p. 174). This type of sampling is used when enough information is known to identify characteristics that may influence how the phenomenon is manifested—for example, with respect to educational background, gender, life experiences, and exposure to abuse.

4 Snowball or chain sampling is a purposeful method of participant selection where research participants recruit other participants for a study. It is used for locating information-rich key participants. It is called "snowball" because "by asking a number of people who else to talk with, the snowball gets bigger and bigger as you accumulate new information-rich cases" (Patton, 1990, p. 176).

stage at which the qualitative data did not provide any new information that would help to clarify the interpretive process.

Participants of the study are referred to here as "interpreters" to emphasize the focus of their role in the study. The study's objective was to access interpreters' naïve (unbiased by the training) beliefs about the relationships between psycho-emotional states and visual characteristics of drawings. Individuals with professional training in interpretation of drawings were excluded because theoretical frameworks they acquired during their training could influence their beliefs about how psychological states are manifested in drawings.

Ages of the participants ranged from 20 to 69 years; the mean age was 34.82 years (standard deviation = 13.01). The interpreters were mostly women (78 percent). Among all participants, 39 (65 percent) reported having been abused in interpersonal relationships. Fifty percent of the interpreters were White, and nonWhites were ethnically diverse: Black (23 percent), Hispanic (10 percent), Indian/South Asian (9 percent), East Asian (5 percent), and biracial (3 percent). Most interpreters had earned or pursued college-level degrees (87 percent). Among all interpreters, 52 percent were nonstudents, working in their professions or vocations, with an exception of six interpreters who were unemployed at the time of the study.

Overall, interpreters were well educated and diverse in respect to professional disciplines: social sciences (32 percent); education as teaching, administration, research, or policy (28 percent); mental health services (23 percent); visual arts and dance (25 percent); humanities (20 percent); natural sciences and technology (15 percent); and vocations, including hairdressing, sales, clerical, and caregiving (13 percent). These proportions do not add up to 100 percent because they are not mutually exclusive; 45 percent of interpreters reported having had formal training and professional experiences in more than one discipline and have worked across multiple disciplines throughout their lifespans. This situation indicated that attempting to categorize interpreters according to professional categories as if they were separate from each other was not as straightforward as it was initially envisioned. These co-occurrences reflected that interpreters had a wealth of professional experiences. The examined characteristics of the interpreters lend support to the ecological approach, which argues against analyzing individual aspects of human experience without considering the totality of experiences for any given individual.

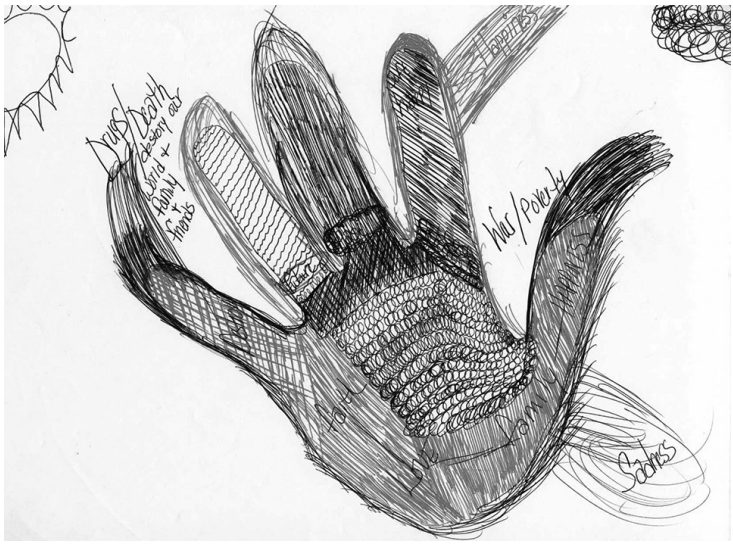
Stimulus Drawings

In research, stimulus materials augment traditional interviewing techniques by prompting the respondents through visual, auditory, or written means. They enable respondents to engage on a more direct level with

the material and elicit discussion about the researched topic.[5] In this study, the original drawings, titled "Inside Me–Outside Me," depicted drawers' self-perceptions and worldviews and were created by undergraduate students at a large public university under controlled conditions for another study (Dollinger, Kazmierczak, & Storkerson, 2011). Students were given a 50-minute time slot to create unrestricted representations of themselves in relation to others by tracing the palm of their hand or their foot onto a sheet of white, legal-size paper. The area inside the tracing designated the inner self, and the area outside the tracing designated the external world. Students populated those areas with rich representations of how they felt about themselves and the world around them. Formal aspects of the drawings included graphic marks, designs, symbols, and words in abstract, realistic, or expressionistic styles. In the current study, 196 of those drawings were sorted and interpreted by independent interpreters. Figure 2 shows an "Inside Me–Outside Me" drawing that is representative of images created by female survivors of abuse. Figure 3 shows a drawing that is representative of images created by non-abused males.

Figure 2

"Inside Me–Outside Me" drawing created by a female survivor of abuse.



5 Based on a definition from the website The Language Factory: Translation Made Simple, accessed August 8, 2018, https://thelanguagefactory.co.uk/stimulus-materials-2/.

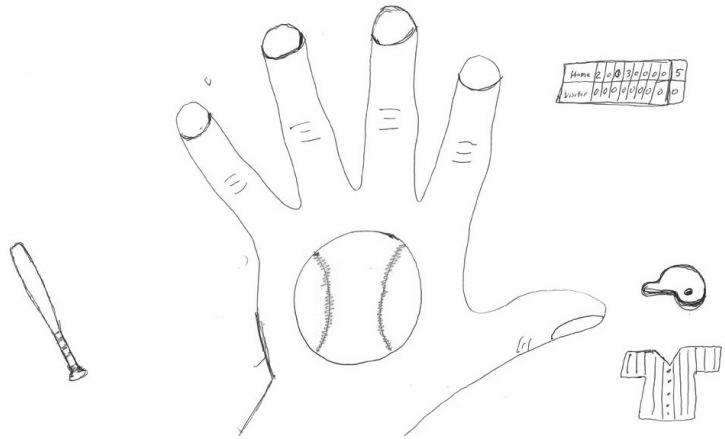


Figure 3

"Inside Me–Outside Me" drawing created by a non-abused male.

The stimulus drawings utilize imagery from Western vernacular iconography, stereotypical representations from popular culture, and imagery that has been acquired at a grade level. Hence, it is assumed that people familiar with Western culture are "capable decision-makers" about the meaning of such images and understand that those images relate to the real-life problems that can affect anybody.

Since previous diagnostic drawing tests in psychology have been interpreted by trained professionals who were actually only on par with laypersons, this study has focused on interpreters with varied skills, talents, and backgrounds to understand their decision process in judging the drawings, which do not require special training to be interpreted. A query into the layperson's decision process about images that draw from a general culture is a step toward building systematic research into interpretation of images as a decision process that can be applied both to general studies of images and to image design in particular

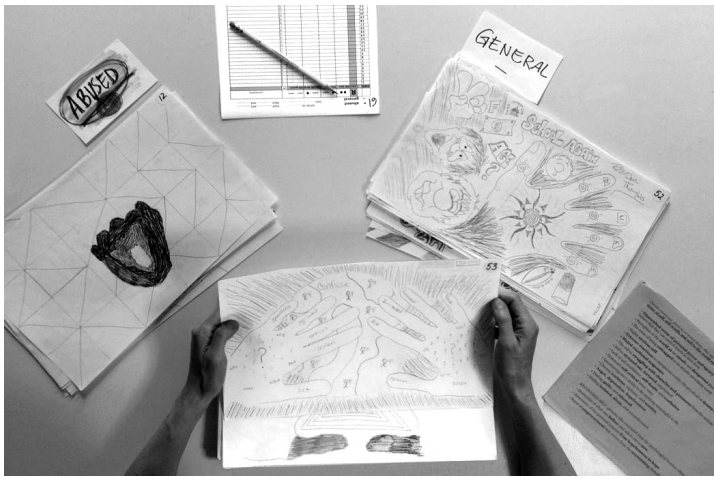
Procedure

The study sessions took place at semiprivate, quiet locations that were designated by the participants, including study rooms, conference rooms, participants' offices, and libraries. Each of the participants sorted and interpreted a set of 196 stimulus drawings. Some of those drawings (37 percent) were created by drawers who reported having been abused. Participants were asked to sort drawings into two piles: a pile with drawings that interpreters believed had been created by drawers who experienced interpersonal abuse, and a pile with drawings that they thought were created by non-abused drawers. Interpreters were provided with a definition of abuse and a list of 18 characteristics describing psychological attributes that can be found among victims of abuse concerning self-perceptions and perceptions of others. Those characteristics had been compiled from trauma literature and included perception of the world as a dangerous place, anxiety, self-blame, guilt, a dominant self-critical voice, and depression (Figley, 1985; Finkelhor & Browne, 1985; Herman, 1992).

The sequence of drawings was randomly changed at every 15th interpreter to counter the biasing influence of a given order. Interpreters were given technical instructions about how to perform the task, but no information was given about how abuse is manifested visually. Following the naturalistic approach, participants were asked to classify the drawings as they would any task in everyday life: devising their decision strategies and relying on their intuition. Upon the completion of the judging task, each interpreter was interviewed according to the qualitative semi-structured questionnaire, which included questions about demographic background and questions about the sorting process, such as, "Do you think that your experiences guided your interpretation of the drawings? Specify, which ones?" After the participants responded to the questionnaire, they were asked, during the interview, "What experiences, thoughts, or methods helped you classify the drawings?" and "What can you say about your interpretive process?" One goal was to avoid implying any criteria that might not be related to experiences that judges indicated in the questionnaire up to that point. Combined, the questions were designed to elicit rich descriptions of the criteria, the process, and the beliefs about how abuse is manifested visually. All interviews were recorded, and the recordings were used to validate the notes, which were taken by the researcher during the interviews. During the sorting procedure, the researcher sat across the table from the interpreters and recorded their responses on a scoring sheet that was constructed for this study. Figure 4 shows the setup of a table during the sorting procedure.

Figure 4

A table setup for the sorting procedure.



Data Analysis

The study sought to find out whether participants could identify criteria by which they sorted the drawings. The interview responses were examined in depth to provide answers to the question, "Did the interpreters develop any sorting criteria and/or heuristics?" Audio recordings were reviewed and analyzed against the researcher's notes that were taken during the interviews to make an initial list of the sorting criteria. For each interpreter, statements—indicating sorting criteria, heuristics, and intuitive beliefs about how abuse and abuse-free worldviews are manifested visually—were transcribed verbatim, that is, exactly the way they were spoken. For interpreters who indicated more than one criterion, the order in which the interpreters indicated the criteria was recorded.

Verbatim transcripts of statements about sorting criteria, heuristics, and meanings were copied from a Word file into an Excel file to accommodate different sorting approaches, searching for repetitive words, phrases, and statements. For the interpreters who provided lengthy and loquacious descriptions, two or three sentences that best represented sorting criteria, heuristics, and meanings were selected. The statements were inspected visually and clustered together in various ways—using the keyword search option—so that the same or similar statements were grouped together. For example, the frequently cited word "dark" was entered to cluster and further analyze statements that included that word for similarities and differences among them and to determine whether they revealed new information. The statements were analyzed line by line within and across varied clusters to discern dominant statements, themes, and their variations (Miles & Huberman, 1994).

To stay close to the data, the transcribed statements were preserved in their original form. Hence, no labeling, no paraphrasing, and no teasing out the possible meanings of the transcribed statements were applied. The original statements about sorting criteria, heuristics, and meanings included entire sentences, phrases, and individual words. They were grouped together if they shared keywords or phrases. For example, the phrase "when I don't like something" was entered as a keyword and counted as an instantiation of a heuristic that will be discussed in the results. Only minor modifications were made to the original statements. For example, "what dominates" was changed during the naming of heuristics into "dominant mood." A straightforward content analytic method was applied and *manifest* content, rather than latent, was analyzed and counted. This approach reduced a need for multiple coders working independently on the same data (Patton, 1990, pp. 382–83).

Statements about sorting criteria, heuristics, and meanings were quantified and entered as categorical variables in

regression analyses and chi-square tests of independence to evaluate whether sorting criteria were related to the accuracy of the judgments and, if so, what the direction and the magnitude of the association for each significant criterion were.

The abuse status of the drawers and the interpreters was recorded as a self-reported measure of abuse (explanatory variable), which included emotional, physical, and sexual abuse. Abuse was defined as "a form of victimization, mistreatment, violation, or treatment of someone so as to cause damage or harm (knowingly or unknowingly) to gain unfair advantage." A general measure has been applied because the study sought to understand the process of interpretation rather than to differentiate among specific forms of abuse (Figley, 1985; Finkelhor & Browne, 1985; Herman, 1992). At the end of the sorting task and after the drawing session, interpreters and drawers respectively were asked, "Have you personally experienced any form of abuse? If yes, specify." They recorded their responses in the semi-structured questionnaires. "Yes" responses were dummy-coded as 1, and "no" responses were coded as 0. The codes were entered into the analysis as a general variable for the self-reported abuse status of each interpreter. The *self-reported* abuse status of the drawers served as the criterion for the *judged* abuse status of the drawers and their drawings.

Results

The length of the sorting task ranged from 15 minutes to 420 minutes, with a mean time of 82 minutes (standard deviation = 64 minutes). The majority (83 percent) of the judging and interviewing were performed in one sitting, whereas ten interpreters (17 percent) completed the task in two or three sittings. Those interpreters asked for breaks to combat fatigue and maintain the ability to perform attentively throughout the entire sample.

Research Question 1: What classification criteria and heuristics can be identified on the basis of interpreters' reports?

Two overall approaches emerged from the analysis of the statements about sorting criteria, heuristics, and meanings. These approaches differed with respect to their specificity, that is, whether they allowed the identification of heuristics and specific visual cues that guided interpreters' judgments about the meaning of the drawings. The two methods consisted of broad decision criteria with which interpreters approached

the sorting task. One group of interpreters sought specific visual cues in the drawings and did so according to specific criteria. The other group of interpreters turned their attention inward and indicated recollecting their life experiences as criteria for the sorting. Hence, these approaches were labeled as "drawing-centered" criteria and "non-drawing-centered" criteria, respectively. The drawing-centered reports supplied ample information about interpreters' decision processes, including operational formulas (heuristics) that interpreters devised to perform the task. In contrast, non-drawing-centered reports were formulated in more general terms and lacked specificity needed for the identification of heuristics. Table 1 summarizes both approaches, with selected examples of interpreters' statements illustrating each approach.

Sixty percent of the reports ($n = 36$) were found in the drawing-centered group, and 38 percent ($n = 23$) were found in the non-drawing-centered group. Comparative analyses of the data were performed to identify specific decision criteria with which interpreters sorted the drawings. The criteria ranged from specific examples of visual cues that interpreters considered indicative of abuse or emotional distress to the gut reactions to what they saw in the drawings. Specific visual cues that interpreters believed indicated abuse included "issues of power" or "dramatic world and fire or blood." Gut reactions to the purported indicators of abuse were represented by statements like, "Anything odd that feels wrong" and "Anything I did not like."

As shown in Table 1, among the non-drawing-centered reports, 18 interpreters referred to familiarity with interpersonal abuse as their experiential knowledge base. That included interpreters' experiences as victims of physical, psychological, or sexual abuse and interpreters who knew about the effects of abuse on mental health directly from individuals who were abused or through learning about interpersonal abuse during their professional training. Three interpreters in that group referred to life experiences in general, including current and past interactions with others and the practice of self-reflection as the basis for the judgments. These criteria were expressed through the following statements: "Past experiences influence the viewing," "Where I am is the basis," and "Maybe my self-reflective work was helpful."

Two interpreters reported using a list of characteristics of a survivor of abuse—presented by the researcher at the beginning of the sorting session as a potential sorting aid—to guide the sorting task. It was included in the non-drawing-centered group because the list specified emotional states without indicating any visual cues. Also, one report fell outside the two categories and was coded as "did not specify," because the interpreter did not provide any information about the decision criteria.

Table 1

Sorting criteria and illustrative statements derived from the interpreters' reports.

Sorting criteria and the illustrative statements	% of the interpreters
Drawing-centered criteria (36 interpreters): • "If it looks happy, not troubled, balanced, then non-abused." • "I look for issues of power, abuse is about power." • "I wanted to be surprised." • "Dramatic, fire or blood." • "What I would draw." • "Negative words." • "Division into before and after." • "Painful memories, past hurt, drugs mean abuse." • "Mad, sad, words related to fear, pain, unlove, uncertainty, harsh, heavy 'dark' lines, even in 'pretty' pictures." • "Anything odd that feels wrong." • "When I don't like something, it means abuse, religion means abuse.	60%
Non-drawing-centered criteria (23 interpreters): 1. **Interpreter's exposure to interpersonal abuse as a victim or via knowing the victims** (18 interpreters). 2. **Interpreter's life experiences** (3 interpreters): • "Where I am is the basis." • "My self-reflecting work was helpful." • "Past experiences influence the viewing." 3. **List of characteristics of a survivor of abuse** (2 interpreters): • "I used only the information I was given." • "I followed the list."	38%
Unspecified (1 interpreter)	2%

Six visual heuristics[6] were identified based on the drawing-centered criteria, which were derived from the analysis of questionnaires and interviews: (1) ease of understanding, (2) out of the norm, (3) dominant mood, (4) seeing the whole, (5) within the norm, and (6) elaboration. The data were organized thematically and sorted by counting the number of mentions of each rule of thumb, according to which interpreters discriminated drawings created by abused drawers from drawings created by non-abused drawers. Table 2 shows the breakdown of the heuristics, which are illustrated by the representative quotes from the interview data. The table shows a total of 50 statements, even though they originate from 36 reports. That is because some of the interpreters indicated utilizing more than one decision criterion. For interpreters who indicated more than one criterion, no attempt was

6 The term "visual heuristic" has been used to emphasize that interpretations or judgments regarded visuals and to distinguish heuristics concerning visual materials from heuristics related to nonvisual data, such as determining which strategy to pick for product development or organizational management.

made to determine whether they were used hierarchically. The priority for the analysis was to identify the criteria.

It has to be noted that not all the interpreters who reported drawing-centered methods screened drawings for cues of abuse. A handful of the interpreters looked for indicators of general distress without attributing it to a specific cause, such as abuse. Those interpreters looked for indicators of a "problem with the drawers' self-perceptions or worldviews," which may or may not be related to abuse. For example, one interpreter who reported looking for things that were out of the norm stated, "I don't know if they are abused, but I put drawings that are 'not right' on this pile." In other words, those interpreters determined whether they saw indicators of out-of-the-norm worldviews but withdrew from making assumptions about the potential causes.

Table 2

Heuristics and illustrative statements derived from the drawing-centered reports.

Heuristics	Illustrative statements from the drawing-centered reports	N / %
Ease of understanding	"Things that are easy to understand."	15/42%
Out of the norm	"Anything that is out of the norm that makes me want to talk to them more."	10/28%
Dominant mood	"What dominates, the negatives or the positives?"	8/22%
Seeing the whole	"Assess the whole picture."	7/19%
Within the norm	"That which is normal." "That which is expected."	5/14%
Elaboration	"How elaborated, developed or time consuming are drawings?"	5/14%

1. *Ease of understanding:* From among the interpreters who reported drawing-centered criteria, 42 percent searched for things that were "easy to understand." The interpreters listed specific thematic and visual cues that they considered easy-to-understand indicators of abuse, such as fear, pain, lack of love, uncertainty, painful memories, drugs, unhappiness, a dramatic view of the world, sadness, and harsh and heavy dark lines.

2. *Out of the norm:* Twenty-eight percent of the drawing-centered reports indicated that interpreters screened the drawings for "anything that is out of the norm" or "anything that is out of the norm that makes me want to talk to them more." The goal of diagnostic judgments is to make predictions about whether people who created the drawings were abused; therefore, anything outside the norm raised red flags for many

interpreters. The interpreters who devised an out-of-the-norm heuristic followed their immediate, negative gut reactions to identify abuse: "Anything odd that feels wrong is abuse" or "When I don't like something [it signifies abuse]." One interpreter was very specific about visual elements that alerted her attention, stating, "Life and death, fight or die, war, all those sad words were raising my attention. I am aware that normal people can draw differently, but if I had to put them on a pile, that is what I looked for." Figure 5 shows the most often reported visual indicators of abuse, whereas Figure 6 shows the most often reported visual indicators of non-abuse. These indicators of abuse and non-abuse were found *easy to understand* in their respective categories by nearly all interpreters: between 92 and 95 percent of interpreters found these indicators of abuse (Figure 5) *easy to understand*, and between 93 and 97 percent found these visual indicators of non-abuse (Figure 6) easy to understand.

Figure 5

Visual indicators of abuse that the interpreters found easy to understand.

Figure 6

Visual indicators of non-abuse that the interpreters found easy to understand.

3. *Dominant mood:* Twenty-two percent of the interpreters in the drawing-centered group screened the drawings to assess whether an overall general theme, mood, emotion, feeling, or cognition was positive or negative. The interpreters examined the drawings to determine whether the depictions were "uppers" or "downers," as one interpreter put it. Another interpreter specified her criterion in this way: "If about loneliness, helplessness, fear, but nothing to counteract, then abused."

4. *Seeing the whole:* Nineteen percent of the interpreters who examined the drawings in search of the cues of abuse or non-abuse strongly indicated that they examined the entire image to infer the meaning of the drawing and make the sorting decision that followed. They described the decision process as being dependent upon looking at the entire image in order to assess the meaning of individual elements and their arrangement to each other and the entire composition. For example, one interpreter reported, "You have to look at the whole picture from all sides to make your choice."

5. *Within the norm:* Fourteen percent of the interpreters who reported screening the drawings in search of specific visual cues mentioned looking for indicators of normal states that were depicted by the drawings. One interpreter reported this strategy as the only decision criterion, and four interpreters reported this criterion in conjunction with other criteria. The interpreters described states "within the norm" as typical situations—expected and usual. Normal states, according to the interpreters, were those that interpreters ordinarily encounter daily. Interpreters expected to see normal states in their daily lives, and so those states did not require any special attention. One interpreter considered any drawing that might be created by her or her children as an indicator of normality: "If I could draw it or my kids could draw [it], I did not think anything about them." Other examples of comments indicating normal states included "Normal is no problem" and "If it looks balanced, then no problem."

6. *Elaboration:* Fourteen percent of the reports in the drawing-centered group indicated that interpreters classified the drawings based on their elaboration—that is, by how much ink was on the page. This criterion stemmed from the interpreters' belief that abused or traumatized individuals create drawings that are tediously drawn or take a great deal of time. The interpreters specified this criterion through the following statements: "A detailed drawing that takes a lot of time is abuse," "Drawings the abused have more substance, more force," and "The abused put a lot of themselves into drawings." The elaboration heuristic is the only heuristic found by this study that is specific to trauma. The other heuristics can be presumed as applicable to other situations in which perceptual judgments have to be made.

Research Question 2: Can heuristics improve the accuracy of judgments?

All interpreters were included in statistical analyses to determine whether there were differences in accuracy[7] rates between the drawing-centered and non-drawing-centered approaches. The accuracy scores for individual interpreters were calculated for each approach, using linear regression to assess whether any of the strategies were associated with higher accuracy rates. There was no significant relationship between accuracy and the non-drawing-centered approach, whereas the association between accuracy and the drawing-centered approach achieved significance. The drawing-centered reports consisted of heuristic criteria; hence, this result indicates that heuristic criteria may be a meaningful factor in visual interpretation.

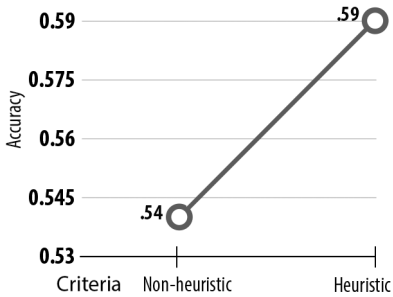
For the drawing-centered approach, the regression model showed a significant effect of heuristic-based decisions on accuracy

7 Accuracy rate = proportion of drawings that were correctly identified.

(β = .04, p < .001), which accounted for 29 percent of the variance in accuracy $F(1, 59) = 23.274$, p < .001. Figure 7 graphs the regression, showing that, on average, interpreters who reported at least one heuristic as their sorting criterion correctly identified 59 percent of the drawings, whereas interpreters who reported non-drawing-centered or non-heuristic-based criteria correctly classified 54 percent of the drawings. The two proportions do not add up to 1 or 100 percent because they are independent from each other and are not mutually exclusive. To explain how these proportions work: hypothetically, interpreters in each group could correctly identify all stimulus drawings, none of the drawings, or some of the drawings and achieve an average accuracy rate falling between 0 percent and 100 percent.

Figure 7

A graph of the regression: Accuracy rates relative to the sorting criteria.



In sum, the increase of four percentage points in the accuracy rate indicates a marginal difference in interpreters' performance. Whether this marginal difference supports the hypothesis that heuristics can improve accuracy can be debated. It can be taken as not supportive, or it can be interpreted as indicative of a general direction of an association between higher accuracy and the use of heuristic-based criteria in some situations. Certainly, more research with a larger number of participants is needed to evaluate how this association performs in other contexts to assess the reliability of the latter interpretation.

Research Question 3: How does the interpreters' self-reported abuse status relate to the quality of the interpretive judgments?

The descriptive statistics in Table 3 show the tendency rates. Tendency is the proportion of drawings that were judged as created by drawers who were abused, whether or not those judgments were correct. On average, of all 60 interpreters, those who did not report having been abused classified 33 percent of the drawings as created by the abused. Interpreters who self-identified as having been abused classified 47 percent of the drawings in the sample as created by the abused—14 percentage

points higher than those who did not self-identify in that way. These findings indicate that judges who reported having been abused saw indicators of abuse in the drawings more frequently than judges who did not report having been abused, regardless of whether those purported indicators were correct. The results have been interpreted as lending support to the hypothesis that interpreters who self-identified as having been abused were sensitized to seeing indicators of abuse in the drawings more frequently than judges who did not self-identify as having been abused, as measured by tendency.

Table 3

Tendency rates relative to the abuse status of the interpreters.

Interpreter	Minimum	Mean	Maximum	Standard Deviation	Number of Interpreters
Abused	0.24	0.47	0.90	0.15	39
Non-Abused	0.14	0.33	0.59	0.12	21

The same association, but more prominent, was found for gender. To illustrate this association, the five highest tendency rates in the sample have been examined against the gender of the abused interpreters. As shown in Table 4, the highest tendency scores were extremely high and were achieved by female interpreters who were abused. For male interpreters who were abused, the highest tendency scores were lower than those of the abused women but higher than the scores found among the non-abused interpreters. In other words, some female interpreters who were survivors of abuse and earned the highest scores on tendency saw indicators of abuse in nearly all drawings in the sample. They judged between 69 and 90 percent of the drawings as created by abused drawers. Men who self-identified as survivors of abuse and earned the highest tendency scores saw indicators of abuse in 65 percent of the drawings. For comparison, the highest tendency scores for non-abused interpreters were 59 percent (Table 3), suggesting they saw indicators of abuse in 59 percent of the drawings.

Table 4

Highest Tendency scores among the interpreters who were abused.

Highest Tendency scores in Percentages	Interpreter's Gender
90%	Female
85%	Female
69%	Female
65%	Male
65%	Male

These results suggest that self-reported abuse status predicts that interpreters who have been abused will have a high predilection for seeing indicators of abuse and will judge images as displaying more indicators of abuse than interpreters who have not self-identified as victims of abuse. This result can be expected to manifest particularly strongly among women who self-identify as having been abused in comparison to interpreters who have not been abused.

Discussion

The study presented in this article sought to examine the interpreters' decision criteria, personality characteristics, and emotion-laden experiences as factors affecting interpretation of images that were created for diagnostic assessment. The study queried what decision criteria interpreters from varied professions employ to judge the abuse status of drawers from their self-representational drawings, which represented drawers' self-perceptions and worldviews. The study measured the accuracy of the judgments relative to the judging criteria to test the hypothesis that heuristics can improve accuracy. Interpreters were asked to sort drawings that were created by undergraduate students (for another study) into two groups: drawings that interpreters believed were created by drawers who had experienced interpersonal abuse as victims and drawings that they believed were created by the non-abused.

The questionnaires and interview data were examined against the model of fast and frugal heuristics as adaptive tools for naturalistic decision-making. The results of this study indicate that 60 percent of the interpreters devised simple heuristic rules to guide their decision process. These heuristics—including ease of understanding, out of the norm, dominant mood, seeing the whole, within the norm, and elaboration— were used as decision criteria and implicated the selective reliance on perceptual cues to aid in the management of a cumbersome task of interpretation of many images (196 drawings), which, on the whole, were complex in form and rich in content.

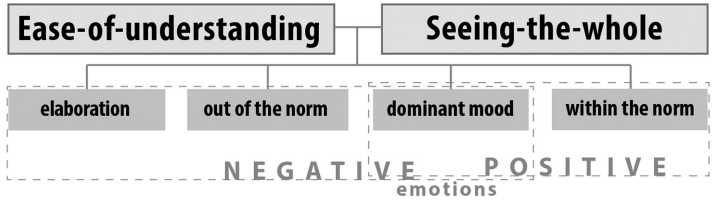
Figure 8 shows how the six heuristics function in the decision process and how they relate to each other against the backdrop of affective judgments. For interpreters who searched for cues in the drawings, each rule of thumb (heuristic) reflects a criterion according to which images were judged. For instance, an interpreter reported *seeing* [each drawing] *as a whole* to determine the *dominant mood*: "If about loneliness, helplessness, fear, *but nothing to counteract*, then abused." Most often, interpreters approached the sorting task intending to find things that were *easy to understand*, or familiar and easily discernible patterns in the images. They

searched for patterns that enabled them to construct coherent wholes—that is, images that make sense. To look for patterns is to apply or devise criteria that make a good fit with the task at hand.

The *seeing the whole* criterion reflects the holistic nature of perceptual judgments, while other heuristics point to specific applications of that criterion. As shown in Figure 8, the *seeing the whole* heuristic is on par with looking for cues that are *easy to understand*. These two heuristics have been positioned as overarching criteria in the decision space that spans from negative to positive valuations of emotions. Emotions are organisms' automatic responses to the environment and relate to functioning in the world that is seen through the lens of whether something is bad or good for the organism, according to Damasio (2012). In an interpretive decision process, emotional valuation is a factor affecting decisions and choices. An area of negative valuation transitions into an area of positive valuation. In the context of this study, an area of negative valuation contains criteria that relate to abuse (*elaboration* and *out of the norm*), whereas an area of positive valuation is associated with criteria that relate to non-abuse (*within the norm*).

Figure 8

Heuristics in the decision process and affective judgments.



The *dominant mood* heuristic is positioned halfway between the positive and negative valuation areas. It belongs to both because it is used for the determination of whether a prevailing mood, theme, feeling, or function of an image is positive or negative. Looking for what dominates requires seeing the whole first. Assessing the dominant mood depends on *ease of understanding* as well, as interpreters reported making judgments about the dominant mood based on depictions that were easier to understand than others. The challenge in design is to identify those visual cues or perceptual variables that make the strongest impact on judgments.

When applied to image design and visual communication design, the decision model designates the criteria of rejection and acceptability. The *within the norm* criterion may or may not be associated with the desirability of a design. Without relevant research, it can be presumed that the *within the norm* criterion indicates acceptance at best or a neutral approach to a design. Through user testing, one can assess what makes a design desirable and what the desirability criterion is. The criterion would occupy the positive valuation area in the model.

The challenge for designers is to establish what expectations and sensory cues in a design are associated with positive and negative emotional responses in specific groups of users. Designers must pay attention to gender and emotion-laden factors, as they always influence judgments and can bias attitudes toward designs in powerful and unexpected ways. By the same token, emotional biases in both genders can be utilized by designers to construct gender-specific visual messages that will achieve a desired emotional impact and influence subsequent decisions.

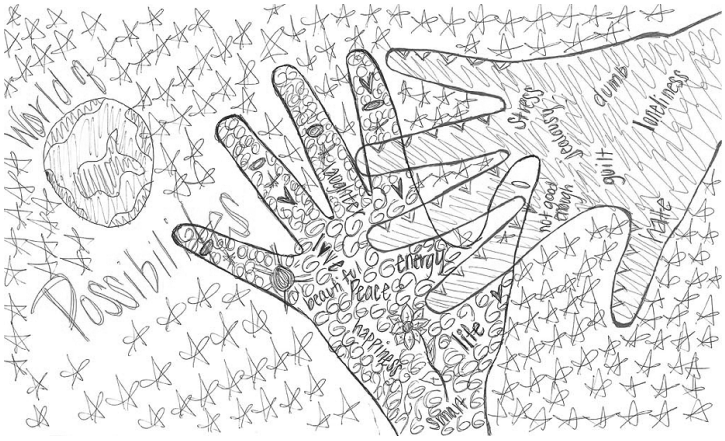
Looking at things holistically and discerning easy-to-understand patterns are typically effortless operations because the cognitive work is done intuitively or implicitly and without the interpreters' awareness. Most decisions and choices are made by the cognitive unconscious according to the learned patterns that have been acquired through interactions with the environment. The pattern-seeking behavior is enforced by looking at things holistically in search of familiar visual cues.

The intuitive decision process becomes deliberate to the point of being halted when interpretation is problematic. Figure 9 shows a drawing that was difficult for interpreters in this study to judge. The difficulty of judging was indicated by the longer time it took interpreters to sort the drawing and by the rate of "non-abused" and "abused" judgments that were assigned to this drawing: 50 percent of interpreters judged it as having been created by a non-abused drawer, and 50 percent determined it was created by an abused drawer. Several interpreters commented that this image has a balance of positive and negative cues, and they could not decide how to interpret it or, subsequently, how to sort it.

Drawings that lacked a dominant mood, feeling, or theme were often perceived as ambiguous. This finding is not surprising. Designers know all too well the situations in which "poor gestalts" or unresolved compositions are poorly received and perceived as unstable and unnerving. They simply do not make "good forms." The difficulty with judging the drawing in Figure 9 is consistent with what Ramachandran and Hirstein (1999) described as a psychological phenomenon of the "peak shift" effect. That is, forms that distinctly extend in one dominant direction trigger stronger reactions than shapes that extend equally in more than one direction. By the same token, Ramachandran and Hirstein (1999) extended their argument toward art: "Art is most appealing if it produces heightened activity in a single dimension (e.g., through the peak shift principle or through grouping) rather than redundant activation of multiple modules" (p. 15).

Figure 9

An ambiguous "Inside Me–Outside Me" drawing that was difficult to judge; created by a non-abused female.



The visual heuristics can be viewed as representative of a more general rule of thumb, that is proposed by Gigerenzer: the *take the best* heuristic. The *take the best* criterion can be understood as a criterion that interpreters applied intuitively (Goldstein & Gigerenzer, 2002). It is a cognitively economical method for making judgments concerning situations about which people know little. Proponents of the fast and frugal heuristics model argue that people automatically decide on the *best* criterion that fits a given situation, especially in unfamiliar situations. In the study presented in this article, all interpreters lacked information about how abuse is manifested visually, and for 35 percent of the interpreters the topic of interpersonal abuse itself was unfamiliar. Hence, it has been concluded that the visual heuristics found by the study exemplify the *take the best* heuristic.

The study found that the heuristic criteria were associated with marginally higher accuracy of judgments in comparison to the interpreters who reported life experiences as the criteria. But since the difference in the accuracy rates between the two groups is small, the result can be interpreted both ways: it can be viewed as supportive of the hypothesis that heuristics can improve the accuracy of judgments, or it can be interpreted that the study did not provide enough evidence to support that hypothesis.

One way to understand the result is to consider it vis-à-vis the cultural context from which the imagery displayed in the stimulus drawings originated. The drawings displayed popular iconography from vernacular culture. Hence, the perceptual expertise needed for the interpretation of the drawings was based on familiarity with popular Western culture and did not require aid in the form of heuristic criteria. The perceptual competence, in this case, depended on general skills in pattern recognition that are connected to the neurobiological foundation of perceptual processes, which are shared across people within and across cultural domains. The stronger dependence on pattern recognition makes the perceptual processes less dependent on the decision aids.

The idea that visual perception is based on general skills in pattern recognition that are connected to the neurobiological foundation of perceptual processes is not isolated or novel. Designers are aware of gestalt principles of visual grouping that inform understanding of how to design effectively. For example, an article in *Visible Language* argued this view from the perspective of participatory design (Zender, 2017). Whatever the interpretation of the finding of the study may be, it is important to keep in mind that best decisions are those that are appropriate to a given task and a situation: "Decision performance is about the fit between cognition and environment" (Keller et al., 2010, pg. 262).

There is more to the economy of the decision process than higher accuracy alone. A general view has been that reliance on heuristics and nonconscious processing lowers the cognitive load of the processing and speeds up subsequent judgments. That, in turn, frees the brain so that it can focus on things that require deliberate decisions. Heuristics have been shown to speed up the process through the *selectivity of attention*. The implication of the selectivity of attention is aligned with the results of a 2019 study on visual attention that found that people attend to the important features in images first: "When visual stimuli are intermingled, they are understood based on visual hierarchy . . . by recognizing the most important features first" (Kim and Fritsch 2019, 109).

When people utilize heuristics as the criteria that guide the decision process, they automatically ignore and deem irrelevant information that does not fit the criterion or criteria (Damasio, 2012; Gladwell, 2005, p. 143). In other words, they operate according to the selectivity of attention. As an example, one interpreter who sorted drawings according to the out of the norm criterion said, "I was looking for anything that is out of the norm that makes me want to talk to them more." This selective attention was one of the contributing factors to the astonishing efficiency of this interpreter's performance, who on average took only 4.6 seconds to evaluate a drawing. This interpreter reviewed and classified 196 stimulus drawings in 15 minutes. This interpreter was not only impressively speedy, but also more accurate than other interpreters.

Regarding personality characteristics, this efficient and successfully performing interpreter could be described as open toward others, interested in others, nonjudgmental toward others, open toward nondiscursive experiences, creative, and self-accepting. These characteristics were measured through the diversity of professional interests, cultivation of special skills, and volunteer work. These personality characteristics, discussed in an earlier section, have been found among successful diagnostic interpreters. This interpreter's personality profile is also aligned with the findings from research on decision making in product design. Almendra and Christiaans (2009) found that participants' self-esteem plays a role in the decision process: "Subjects with high self-esteem who are assertive and not

averse of risk taking and uncertainty are more likely to decide in ways that allow processes to progress towards a consistent final solution" (p. 517).

In sum, personality characteristics add a genetic dimension to the factors affecting interpreters' judgments, whereas the naturalistic framework accounts for the holistic approach to the perceptual and experiential factors. The argument is that a layperson's skills, knowledge, preferences, and professional expertise in any field are all cultivated by one highly capable mind, be it conscious or unconscious, and contribute to the development of interpretive skills.

Moreover, the study has demonstrated that emotion-laden experiences, such as the experience of abuse as victims in both genders—and in women, in particular—play a powerful role in altering worldviews, which in turn dramatically affect the interpretation of images. This result is aligned with studies on decision-making under the influence of stress and negative emotions such as anxiety, anger, or embarrassment. Such studies indicate that stress and negative emotions can drastically alter the decision process (Tierney & Baumeister, 2019).

The heuristic model pertains to one aspect of the decision process. Deliberate decisions make up the other side. Damasio's (2012) view is that conscious deliberation takes care of reflection over knowledge: "We apply reflection and knowledge when we decide on important matters in our lives" (p. 287). He gives examples of decisions about how to conduct relationships with loved ones and friends, career planning, and moral behavior. Deliberate decisions involve long and careful consideration. Their processing, according to Damasio (2012), competes with the immediate perceptual processing for the limited processing power of the brain to the extent that it can "overwhelm external perception" (p. 287).

In light of this argument, the decision process of interpreters who reported relying on life experiences and did not report more specific decision criteria can be construed as follows: The interpreters shifted their attention inward to recall relevant experiences. The inward move, the recall, and reflection on the experiences may have activated the conscious deliberation process, which made the decision process longer. Seventy-eight percent (n = 18) of the interpreters in this group self-identified as victims of abuse. The data have shown an association between the interpreters' experience of abuse as victims and longer judging time. Some of the abused interpreters indicated wanting to give the drawers full and careful consideration. By the same token, as the abused interpreters recalled the trauma of abuse, they may have gotten distracted by their recollections. Alternatively, as they carefully deliberated the stimulus drawings, they may have experienced the limited processing power of the brain and became overwhelmed by the seriousness of the task and numerous perceptual variables. (Keep in mind that the drawings were rich in form and complex in content.)

Limitations

There are limitations to this study that warrant attention. First, considering the sample design and recruitment strategies with a high self-selection rate of participants, none of whom had training in the evaluation of diagnostic drawings, the results from this study are not generalizable to the broad population of Americans, but rather, apply to individuals who are open to nondiscursive experiences and are interested in other people. A larger sample of diverse interpreters is needed to gain confidence in the conclusions drawn from this study, especially regarding the reliability of an association between heuristics and the accuracy of judgements.

Second, the interviews were conducted after the sorting task. Therefore, the reports were retrospective and might have been interpreters' rationalizations that were automatically created to suffice as insights into the decisions that were nonconsciously realized (Nisbett & Wilson, 1977). There is a risk that interpreters did not access their internal processes but guessed what their decision criteria were. The reason for delaying the request "Tell me how you decided or judged" was informed by research that indicated that questioning the decision process as it occurs can be confusing and can negatively affect the ability to make sound judgments.

Psychology and cognitive science postulate that the decision process takes place on a spectrum between the cognitive unconscious and conscious deliberation (Damasio, 2012). People lack the tools to assess to what degree and which part of the brain was mobilized in the decision process. In defense of introspection, Damasio (2012) argued, "Engaging in introspection turns out to be a translation, within the mind, of a process that complex brains have been engaged in for a long time in evolution: talking to themselves, both literally and in the language of neuron activity" (p. 195). Moreover, Damasio (2012) stated, "Introspection, as we have seen, can provide misleading information. But the risk is well worth taking, given that introspection offers the only direct view of what we wish to explain. Besides, if the information we gather leads to flawed hypotheses, then future empirical testing will reveal them to be so" (p. 195). Thus, self-reports were used as phenomenological indicators of interpreters' awareness of their interpretive criteria and methods, not as veridical statements about the invisible processes that underlie interpretation (Ericsson & Simon, 1984). So, the results should be viewed with an understanding of the limitations of retrospective insights.

Third, one-person coding—the result of time constraints and lack of funding—poses a methodological limitation of this study. In an ideal world the coding would have been performed by more than one person, and inter-rater reliability measures would have been reported. Future research projects that build on the study presented in this

article can incorporate inter-rater reliability measures to increase the validity of the data and analysis.

Fourth, the study's method was not granular enough to capture the decision processes of the interpreters who reported relying on life experiences broadly conceived. Those reports have not been linked with specific operational decision criteria. The interpreters in that group might have applied heuristics without realizing it or without mobilizing enough introspective effort that would allow the interpreters to identify and report more specific criteria for the decision process.

Significance and Future Research

The study presented in this article empirically tested the utility of a framework that can be applied to studies of interpretive judgments. This integrative framework makes possible empirical research that accounts for both biological and cultural dimensions of interpretation. The framework perfectly fits the intuitive and open-ended foundation of the creative process by relying on naturalistic methods as they are applied in real-life situations. This study sets a stage for developing an empirically grounded methodology for exploring how people infer meanings from images. Whether used independently or together with the heuristic decision model, Brunswik's (1952) ecological approach to perceptual judgments is suitable to both qualitative and quantitative methods. Ample research that utilizes his methodology in perceptual and cognitive psychology can inform future researchers studying how images are interpreted (Juslin & Montgomery, 1999; Kirlik, 2009). Similarly, the heuristic approach that links processes of image interpretation with visual cognition and heuristic judgments applies a body of knowledge from those research areas as well.

The results illustrate how Brunswikian principles of perceptual judgments, especially Brunswik's (1952) emphasis on the selectivity of perceptual judgments, can be applied to studies of visual interpretation. Importantly, he provided both a theory that is grounded in empirical research and a methodology that is well suited to such research that is concerned with visual interpretation as a decision process. Brunswikian calls for experimental studies that mirror real-life situations are not new. For instance, naturalistic methods flourish in user testing in human-computer interaction design. User studies provide naturalistic or real-world settings without the label "naturalistic." Users' interactions with the computer are set up to simulate real-world or real-life situations. However, they are applied without a theoretical grounding—that is, without a general theory that can explain how people make sense of the external world with which they interact. A Brunswikian model can provide such a framework.

The results of this study lay the foundation for a model of visual interpretation as a complex decision process that is affected by specific factors. The results show that visual interpretation is not a matter of visual perception alone, but involves a complex process of decision making that depends on the decision criteria, personality factors, gender, and emotional biases. The model can be expanded by future studies of other factors. Moreover, the results show that people are successful in making inferences, consciously or not, about the meaning of images in situations with incomplete information and limited access to time or decision aids, such as statistical tools or additional information about the subject. Those inferences are consequential insofar as they guide subsequent decisions and actions.

Importantly, the study conceptualizes interpretation of images as a decision process of a certain kind: one that relies on abductions—that is, creative leaps of ideas. The sorting task required that interpreters make guesses about the drawers' state of mind based on how interpreters judged what they saw in the drawings. In Peircean terms, abduction is "the process of forming explanatory hypotheses" (CP, 5.171). It is an "act of insight" by which new knowledge can be obtained (CP, 5.181). In general, abduction is at the core of creative and aesthetic endeavors, including design (Merrell & Queiroz, 2010). Designers make abductions all the time, although without attaching the "abduction" label to the process.

The results of the study draw designers' attention to the significance of images that are outside the norm. Knowing the characteristics of images that deviate from the norm can play a strategic role in utilizing the images to capture attention and to elicit specific affective responses in the users and audiences. That is especially true for images representing universal, common emotions such as fear, anger, sadness, happiness, disgust, and surprise (Damasio, 2012, p. 131). Further, knowing which indicators of negative emotions tend to be associated with the deviation from the norm can be strategically utilized in the design of images.

Future research, first, can investigate the following questions about the decision process and the decision context: Under what conditions do people utilize heuristics? When do people utilize deliberate decision processes? And which decision criteria are more effective and under what conditions? Future research also can lead to a better understanding of the subjective factors that affect the decision process by asking about the characteristics of interpreters who devise heuristic strategies more often than others and in what situations.

Second, future studies can evaluate the heuristic-based model of visual interpretation using the think-aloud method (Nielsen, 1993, 2012) rather than retrospection. Participants can be asked to speak aloud the criteria by which they judge images during the process of judging. Moreover, such studies can evaluate whether the thesis of the study—that is, that people have competencies in visual analysis regardless of their

professional expertise—holds true for designers and non-designers when faced with varied types of images.

Recommendations for Design

The primary goal of visual design is to design for human use, that is, *to make things scrutable* and *easy to understand and use*. To understand visual design is a matter of understanding patterns, patterns within patterns, and patterns connecting with patterns. It is a gestalt. Directional signs or way-showing signs are ways to create patterns. The goal of design is to flatten the learning curve by making consistency and a hierarchy of patterns comprehensible as well as by building on what people already know and apprehend. This study contributes to such a goal. The results of this study suggest that examining decision making can lead to a better understanding of the process of visual interpretation. The conceptual framework of visual interpretation as a decision process that involves specific decision criteria can be utilized in human-centered design. The heuristic criteria that have been identified by the study (except for the elaboration heuristic)[8] are applicable to the study of how people make sense of visual designs. Here is how the heuristic criteria can guide designers' work:

(1) Designs must be *easy to understand* by people who use them.

(2) Incomprehensible designs are associated with negative emotions and are construed as *deviations from the norm*. Such designs raise *red flags* in the minds of users and are usually rejected.

(3) Designs must have a clear and understandable (to users) *dominant purpose and function*.

(4) Designs must function as *coherent wholes*, not as assemblages of disparate elements.

(5) Designs must be built on *patterns that users recognize*.

These factors play a role in evaluating whether users can make sense of and be drawn toward or away from newly designed environments, communications, or devices. It is the responsibility of designers to create situations that enable people to reliably and intuitively learn to recognize new patterns of information. Designers are well-advised to keep in mind that what is normal for some may not be normal for others, because a sense of normalcy develops over time from experience. Hence, it is wise to avoid making assumptions about users based on one's own experience and instead to rely on users' feedback.

8 The elaboration heuristic is not applicable to non-trauma-related situations because it relates to the belief that trauma is associated with elaborated drawings.

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