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Contributions of Cognitive Science to the Rorschach Technique: Cognitive and Neuropsychological Correlates of the Response Process

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This article presents an understanding of the Rorschach Technique in terms of emergent models from cognitive science. We propose a linkage between cognitive psychology and neuropsychology in understanding the operations that underlie the Rorschach response process. Contemporary information processing models are described. The Rorschach Technique is conceived of as a complex process involving all areas of the cerebral hemispheres, encompassing various aspects of visual attention and perception, object recognition, associative memory, language production, and executive functioning. Exner's model of the response process is delineated, including both Association and Inquiry phases, in terms of requisite underlying neuropsychological abilities and anatomical substrates. The question of the Rorschach Technique's status, utility, and potential as a neuropsychological assessment tool is discussed. Understanding the Rorschach in terms of contemporary cognitive psychological and neuropsychological models heightens appreciation of the technique's complexity and provides a heuristic and conceptual foundation for empirical research.

The cognitive revolution in psychology that has taken place over the last 30 years, in combination with recent developments in neuroscience and cognitive neuropsychology, has set the stage for applying exciting new perspectives to the Rorschach Technique. As yet, applications of cognitive psychology and neuropsychology to the Rorschach Technique are not well developed. The Rorschach response process is a complex process integrating visual, semantic, and executive cerebral functions. Cognitive psychological and neuropsychological ideas provide fertile resources for understanding the processes that underlie the deceptively simple task of answering the question: "What might this be?"

This article is the third in a series articulating Rorschach psychology in terms of a dominant psychological paradigm: cognitive science (Acklin, 1991, 1994). The purpose of this study is an examination of the cognitive, psychological, and neuropsychological functions and abilities that attend Exner's conceptualization of the Rorschach response process (Exner, 1989, 1993). We believe that a cognitive neuropsychological approach to the Rorschach represents a potentially useful, contemporaneous framework for understanding Rorschach phenomena. Our purpose here is to demonstrate how a cognitive science framework illuminates the processes into which the Rorschach Technique taps.

STATUS OF THE RORSCHACH IN NEUROPSYCHOLOGICAL ASSESSMENT

The status, utility, and potential of the Rorschach Technique as a neuropsychological assessment tool has never been developed. Defining a neuropsychological assessment instrument, however, is not as straightforward as it might initially seem. A sharp debate is current about the definition, relationship, and what distinguishes cognitive and neuropsychological assessment measures (Mapou & Spector, 1995). Lezak (1994) defined a neuropsychological test as "a procedure that examines the integrity of the brain by examining its behavioral product" (p. 9). Mapou (1988), on the other hand, argued that using neuropsychological testing to localize or lateralize brain function is no longer a necessary enterprise and that instruments should be evaluated based on their sensitivity to changes in specific aspects of cognitive function, rather than their sensitivity to brain damage per se. Nevertheless, neuropsychologists continue to insist that sensitivity, localization, and lateralization remain the ultimate tests of an instrument's validity (Spector, 1995, p. 346). Lezak (1983) suggested the use of the Rorschach to assess perceptual abilities in brain-injured subjects. She specified four aspects of perceptual activity that Rorschach and other tests using ambiguous visual stimuli may tap: (a) accuracy of percept, (b) subject's ability to process and integrate multiple stimuli, (c) reliability (e.g., many brain injured patients do not trust their perceptions), and (d) use of reaction time. Though Exner has frequently presented workshops linking neuropsychological evaluation data with the Rorschach, the literature is absent of published studies. In short, the status of the Rorschach as a cognitive and/or neuropsychological assessment measure is currently undeveloped, though we contend that it may have great potential, especially with a standardized approach provided by the Comprehensive System and increasing sophistication in classifying neuropsychological insults by means of neurodiagnostic imaging techniques.

INFORMATION PROCESSING APPROACHES

Information processing approaches are at the center of the cognitive revolution. Information-processing analyses define human cognition as a series of stages, or transformations, between stimulus input and response output (Greenwald, 1992). Information processing approaches focus on the structures and operations of cognition and how they function in the selection, transformation, encoding, storage, retrieval, and generation of information and behavior (Acklin, 1994).

In its initial stages, the cognitive revolution made giant leaps forward in understanding human cognition by approaching mental processes in terms of the serial or sequential processor of a digital computer. The "sequential symbolic" or "symbolic" paradigm has dominated the field of cognitive psychology for almost three decades. Figure 1 depicts a typical symbolic model of mental processes (Acklin, 1994; Feldman & Ballard, 1982). The emergence of an information processing paradigm allowed for a more sophisticated view of the way people think and was a potent catalyst for research in cognitive experimental psychology. More

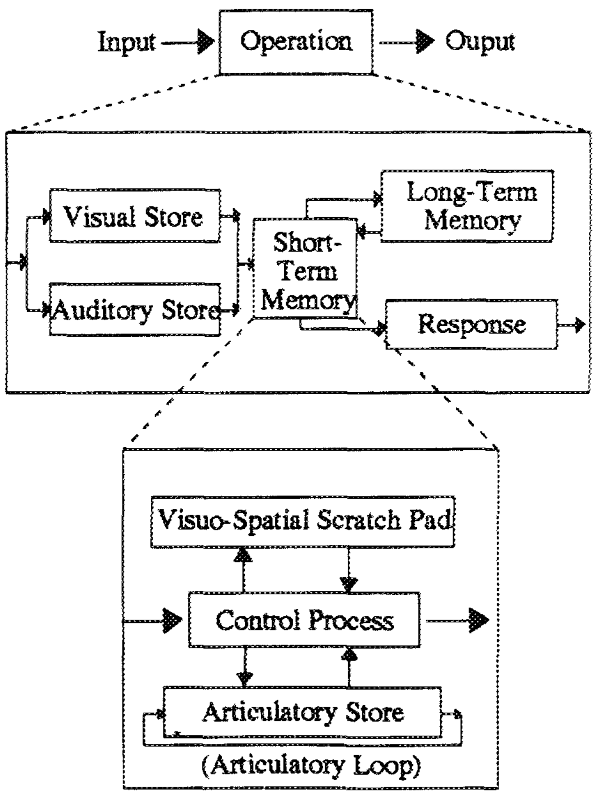

FIGURE 1 Schema of a serial or symbolic model of mental processes. From "Some contributions of cognitive science to the Rorschach test," by M. W. Acklin, 1994, *Rorschachiana, XIX*, p. 135. Copyright 1994 by Hogrefe and Huber Publishers, Seattle Office, P. O. Box 2487, Kirkland, WA 98083. Reprinted with permission.

recently, however, limitations of the sequential processing model have become apparent, specifically with respect to limits in the speed and simultaneity of serial processing models in simulating human cognitive processes.

Currently, theories of cognitive architecture are viewed as either sequential/symbolic, connectionist, or some amalgam of the two. The elements of symbolic approaches consist of physical tokens, or "symbols," that are stored in associative structures (Stein, 1992). Sequential/symbolic paradigms include levels of processing models (Craik & Lockhart, 1972), spreading activation constructs (Collins & Loftus, 1975), and schema approaches (Neisser, 1967). Connectionist models, on the other hand, view cognition as distributed and parallel-processed, based on interconnected neural networks (Rumelhart & McClelland, 1986a, 1986b). Figure 2 depicts a connectionist network illustrating the continuous and simultaneous processing performed by numerous simple, but densely interconnected, elements. Connectionist systems attempt to model mental processes by approximating the functioning of neural networks. With the advent of parallel-distributed processing and neural network models, reliance on a neural rather than a computer metaphor for mental functioning better approximates the way the brain actually works. Parallel-distributed processing models exploit "brain-like" models of information processing (Norman, 1986). With the advancement of neural models of information processing, the focus is now on parallels between cognition and brain processes.

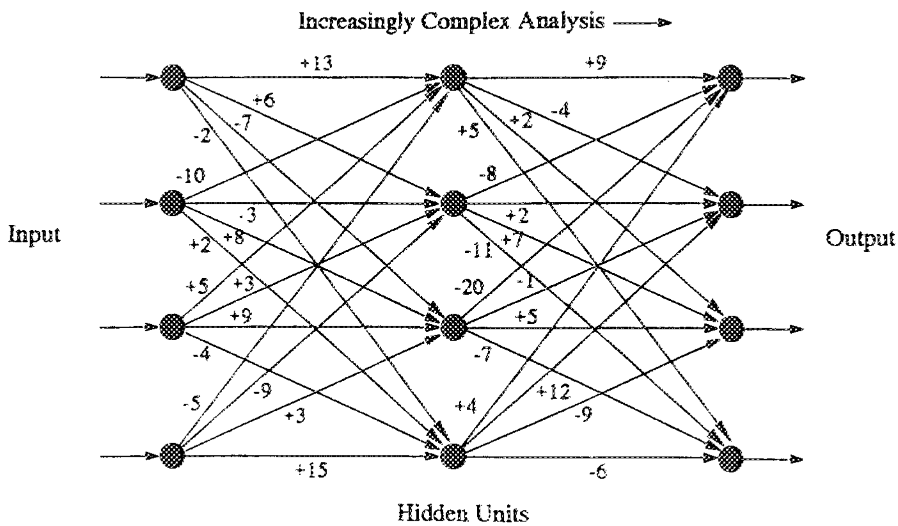

FIGURE 2 A connectionist network illustrating continuous and simultaneous processing. From "Some contributions of cognitive science to the Rorschach test," by M. W. Acklin, 1994, *Rorschachiana, XIX*, p. 136. Copyright 1994 by Hogrefe and Huber Publishers, Seattle Office, P. O. Box 2487, Kirkland, WA 98083. Reprinted with permission.

Rapid developments in neuroimaging, specifically positron-emission tomography (PET) and regional cerebral blood flow (rCBF) technology, as a means for observing real-time brain processes involved in the performance of problem-solving (e.g., solving a chess problem), promises to open a whole new frontier in understanding human cognition (Grafman & Tamminga, 1995; Selemon, Goldman-Rakic, & Tamminga, 1995).

RESPONSE PROCESS

Acklin (1991, 1994), in two previous articles, applied basic cognitive psychology, including information processing, schema theory, and connectionist models, to the Rorschach response process. The current contribution extends this thinking to a more defined examination of Exner's notions of the response process in terms of underlying cognitive processes and neuropsychological abilities. Exner's conception of the Rorschach response process contains an embedded information processing model (see Table 1; Exner, 1989). However, he does not address issues of internal processing and transformation of blot information, ignoring, particularly, the role of parallel and distributed processing or schema activation. We believe that explicating the processes that underlie the response process will both deepen understanding and appreciation of the test and assist in developing testable hypotheses for research.

ASSOCIATION PHASE

To begin exploring the cognitive complexities inherent in the Rorschach response process, we specified the neuropsychological and cognitive abilities associated with Exner's conceptualization of the task. For the association phase, these include short-term auditory attention; visual attention, scanning, and encoding; retrieval from long-term memory; short-term visual storage; pattern recognition and good-

TABLE 1
Response Process Phases and Operations

Phase I	1. Encoding the stimulus field
	2. Classifying the encoded image and its parts into potential answers
Phase II	3. Rescanning the field to refine potential answers
	4. Discarding unusable or unwanted answers by paired-comparison ranking or censorship
Phase III	5. Final selection from remaining potential answers
	6. Articulation of the selected answer

Note. Exner's conceptualization of the Rorschach response process. From "Searching for projection in the Rorschach," by J. E. Exner, Jr., 1989, *Journal of Personality Assessment, 53*, p. 522. Copyright 1989 by Lawrence Erlbaum Associates, Inc. Reprinted with permission.

ness-of-fit operations; semantic processing; and verbal expression and articulation. In addition, the context of the evaluation must be maintained in "working memory" (Baddeley & Hitch, 1994) as a sort of censor, because what one says may oftentimes have practical consequences. The notions of a visuospatial "sketchpad" (Baddeley & Hitch, 1994), which stores and manipulates input, and an "attentional window" (Kosslyn & Koenig, 1992), which directs attention in stimulus search and classification processes, are useful in considering the functioning of working memory. Determination of anatomical areas involved in these functions is somewhat arbitrary because processing is continuous and simultaneous. Neuropsychologically, these operations involve functions that are widely distributed and integrated in the response process, including the prefrontal areas in maintaining attention, context information, and response inhibition; temporal cortex and hippocampus in memory processing; visual and associational cortex in retrieval and "goodness of fit" operations; and left-hemisphere language processing for response production and articulation.

Our focus is on "higher level," or "top down," processing, though one cannot overlook the need for the integrity of "lower level" processing. These include sensory receptors, neural tracts, brain stem operations, and cerebellar functions that are involved in maintaining a conscious, aware, upright, and sentient human subject (Kim, Ugurbil, & Strick, 1994). Higher level processes, our concern here, are those that are the most "mental" (Kosslyn & Koenig, 1992) and distinguish humans from lower animals.

The processes of visual attention, scanning, and processing involve two primary neural tracts. The ventral system of brain areas runs from the occipital lobe down to the inferior temporal lobe. The ventral system processes stimulus information related to object properties such as shape and color. The dorsal system runs from the occipital lobes up to the parietal lobes. The dorsal system deals with spatial properties of the stimulus, including location in space, actual size, and orientation. Neurons in both areas have large receptive fields. Outputs from both ventral and dorsal encoding systems converge in associative memory where they are matched to stored information (Gochin, Colombo, Dorfman, Gerstein, & Gross, 1994; Kosslyn & Koenig, 1992). As noted by Kosslyn and Koenig (1992): "Stored information is used to make a guess about what we are seeing, and this guess then guides further encoding" (p. 57). This use of stored information in subsequent scanning and processing is a sort of hypothesis testing phase, or "classification" during Exner's Phase I (see Table 1) and "Rescanning and Discarding" (most of Exner's Phase II). In categorizing the stimulus, property "look-up" (i.e., identification and categorization) subsystems access associative memory in search of distinctive stored properties of the candidate object and their properties (Kosslyn & Koenig, 1992). If the object represented to the visual fields is ambiguous or requires more extensive processing as, for example, aspects of the Rorschach blots that are not readily classified (i.e., *Dd* areas), then constraints set by stimulus features as well as context-direct subsequent processing. These constraints result in activation of specific spatial relationships to the attention shifting subsystem, as well as a similar activation of the pattern activation subsystem. The attention window is moved to the location of the to-be-imaged part, and the image of that part is activated. (Kosslyn & Koenig, 1992).

Memory processes play a central role in the Rorschach response process. The neural processes underlying the formation and maintenance of perceptual and propositional memory involve a set of anatomical structures—the hippocampus, limbic thalamus, and basal forebrain. The hippocampus is not only involved in the storage of new representations of stimulus properties, but also in storing associations between representations (Mishkin & Appenzeller, 1987). The limbic thalamus appears to be involved in attentional processes, especially in priming, amplifying, augmenting, and relaying to-be-remembered information (Mishkin & Appenzeller, 1987). The basal forebrain is linked through acetylcholine-containing neurons to various structures involved in perceptual encoding, as well as to the hippocampus (Kosslyn & Koenig, 1992).

Object identification, of course, implies more about the stimulus than is apparent during immediate input. Identification of an apple, for example, implies knowledge about what an apple is, what it is for, where it comes from, and what is inside it (Kosslyn & Koenig, 1992, p. 53). Similarly, activation of long-term memory processes during the association phase of the Rorschach Test activates episodic memory; that is, biographical memory that has self reference (Acklin, Bibb, Boyer, & Jain, 1991). This tends to support the long-held contention that Rorschach "percepts" are ultimately linked to experience and phenomenology (Acklin, 1994). This approach also eliminates the distinction, long held in projective psychology, between the notion of "pure" perception and apperception, in which perception is inevitably linked with needs, motivation, organismic states, and episodic memory (Bellak, 1975; Bruner, 1992; Greenwald, 1992). Bruner (1992) wrote that the message of the "New Look" was that "perception was not, in the positivist sense, a mere registration of what was 'out there' but was, rather, an activity affected by other concurrent processes of thought, memory, and so on" (p. 780).

Validation of these notions awaits studies of the Rorschach Test in relation to functional deficits associated with specific cerebral damage; for example, "impaired processing subsystems, impaired connections among subsystems, compensatory changes, and reduced activation" (Kosslyn & Koenig, 1992, p. 10). These studies might include Rorschach examination of typically encountered lesion-associated neuropsychological conditions, including visual agnosias, prosopagnosia, and visual neglect. Brain scanning techniques have found that visual mental imagery processes result in large increases in rCBF in the occipital lobe, posterior superior parietal lobe, and posterior inferior temporal lobe, all of which have been previously mentioned as central to visual encoding processes. Similarly, PET research has shown that the occipital lobe is activated when people perform visual imagery tasks. Confirmation of these notions as they apply to the Rorschach await rCBF and PET studies.

Exner's Phase III of the response process, Final Selection, involves the "styles, habits, and dispositions" aspect of the process that lies at the heart of what we call personality. Although we cannot rule out the idea that individuality of information processing is the distributed output of whole brain operations, it is likely that these aspects of personality are associated with the prefrontal areas of the brain. Schemas, as information structures that are individualized and the result of learning, form the basis for both "styles" and content of the response. These include, for example, selective attention and perceptual defense, studies of which during the era of the New Look illuminated how emotional or motivational processes impact perception (Greenwald, 1992). They would include, further, selective or biased attention to emotional memory in the retrieval from long-term memory during the choice, censoring, and formulation of the verbal response. Many of these processes may be conscious, that is, intentional. Most others, and this is the basis of the notion that the Rorschach taps into more covert personality processes, are not. The role of schematic activation as an organizer of thinking is not normally conceptualized as being a process that can be monitored by metacognition, namely the participant's knowledge, understanding, and awareness of cognitive processes and states (Greenwald, 1992). Finally, aside from process factors in how the response is formulated, there is the actual content of the response. Acklin (1994), quoting Norman (1986), noted that schemas are essentially ad hoc prototypes that are constructed anew for each occasion by combining past experiences with their biases and activation levels resulting from the current experience and the context in which it occurs. Rorschach content, as mentioned earlier, accesses episodic memory and is a retrieval of lived experience.

INQUIRY PHASE

The instructional set imposed by the Inquiry is both more and less complex for the participant. The participant is confronted with his or her productions, and is required to rehear, rescan, remember, justify, and rearticulate. This requires sustained attention, short-term verbal and visual memory, goodness-of-fit operations with the previously articulated response, and verbal and logical justification of the response. Here, again, a highly integrated blend of prefrontal, temporal, occipital, and parietal operations are required to fine-tune the response and justify it in terms of logical categories and reasons.

SUMMARY

The test of the Rorschach's profundity is its ability to transcend theoretical and paradigmatic shifts and fads. The impact of cognitive neuroscience and neuropsychology is just beginning to be felt in Rorschach psychology and likely to be influential for a long time to come. The true value of paradigm shifts is the incremental capacity of the new framework to illuminate the phenomena of interest. We submit that a cognitive neuropsychological approach to the Rorschach promises to further deepen our understanding and appreciation of the test. We believe that emerging applications of cognitive science to the Rorschach will deepen our understanding of the test as well as provide the basis for a new frontier of research. Despite widespread concern that the emergence of neurobiological models of cognition will threaten psychological theories and tests based on them, including the Rorschach, the incorporation of these advances, we contend, will allow for a more sophisticated approach to understanding human behavior and, ultimately, its underlying cognitive processes.

REFERENCES

Acklin, M. W. (1991). Alexithymia, somatization, and the Rorschach response process. In I. B. Weiner (Ed.), *Rorschachiana XVII* (pp. 180–187). Bern, Switzerland: Verlag Hans Huber.

Acklin, M. W. (1994). Some contributions of cognitive science to the Rorschach Test. In I. B. Weiner (Ed.), *Rorschachiana XIX* (pp. 129–145). Bern, Switzerland: Hogrefe and Huber.

Acklin, M. W., Bibb, J. L., Boyer, P., & Jain, V. (1991). Early memories as expressions of relationship paradigms: A preliminary investigation. *Journal of Personality Assessment, 57*, 177–192.

Baddeley, A. D., & Hitch, G. J. (1994). Developments in the concept of working memory. *Neuropsychology, 8*, 485–493.

Bellak, L. (1975). *The TAT, CAT, and SAT in clinical use* (3rd ed.). New York: Grune & Stratton.

Bruner, J. (1992). Another look at New Look 1. *American Psychologist, 47*, 780–783.

Collins, A. M., & Loftus, E. (1975). A spreading-activation theory of semantic processing. *Psychological Review, 82*, 407–428.

Craik, F., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11*, 671–684.

Exner, J. E. (1989). Searching for projection in the Rorschach. *Journal of Personality Assessment, 53*, 520–536.

Exner, J. E. (1993). *The Rorschach: A comprehensive system. Volume I* (3rd ed.). New York: Wiley.

Feldman, J., & Ballard, D. H. (1982). Connectionist models and their properties. *Cognitive Science, 6*, 205–254.

Gochin, P. M., Colombo, M., Dorfman, G. A., Gerstein, G. L., & Gross, C. C. (1994). Neural ensemble coding in inferior temporal cortex. *Journal of Neurophysiology, 71*, 2325–2337.

Grafman, J., & Tamminga, C. A. (1995). Images in neuroscience: Cortex, IV. *American Journal of Psychiatry, 152*. 163.

Greenwald, A. G. (1992). New Look 3: Unconscious cognition reclaimed. *American Psychologist, 47*, 766–779.

Kim, S. G., Ugurbil, K., & Strick, P. (1994). Activation of a cerebellar output nucleus during cognitive processing. *Science, 265*, 949–951.

Kosslyn, S. M., & Koenig, O. (1992). *Wet mind: The new cognitive neuroscience*. New York: Free Press.

Lezak, M. (1983). *Neuropsychological assessment* (2nd ed.). New York: Oxford University Press.

Lezak, M. (1994). *Neuropsychological assessment* (4th ed.). New York: Oxford University Press.

Mapou, R. L. (1988). Testing to detect brain damage: An alternative to what may no longer be useful. *Journal of Clinical Experimental Neuropsychology, 10*, 271–278.

Mapou, R. L. & Spector, J. (1995). *Clinical neuropsychological assessment: A cognitive approach*. New York: Plenum.

Mishkin, M., & Appenzeller, T. (1987). The anatomy of memory. *Scientific American, 256*, 80–89.

Neisser, U. (1967). *Cognitive psychology*. New York: Appleton-Century-Crofts.

Norman, D. A. (1986). Reflections on cognition and parallel distributing processing. In J. McClelland, D. Rumelhart, and the PDP Research Group (Eds.), *Parallel distributed processing: Explorations in the microstructure of cognition. Vol. 2: Psychological and biological models* (pp. 531–546). Cambridge, MA: MIT Press.

Rumelhart, D. E., & McClelland, J. L. (Eds.). (1986a). *Parallel distributed processing: Explorations in the microstructure of cognition. Vol. 1: Foundations*. Cambridge, MA: MIT Press.

Rumelhart, D. E., & McClelland, J. L. (Eds.). (1986b). *Parallel distributed processing: Explorations in the microstructure of cognition. Vol. 2: Psychological and biological models*. Cambridge: MIT Press.

Selemon, L. D., Goldman-Rakic, P. S., & Tamminga, C. A. (1995). Images in neuroscience: Cortex, III. *American Journal of Psychiatry, 152*, 5.

Spector, J. (1995).Integrating cognitive and clinical neuropsychology: Current issues and future directions. In R. L. Mapou & J. Spector (Eds.), *Clinical neuropsychological assessment: A cognitive approach* (339–354). New York: Plenum.

Stein, D. (1992). Clinical cognitive science: Possibilities and limitations. In D. J. Stein & J. E. Young (Eds.), *Cognitive science and clinical disorders*. San Diego, CA: Academic.

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