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ARTICLES

The "Feeling of Movement": Notes on the Rorschach Human Movement Response

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ABSTRACT
Human movement responses (M) on the Rorschach have been traditionally viewed as lying neither completely in the inkblot (external reality) nor within the subject's mind (inner world). The authors contend that M is not reducible to the "body that I have" but to the "body that I am," which is a higher level organization of bottom-up and top-down brain networks, integrating body implicit awareness, psychological functioning, and social cognition. Two sources of evidence suggest the close relationship among M, psychological functions, and brain mechanisms. One comes from meta-analytical evidence supporting the close association between M and higher level cognitive functioning or empathy. The second comes from some preliminary studies showing that M activates brain circuits included in the mirror neuron system (MNS). Two conclusions can be drawn: (a) M is related to the effective use of the mentalization function; and (b) future neuroscientific investigations could lead to an understanding of the neuropsychological mechanisms underlying Rorschach responses and variables.

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The human movement response (M) is one of the oldest and most investigated Rorschach scores. Despite the breadth of differences among Rorschach systems over the past century, M has been retained in all coding systems (Exner, 1969), and there is broad consensus among clinicians regarding its conceptual meaning and clinical significance (Weiner, 2003). For example, Piotrowski (1977) suggested Ms "provide, more than any other single test component, specific and significant information about the individual's role in interhuman relationships that matter to him" (p. 189). Rapaport, Gill, and Schafer (1946) claimed that M indicates the ability to delay the individual's emotional response, the readiness to anticipate events effectively, and the flexibility of perceptual and associative processes in general. Exner (2003) considered M as an index of the active and deliberate directing of one's inner life. In the Rorschach Performance Assessment System (R–PAS; Meyer, Viglione, Mihura, Erard, & Erdberg, 2011), the developers view M as "a type of mentalization that contributes to the capacity for identification with others and for empathy" (Meyer et al., 2011, p. 340). Additionally, meta-analytical evidence has demonstrated that M responses are associated positively with mental abilities such as planning, intelligence, imagination, and empathy, and negatively with education and diagnoses of attention-deficit hyperactivity disorder, Alzheimer's disease, Asperger's disorder, and closed head injury (Mihura, Meyer, Dumitrascu, & Bombel, 2013).

Rorschach determinants reflect distinct perceptual features, pulled directly from the actual characteristics of the blots. Three categories of determinants—form, color, and shading—are inherent to the Rorschach stimuli and, when used, determine the response (hence the label of *determinant*). The fourth category (movement) is different. Although M is a determinant, the origin of the representation (e.g., the common Card III response of "two people dancing together") differs from the perceptual processes underlying the other three determinants. Because blots do not move, perceived movement is added to the stimulus field, presumably as a product of ideational and imagined activity of the respondent. In the Comprehensive System (CS), M, especially when occurring with embellishments and poor form quality, is regarded as an example of projection, in which the subject infuses an external perception with inputs from the inner world (Exner, 2003). Given this characteristic, human movement seems more of a Special Score than an actual determinant. In this same sense, Rapaport et al. (1946) considered M as a "fabulized" response, indicating that the subject's associations had departed from the reality of the blot. In their view, "fabulization" occurred when the response was embellished with imagination (or ideation) belonging to the inner world of the subject, not the reality of the blot (e.g., "a *beautiful* flower," "an *angry* face," or "*flying* bat"). As such, fabulization was an index of pathological thinking when it occurred excessively in a protocol. In contrast, Mayman (1977) viewed M as one of the healthiest ways to enliven a response with ideation and fantasy.

Consistent with these views, we regard M as an experience of implicit movement that comes from the internal world of the subject, who adds this imagined feature to the static inkblot. In keeping with recent neuroscientific findings on embodied stimulation (Damasio, 1999; Northoff, 2014; Solms & Turnbull, 2002), we hypothesize that Ror-

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schach human movement responses are related to an unconscious sense of movement embodied in the subjective, prerational body.

Scoring M: Kinesthetic and objective criteria

Whereas it seems quite clear what M is (higher level psychological functioning), it is more difficult to understand where it is. Unlike the determinants of form, color, and shading, M is a product of both the objective perceptual features of the blot and the subjective ideational activity of the subject. The scoring criteria for M in the literature have followed this ambiguity by endorsing either the subjective or the objective side of the coin. Rorschach was firmly convinced of the relevance of the subjective criterion, as he considered M the result of an inverse relation between physical motility and psychic dynamism, between outward action and inner life. The idea of *M* came to him after a particular dream. The night following his first autopsy as a medical student, he dreamed that his own brain was being cut into slices and felt them falling forward, one after another, across his forehead. The visual image of the falling slices was translated into a physical sensation of this movement, a feeling that is impossible when viewed from a physiological perspective, as the brain has no interior sense of movement and is not sensitive to touch. He therefore wondered how visual images could be translated into and reexperienced as kinesthetic images (Akavia, 2013). According to Rorschach, the scoring criteria for M (or K for *kinesthesia,* in German) were therefore defined as

> those interpretations in which it can be ascertained that *kinesthetic* engrams (visual memories of movements observed, imagined, or executed previously) have had a determining influence in addition to the consciousness of the form of the blot. The subject imagines the object "seen" as moving. … Does the movement indicated play a primary role in the determination of the answer? Do we deal with an actual *sensation of motion,* or simply the conception of a form that is secondarily interpreted as moving? (Rorschach, 1942, pp. 22–25)

In other words, Rorschach emphasized an internal experience, in this case, a primary feeling of movement, of which the subject might or might not be aware. Although from his words, one cannot conclude whether the movement is necessarily felt and not simply imagined, Rorschach was convinced that this primary feeling of movement, without actual bodily movement, would be necessary to consider M as the true determinant of the response. Furthermore, he believed that true M responses were not simply perceived forms that were secondarily interpreted as moving. Indirect support for this belief can be found in his coding of animal movement as a pure form response. Simply seeing or imagining an animal moving does not convey the necessary primary feeling of movement, unless the movement was anthropomorphized, or perceived as a form of movement, which humans, themselves, can feel (Rorschach & Oberholzer, 1923). However, the difficulty with Rorschach's original idea is that the observer cannot really know whether the subject consciously perceives the movement within him or her while delivering an M response.

To address this difficulty and reduce ambiguity, contemporary Rorschach systems have established objective scoring criteria for M responses. For example, in the CS, "*M* is scored for human activity … it could not be assumed simply when human figures are perceived. The movement itself must be articulated for a response to be scored *M*" (Exner, 2003, p. 107). Similarly, in the R–PAS, M is scored when the human figure "is seen in motion … and includes all types of human activity, experience, sensation, and emotion" (Meyer et al., 2011, p. 44).

M and the notion of body

More than other Rorschach responses, Schafer (1954) considered *M* as "a dialectic tension between *external* reality (actual features of the blot) and *inner* world (inside feelings)" (p. 109, italics added). Along the same lines, Schachtel (1959) stated that "in the perception of the movement on the Rorschach, the subject knows not merely from the *outside,* but from the *inside,* how the human figure seen in the blot moves or holds his posture. It was *as if* he were for a moment and to some extent inside the figure" (p. 71). These authors seem to suggest that human movement is in the subject (although not necessarily consciously perceived) but also as if it is in the blot when the subject verbally articulates the response.

Arnheim (1951), the first professor of psychology of art at Harvard University, called human movement on the Rorschach "movement without motion" and thought that as the subject "experiences the visual dynamics of the percept, a corresponding *muscular sensation* is aroused in his *own body*" (p. 277). Arnheim introduced the notion of body as a third component within the dialectic tension between outside and inside. According to his suggestion, M is in the blot and in the mind; at the same time, though, it is neither completely in the blot nor in the mind. Rather, it is in the body. However, to Arnheim's point, we ask, "Which body?"

In agreement with phenomenology (Merleau-Ponty, 1945/1962; Needleman, 1963), contemporary neuroscience indicates that human beings have two different kinds of representations of the body, the body that I have and the body that I am (Gallese, 2009). It is relatively easy to define the body that I have: It lives in the external space as an object among other objects. We can see it directly by looking at our picture or through a mirror. Everyone can see it from the outside and everyone can even see the internal body (e.g., viscera, lungs, pancreas) through appropriate technical devices. In German, this is referred to as *Koerper,* indicting an explicit dimension of the body that the subject is largely aware of, that can be easily put into words, and that is largely mediated by cortical structures in the brain (Gallese, 2014). However, it is much harder to define the body that I am (referred to as *Leib* in German) because it is not an object among other objects. It is not consciously perceived by the subject; and because it is prerational and largely mediated by limbic and extracortical brain structures, it is difficult to translate into words (Damasio, 2010). In borrowing these terms from philosophy and neuroscience, we hypothesize that M is more related to the implicit feeling of movement within the body that I am, rather than the conscious and explicit motion expressed by the body that I have.

The body that I am as an emergent property

Accumulated data in neuroscience (Damasio & Carvalho, 2013) have shown that the central nervous system (CNS) is continuously monitoring the external (via sensory channels) and the internal (via proprioceptive channels, from heartbeats to glycemic levels to intestinal motility, etc.) environment in real time. Through ascending steps (from spinal cord to brainstem, hypothalamus, and thalamic nuclei), some brain cortical structures (anterior cingulate cortex, prefrontal cortex, hippocampus, amygdala, nucleus accumbens, basal ganglia, and particularly the insula and the somatosensory cortex) actively build body maps. These become the means through which the brain informs itself about the changing states of the body by integrating top-down cognitive-affective information, connecting the current body states with stored images and experiences in memory, and providing direct substrates of feelings (Damasio, 1999).

Many biologically important connections between perception and movement are hardwired in the brain and do not depend on learning (Malmgren, 2000). For example, in the phenomenon of the visual cliff (Gibson & Walk, 1960), infants who are put on glass, under half of which the lower bottom of a cage is visible, strictly avoid walking onto that half, although they have never had any experience of falling. This behavior is not based on any learned association because the infants (specifically, the body that they have) had never been exposed to such a threat. Nonetheless, this behavior is spontaneously generated by immediate translations of implicit raw emotions of fear and into a proprioceptive feeling of physical insecurity and then to an explicit behavior of avoidance (the body that they are). Mental and bodily events, as well as perceptual and interpretive (or projective) phenomena, should not be considered as distinct entities belonging to separate places (outside and inside) but, following contemporary neuroscience, as two sides of the same neural coin, the same thing seen from different, sometimes seemingly irreducible, perspectives (Northoff, 2014; Panksepp, 2005; Solms & Turnbull, 2002). Mind and body and brain are equally real, although existing at a different level of complexity.

Many cognitive scientists hold the view that mind is an emergent property of the brain and body. An *emergent property* is a process of complex pattern formation from simpler rules at a lower level, characterized by (a) novelty (it is described with a qualitatively different language from the language of the system), (b) bottom-up direction (it is issued from the interaction of the components of the system), (c) unpredictability (from the local interactions of the components of the system), and (d) irreducibility (there is a complete independence from the components of the system; Chalmers, 1996). The main example often cited for emergence is water. Water (wet and floating when one sees it) emerges from a combination of hydrogen and oxygen but has distinctive properties of its own (not belonging to its constituents, hydrogen and oxygen). In the same way, mind is conceived as a higher level organization of neurons in the human brain, even though the lower level constituent neurons are not able to think themselves (Northoff, 2014; Solms & Turnbull, 2002). Body is seemingly conceived not as an aggregated puzzle of organs and systems (the body that I have), but as a higher level organization of brain networks with a main role played by representation of the body in the somatosensory and motor cortex (the body that I am).

The contemporary concept that mind is an emergent property of the brain and body is the theoretical ground for Bucci's (1997) multiple code theory in integrating neuroscience and psychoanalysis. Within this model, M responses might be conceived as the resulting connections of subsymbolic hardwired patterns of sensory, visceral, and kinesthetic sensations with preverbal representations (feelings, mental images) and verbal symbols (language), thereby allowing for a transformation of the meanings represented in the nonverbal modes.

M can be considered a good example of how the brain informs itself of changes in bodily states through the building of body maps (Damasio, 1999) or, if M is viewed from the Gestalt perspective, the processing of subsymbolic inputs from the body (Bucci, 1997). Rapaport et al. (1946) referred to the Gestalt notion of *praegnanz* (a German word for meaningfulness or pregnancy with meaning) in explaining part of the perceptual mechanisms underlying human movement. The subject sees an imbalanced figure in the blot (e.g., the two human-like characters in D9 of Card III that seem to be bending forward because of the imbalanced stance along the diagonal line) and attributes a direction of change toward a balanced, more stable configuration. At the same time, "the subject is also reacting to the 'imbalance' within himself which the perceptual imbalance reminds him of," as argued by Mayman (1977, p. 233). In our terms, the subject feels the implicit tension in his or her "body that I am," as it is translated in the brain body maps (according to Damasio, 1999) or in referential links (according to Bucci, 1997). The resulting M response is thus based on this complex somatic and psychic input data processing.

Some evidence linking M to implicit body processing

Returning to the question of whether subjects who see human movement in static inkblots are consciously experiencing a sense of movement in their bodies stemming from unconscious and implicit processing of the body that I am, we pose an analogous situation to the experience of physical pain. For example, imagine that you had been burned as a child and have a scar on your body. Then, as an adult, when you see another person with a burn scar, you might feel pain as a conscious current physical experience. You might even be aware of the origin of this sensation and be able to talk about it. On the other hand, you might simply recall the past affective painful experience as a current representation in your mind, still identifiable but not as an actual physical sensation. Which of these is most similar to human movement on the Rorschach? Does seeing "people dancing" on Card III reflect a sense of implicit movement in the body that I am or a memory of how people can move or how the body that I have has moved in the past?

To our knowledge, no study has directly investigated the association between M and multiple assessments of the body that I have (e.g., electromyography) and the body that I am (e.g., functional magnetic resonance imaging [fMRI] of somatosensory cortex and body-related regions of interest such as insula or amygdala). There are only a few studies investigating how M is related to body representations or feelings. In one study (Bendick & Klopfer, 1964) a group of undergraduate students was administered six (three achromatic and three chromatic) Rorschach cards in two different experimental conditions: motor inhibition (subjects were seated in an armchair with their arms strapped at the wrist, their legs at the ankle, and their waist secured behind the chair) and sensory deprivation (subjects were placed alone in a lightproof, soundproof room, and were given earplugs in addition and invited to move slowly up and down the room before administering the test). All three kinds of movement responses (human, animal, and inanimate) were found to increase after sensory deprivation, but only M and FM responses were higher in the motor inhibition condition. In another study (Steele & Kahn, 1969), the Rorschach was administered while muscle potentials were recorded by an electromyogram (EMG) polygraph. Of the 30 experimental subjects, 18 (60%) showed EMG increases with more than half of their produced Ms. No increase in muscle potential was associated with the production of few M responses ($n = 1$–3), but the increased effect was associated with the production of many Ms ($n = 6$–11). In fact, five out of six subjects with no EMG increase had three or fewer Ms, and the subject with the highest number of Ms (11) had nine that were clearly over the criterion. In a third investigation (Greenberg & Fisher, 1973), the researchers used a pre–post study design with Form A and B of the Holtzman cards, similar to the Rorschach stimuli. M responses were found to increase over a variety of experimental conditions involving (a) heightened body awareness, and particularly in exciting (marching while listening to rousing march music) versus deactivating (relaxing while listening to soothing music) auditory stimuli; (b) in post-hypnosis (heightened body awareness) versus before the hypnotic induction; and (c) in relaxation trials focusing on external body (musculature and skin) versus interior body (heart, breath, gut) versus no body focus.

These studies are far from being conclusive, and several arguments can be advanced to explain their findings. For example, in Bendick and Klopfer's (1964) study, M could have increased because of a simple effect of physical constraint. In Steele and Kahn's (1969) investigation, not every subject in the high M group had increased EMG records. Finally, in Greenberg and Fisher's (1973) study, an increase in *M* could have been due to a priming effect. However, more recently, Luciani et al. (2014) analyzed electroencephalogram (EEG) records of a small group of healthy subjects who were exposed to the 10 Rorschach cards and 10 control stimuli (simple geometrical objects). Comparison of mean frequency values of event-related potentials and mean MRI normalized voxel values of the low-resolution electromagnetic tomography showed a greater activation of motor (right BA4) and somatosensory (left BA1, left and right BA2, and left BA7) cortices during exposure to Rorschach cards compared to control stimuli. The involvement of the primary and associated somatosensory cortex might indicate the participants internally generated somatosensory representations to find possible meanings for the unstructured stimuli, which is consistent with the role played by embodied knowledge in social cognition (Adolphs, 2003; Goldman & de Vignemont, 2009) and psychoanalysis (Northoff, Bermpohl, Schoeneich, & Boeker, 2007).

M and mentalization

Accumulated knowledge in neuroscience and these few preliminary Rorschach studies suggest that M responses are a product of processing the implicit feelings of the body that I am, which the subject is not aware of. Stated differently, M seems to refer to the ensemble of complex processes referred to as *embodied cognition* that integrate upstreaming inputs from the peripheral regions of the body and the viscera through hormonal (blood flow) and neural (autonomous nervous system) pathways to the body maps in the brain, as well as downstreaming psychological functions and interpersonal representations from the cortex to the limbic structures.

The ability to make and use symbolic representations of one's own and the other's mental states, which has been found theoretically and empirically to relate to *M* (Mihura et al., 2013), has been referred to as mentalization within the psychodynamic framework (Fonagy, Gergely, Jurist, & Target, 2004). *Mentalization* is defined as a form of imaginative mental activity about others or oneself, namely, perceiving and interpreting human behavior in terms of intentional mental states to make inferences about mental states in oneself and in others. At a theoretical level, the construct of mentalization is consistent with what has already been described regarding M because it establishes a close link between the mental processing of implicit and explicit mind, body, and self and the ability to identify and understand other people. From the perspective of social neuroscience, the multicomponent process of experience sharing and mental state attribution is referred to as empathy or social cognition (Decety, 2012). *Empathy* can be defined as the ability to form an embodied representation of another's emotional state, at the same time being aware of the causal mechanism that induced the emotional state in the other, as well being aware that the source of the state is the other and not oneself (Gonzalez-Liencres, Shamay-Tsoory, & Brüne, 2013).

To our knowledge, no study has investigated the direct relationship between mentalization and M. The findings from the literature reviewed earlier and from Mihura et al.'s (2013) meta-analysis indicate indirect links of M with different, related constructs. Other indirect findings come from another field of investigation. If the relationship between M and mentalization is true, then one would be expected to find negative associations with constructs related to defective mentalization. One of these constructs is represented by alexithymia, a multifaceted personality construct that represents a deficit in the cognitive processing of emotion (Nemiah, Freyberger, & Sifneos, 1976). Alexithymia is currently conceived as two higher order factors including a deficit in affect awareness (difficulty identifying and describing feelings) and the presence of operatory thinking (externally oriented thinking and poor imaginal processes; Taylor, Bagby, & Parker, 1997). Alexithymia partially overlaps with defective mentalization in that it concerns the inability to connect feelings with memories, imagination, and reasoning that gives personal meanings to current feelings and can be used to guide thinking and behavior and regulate states of emotional arousal and interpersonal relationships (Taylor, 2010). In a large sample of consecutive outpatients with medical (inflammatory bowel disease) and psychiatric (mainly mood and anxiety spectrum) disorders (Porcelli & Mayer, 2002; Porcelli & Mihura, 2010), M was negatively associated with alexithymia, whether assessed with the standard self-report 20-item Toronto Alexithymia Scale (TAS–20; Taylor, Bagby, & Luminet, 2000) or the Rorschach Alexithymia Scale (RAS; Porcelli & Mihura, 2010). In particular, the number of M responses was significantly lower in patients with high as opposed to low alexithymia scores on the TAS–20 ($d = 1.46$) and the RAS ($d = 1.23$). Of note, 96% of nonalexithymic patients had M > 1 in their Rorschach protocol, whereas 67% (with the RAS) to 74% (with the TAS–20) of alexithymic patients had no or only one M.

Therefore, empirical research suggests that M responses are related to higher mental process, mentalization, and empathy, namely to a more sophisticated awareness of self and others. As highlighted by Urist (1976), M seems to reflect the capacity to experience others via sensitivity to their subjective experience, as alive and human, and as whole figures whose total personalities represent a complex integration of various affectively charged and more neutral attitudes.

However, as experienced clinicians are aware, the presence of M responses by themselves does not automatically imply healthier psychological functioning (Kleiger, 1992) or, specifically, the capacity for empathy. A number of crucial aspects of empathy are not assessed simply by the mere presence of M responses. These include such phenomena as loss or preservation of ego boundaries (requisite for self–other differentiation and integration), which could either reflect primitive identification (loss of boundary between self and other) or mature empathy (sharing another's affective experience but preserving the identity of self and other; Mayman, 1977).

Thus, it is not unusual to find a greater number of M responses in some forms of psychopathology. For example, hypervigilant individuals with narcissistic or paranoid features might produce Ms that reflect narcissistic oversensitivity or projective identification, as opposed to mature empathy. King (1958) found that highly delusional paranoid schizophrenic patients tended to perceive a relatively high number of M responses. Hypervigilant paranoid patients might produce highly embellished or confabulated M responses with good form. Such patients make the point rather dramatically that a high sum M does not imply the ability to differentiate self from not self. Weiner (1966) also pointed out the increased presence of M as a distinguishing characteristic in the records of patients with paranoid, as opposed to nonparanoid, schizophrenia. Perhaps it is more the feature of hypervigilance and less paranoia, per se, that is the issue with elevated M in some patient groups. More recently, a group of 51 mental health patients with refugee backgrounds and extensive trauma histories from the Middle East, Asia, the Balkan states, and Africa showed a mean number of 3 Ms, which is higher than expected in this population (although within the reference range). The relatively high number of M responses in this group might reflect a kind of vigilance or careful attentiveness toward other people's every move, learned through years of threat and abuse (Opaas & Hartmann, 2013).

Self and others: Neurobiology of empathy

According to Zaki and Ochsner (2012), the construct of empathy includes three broad classes of phenomena: (a) experience sharing, called affective empathy, shared self–other representations, and emotional contagion, which is described as the tendency to take on, resonate with, or share the emotions of others; (b) mentalizing, referred to as cognitive empathy, metacognition, perspective taking, and theory of mind, which is the ability to explicitly reason and draw inferences about others' mental states; and (c) prosocial concern, also known as empathic motivation, sympathy, and empathic concern, which involves the motivation to help or care about others as a result of using one or both of the other two facets to share or cognitively understand the emotions that others are experiencing.

In further refining an understanding of empathy and mentalizing, Gallese (2014) indicated that

> We can "objectively" explain others, reflect, and categorize their actions and emotions. The purpose of such cognitive operations is the deliberate categorization of an external state of affairs, viz. the mental representations of others. However, when relating to others, we also experience them as bodily selves, similar to how we experience ourselves as the owners of our body and the authors of our actions. When exposed to others, we simultaneously experience their goal-directedness and intentional character, as we experience ourselves as the agents of *our* actions, the subjects of *our* affects, the owner of *our* thoughts, fantasies, imaginations, and dreams. (p. 5)

Gallese (2009) further explained that "we not only understand what others are doing but also why, that is, we can attribute intentions to others" (p. 521).

We do not know whether understanding the emotions of others is identical to experiencing the same emotion. However, data from contemporary neuroscience are confirming what psychoanalysis has claimed over the last century: We might feel something even though we might be not aware of what and why we are feeling that emotion. In a seminal fMRI paper—successively confirmed by several other independent investigations under different experimental conditions—Singer et al. (2004) scanned 16 women while painful stimulation was applied to their own dominant hand (self condition) or to the dominant hand of their partner seated next to them (other condition) through an electrode attached to the back of the hand. Regions in the brain pain matrix processing the somatic component of pain (particularly the right insula) were activated in the self condition very soon and with high intensity—thus reflecting the processing of afferent inputs from the peripheral body. However, no difference in time lag and intensity was observed by comparing the activation of the affective components of the pain matrix between the self and the other conditions. Wicker et al. (2003) investigated the brain activity through fMRI scanning of individuals while experiencing disgust induced by odorants and while viewing video clips showing others' emotional facial expressions of disgust. Observing faces and feeling disgust activated the same sites in the anterior insula and to a lesser extent in the anterior cingulate cortex.

These studies not only support our daily experience, but indicate that the human brain is wired to understand the experience of another person by reactivating the same brain circuits used to process the same experience in the self, thus resulting in experiencing others' affective and sensory states as if experienced in one's own body. This seems to be a process that individuals sometimes are aware of (the mentalizing component of empathy) and sometimes not (the emotional contagion component of empathy; Fan, Duncan, de Greck, & Northoff, 2011; Lombardo et al., 2010). This process has been referred to as *embodied simulation,* a functional mechanism through which the actions, emotions, or sensations we see activate our own internal representations of the body states that are associated with these social stimuli, as if we were engaged in a similar action or experiencing a similar emotion or sensation (Freedberg & Gallese, 2007). It is similar to the older concept of *Einfülung,* a German term meaning literally "feeling into," which has been used in the Romantic philosophy of art indicating the immediate physical responses generated in the observer by the exposure to paintings.

Embodied simulation and the mirror neuron system

Embodied simulation is the core construct underlying the MNS. Mirror neurons are cortical brain cells, mainly located in the inferior frontal gyrus, that fire during both the execution and the observation of motor behavior. The MNS is regarded as an observation–execution matching system, which allows imitation, action recognition, and action understanding (Rizzolatti, Fogassi, & Gallese, 2001; Umiltà et al., 2001). After two decades of worldwide investigations, today there are reasons to think that, in humans, the MNS does not function in isolation, but receives inputs from a variety of regions and sends outputs to an equal variety of regions, including the sensorimotor cortex. Hence, there is now the notion of an extended MNS that includes a much wider range of areas that are functionally connected with the classical frontal MNS to instantiate embodiment, imitation, and empathy during the perception of meaningful movement (for a review, see Molenberghs, Cunnington, & Mattingley, 2012; Pineda, 2008). This supports the notion that our ability to understand others partially relies on vicarious activation of the premotor cortex area in the individual brain as if the subject might feel the intentions of others' behavior within his or her body, not at a conscious level (the body that I have) but at a premotor stage by unconsciously reproducing the intentions of the other within himself or herself (the body that I am). In fact, the primary and secondary cortex are activated when we perceive other people being touched, performing an action, or experiencing somatic pain (Keysers, Kaas, & Gazzola, 2010). Anatomical data demonstrating that the insular lobe is connected with the limbic system make the insula—where emotional and somatic inputs are preconsciously processed—a plausible candidate for relaying action representation information both to limbic areas for emotional processing and to neocortical regions for cognitive awareness (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003).

Mirror neurons represent not only the physical aspects of an action but also the underlying intentions, thoughts, and feelings that motivated that action. Said differently, they likely provide the neural basis for unique human social skills such as empathy and theory of mind (Gallese, 2001, 2003) that allow effective social cognitive processes and interactions. In humans, some specific clues in the stimuli are required for the MNS activation, such as a goal, an agent, and a context for the perceived action. Although the parieto-frontal mirror mechanism is active in all conditions in which the motor task has to be directly understood, when subjects are required to judge the reasons behind the observed actions, there is an activation of a sector of the anterior cingulate cortex and of other areas of the so-called mentalizing network (Gallese, Keysers, and Rizzolatti, 2004). Altogether, there is strong evidence today that mirror neurons are activated in the following conditions (for a review, see Kilner & Lemon, 2013; Rizzolatti & Fogassi, 2014):

1. When the final part of an action, most crucial in triggering the response in full vision, was hidden to the observer; that is, when the intention of the hand gesture could only be inferred.
2. In the correct identification of others' feelings by their facial expression.
3. In individuals scoring high on empathy scales.
4. In aplasic individuals (born without arms and hands) exposed to hand motor acts performed by other people that were never executed by them but that they could achieve using their feet or mouth (e.g., painting by using the mouth).
5. In expert pianists when they are exposed to the music of a piano sonata as compared to novices.
6. When an action is only heard by sound (e.g., MNS activated not only to the sight of someone cracking nuts but also simply to the sound alone of the nuts cracking).
7. When exposed to visual stimuli of objects (e.g., a glass of beer or a knife) that might trigger object-related actions (drinking, cutting), even in the absence of overt movement.
8. Closer to the Rorschach paradigm, when observing static images of actions, or implied motion (e.g., the picture or even an abstract drawing of someone engaged in a meaningful act as dancing). For example, the medial temporal/medial superior temporal cortex (MT/MST complex) is thought to activate during the visual experience of real (as in movies) or illusory motion, namely when the observer can infer the position of an object in a subsequent moment in time without seeing the actual movement, such as seeing two photographs of an athlete before and after heaving a shot put (Kourtzi & Kanwisher, 2000). Similarly, the MNS is responsive when dynamic information about body actions is inferred from static pictures of body postures (photographs of pincer grips; Urgesi, Moro, Candidi, & Aglioti, 2006).
9. Again closer to Rorschach, when observing artworks suggesting an intentional action. One study (Sbriscia-Fioretti, Berchio, Freedberg, Gallese, & Umiltà, 2013) used three black-and-white paintings by Franz Kline characterized by shapeless brushstrokes with visible consequences of the artist's gesture (drips of paint, blurred contours, differences in pressure on the brush, etc.). Another study (Umiltà, Berchio, Sestito, Freedberg, & Gallese, 2012) used three abstract artworks by Lucio Fontana, characterized each by one, two, and three cuts on the canvas. The control stimuli were drawings digitally modified by software that used the original artworks as a template but removed all the dynamic components of the original artworks. Both studies found that, compared

to control stimuli, the observation of the original artworks produced a clear and significantly greater activation of the MNS brain regions.

M responses and the mirror neuron system

Given the convergence of neuroscience data on embodied cognition and MNS with the theoretical notions of empathy and mentalization, three recent studies investigated whether the observation of Rorschach ambiguous static stimuli are able to activate embodied simulation that seems necessary for delivering human movement. The MNS activity was assessed with EEG. EEG records the synchronized activity of large numbers of neurons that can give rise to macroscopic oscillations of their firing patterns. The several simultaneous oscillations observed during EEG have traditionally been subdivided into frequency bands, as, for example, alpha (8–13 Hz) and beta (about 14–30 Hz; Llinas, 2014). At rest, the sensorimotor neurons spontaneously fire in synchrony, leading to large-amplitude EEG oscillations in the 8 to 13 Hz frequency band, or mu waves. Unlike the alpha wave, which occurs at a similar frequency over the resting visual cortex at the back of the head, the mu wave is found over the motor cortex, in a band approximately from ear to ear. A person suppresses mu wave patterns (desynchronization) when performing a motor action or also visualizing performing a motor action. In this procedure, subjects are seated inside an acoustically and electromagnetically shielded testing chamber, facing a computer screen, with electrodes embedded in a cap placed at scalp positions corresponding to brain central sites and control sites in the frontal, occipital, parietal, and temporal brain regions. Given that subjects are physically still, activation of mu waves is expected. If mu waves are suppressed at the central brain sites compared to the control brain regions when delivering an M response, then the mu wave suppression would indicate the MNS activity as if subjects were moving although actually they performed no action.

Study 1

In the first study (Giromini, Porcelli, Viglione, Parolin, & Pineda, 2010), EEG data of 19 undergraduate students were collected during baseline and three different conditions. In the first condition (experimental group: movement attribution), individuals were administered the two Rorschach cards with the highest (Cards III and VII) and lowest (Cards V and VI) frequency of M responses in the CS reference database (Exner & Erdberg, 2005). In the second condition (contrast group: movement identification), participants were given commonly reported M responses to Cards III through VII (e.g., two people doing something together) and commonly reported Pure F responses to Cards V and VI (e.g., a tree) and asked if they were able to identify the suggested responses. In the third condition (control group: movement observation), individuals were administered four nonambiguous handmade drawings similar to the four original cards showing two people in love looking at each other with a red butterfly in the middle and two hearts hanging at their side (similar to Card III), two girls facing each other in their bumper cars (representative of Card VII), a black butterfly (suggestive of Card V), and a Christmas tree (like Card VI). As expected, a significantly greater mu wave suppression occurred at central rather than control occipital brain sites when human movement was either strongly suggested by (a) features of the nonambiguous drawings (control condition: human movement suggested by visual cues), (b) suggestions provided during the visual exposure to the Rorschach cards (constrast condition: human movement suggested by verbal cues), and (c) the subjective internally generated representation of human movement (experimental condition: human movement suggested by inner implicit feelings).

Study 2

In the second study (Pineda, Giromini, Porcelli, Parolin, & Viglione, 2011), some limitations of the ecological validity of the first study were addressed by using the standard administration of the 10 cards to a larger sample of 24 participants. Furthermore, a more appropriate control for baseline attention was created (participants were asked to engage in a continuous performance task during the 90-s baseline period by counting the number of times the screen turned red and blue) and longer data collection periods (600 s) of EEG data were used. Replicating earlier findings, mu wave suppression at central brain sites was greater in association with M responses compared to non-M responses throughout all 10 Rorschach cards. Moreover, event-related desynchronization analyses showed that, unlike the non-M responses, when delivering M responses, mu wave suppression occurred very early, during the first 1 or 2 s of exposition to the cards (before the verbal articulation of the M response), and remained so for the entire exposure time. This might suggest that the mirroring phenomenon occurs prior to the conscious decision of the participant to actually deliver an M-scorable response. Of interest, in Sbriscia-Fioretti et al.'s (2013) EEG study using the Franz Kline pictures, the frontocentral brain sites similarly started to activate within the first second after the exposure to Kline's original paintings as compared to control stimuli.

Study 3

In the third study (Porcelli, Giromini, Parolin, Pineda, & Viglione, 2013), the Rorschach protocols of Study 2 were used to investigate whether the MNS activity was related specifically to M responses compared to all other determinants. Confirming the previous findings and expectations, mu wave suppression was significantly higher only when participants delivered M responses compared to other movement (animal and inanimate movements), nonmovement (pure form, color, and shading determinants), and human-related codes (human contents without M, different M form quality, active vs. passive human movements, and M associated with whole vs. part/fictional human contents). In terms of strength of association, effect size was in the large range only when mu wave oscillations were compared in the M versus the non-M condition.

To summarize the EEG findings, after controlling for multiple conditions, these pilot studies showed the following results:

1. Brain areas where the MNS is located are activated when subjects are exposed to static, ambiguous pictures like the Rorschach cards suggesting a sense of movement.

2. The embodied simulation induced by the Rorschach cards can be observed very early, after just 1 to 2 s and prior to obtaining a verbal M response, thus suggesting the "feeling of movement" is induced at a preconscious level when the subject might be not aware of the process.
3. The neural mirroring activity is specific for M responses and does not occur with other kinds of movement and nonmovement determinants.

It is important to note that the MNS is mainly located in premotor brain areas highly connected with limbic structures, as well as in specialized brain regions, including the somatosensory cortex. This means that the mirroring neural activity is a predisposition to conscious and deliberate behavioral actions, not a biological mechanism for action execution and recognition. The MNS is activated by different stimuli, including static and abstract artworks or ambiguous inkblots, requiring specific cues as a goal, an agent, and a context for the perceived action. Briefly, the MNS is activated when individuals understand the meaning of others' behavior and prepare themselves to perform a deliberate action by activating the appropriate motor system. For example, sensorimotor cortex becomes active in performing conscious behavior, prefrontal and premotor areas in coding actions, and subcortical structures for emotional-laden stimuli (Keysers et al., 2010; Rizzolatti et al., 2001). The association between M responses and MNS suggests, therefore, that Rorschach human movement is related to the implicit feeling of the body that I am.

Conclusions

Neuroscience is increasingly recognizing that brain, body, and the interpersonal environment form a mutually regulatory adaptive system; namely, what is going on in the brain is not only within the brain alone, but also in the body and the social world. There is increasing consensus that the individual mind is an extended mind that is not only mental, in the traditional meaning of the word, but is primarily embodied, enacted, and placed in the social environment and the interpersonal relationships (Menary, 2010; Panksepp, 1998). Human movement responses to the Rorschach seem to indwell the notion of extended mind or embodied simulation.

Over the last century, the M response has been considered on the border between inside and outside. From one side, many authors, including Rorschach himself, have emphasized the subjective aspect (*kinesthesia*), namely the basic requirement that the individual has to perceive internally the sense of movement that must be primarily felt. From the other side, many other authors, including Exner, have emphasized the objective aspect, namely the basic requirement that the subject has to describe verbally the observed movement because the examiner has no means to ascertain whether the described movement has been felt by the subject.

Contemporary neuroscience might help to address this conundrum that is intrinsic in the method of the 10 inkblots. The M response seems to rest both in the outside (the perception of what is there in the blot) and in the inside (the mental operations activated enlivening the perception) and, at the same time, neither completely in the blot nor in the mind. The M response seems to stay in the body that I am, namely in the complex processing associated with the activation of brain networks related to the psychological functions of empathy and mentalization. As reviewed in this article, two lines of evidence support this hypothesis. The first source of evidence comes from the traditional approach of construct validity that shows strong meta-analytical evidence that M is associated with higher psychological functioning, namely increased awareness of the self (intelligence, ability to delay impulses and gratification, perspective taking, ego strength, imagination) and the others (effective interpersonal relations and ability to identify with another human being). The second source of evidence comes from some preliminary studies aiming to integrate the Rorschach Inkblot Method with neuroscience, namely to have a more comprehensive view of what happens inside the "black box" of the brain when body feelings and intersubjectivity activate shared self–other neural circuits. As described earlier, the relatively new discovery of mirror neurons in the last two decades might help to identify the bridge among body, mind, and brain underlying the human movement response.

Two tentative conclusions can be drawn from this approach to the *M* response. First, as every assessment psychologist who values the Rorschach Inkblot Method knows, no single test variable or index can be interpreted in isolation (Weiner, 2003). With this limitation in mind, M might be considered the most unique proxy variable of mentalization in a Rorschach record, even though it cannot be said it is an index of mentalization. Consistent with the preliminary data from the investigations on M and MNS reviewed here, M is likely to relate to some basic requisites—that is, activation of brain areas of embodied simulation that in turn predispose someone to activate higher and more complex self–other psychological functioning—for an effective use of the mentalizing process that, of course, requires the recruitment of several other brain and psychological functions. As written by Piotrowski (1977), "*M* responses provide, more than any other single test component, specific and significant information about the individual's role in the inter-human relationships that matter to him. … These responses are *potential, not actual, actions.* One might say they are *initial stages of actions* at a very low level of intensity" (p. 189, italics added). Further studies are needed to confirm these preliminary results with (a) different higher time resolution (e.g., transcranial magnetic stimulation) and space resolution (e.g., fMRI) imaging; (b) larger sample sizes, including clinical subjects with known mentalization deficits, such as patients with alexithymia (Porcelli, 2004) and borderline personality disorder (Fonagy et al., 2004); and (c) additional Rorschach characteristics subtyping M in adaptive versus maladaptive human representations.

Second, as stated by Acklin and Wu-Holt (1996), the impact of cognitive neuroscience is just beginning to be felt in Rorschach psychology and is likely to be influential for a long time to come. Emerging applications of neurocognitive science to the Rorschach will likely deepen our understanding of the test, as well as provide the basis for a new frontier of research (Acklin & Wu-Holt, 1996; Schott, 2014). For example, it has been shown that emotional networks activated in highly original perceptions in healthy subjects or daily perceptions in psychotic subjects (right temporal lobe, prefrontal cortex, amygdala, and cingulate gyrus) are associated with poor form quality responses on the Rorschach (Asari et al., 2008, 2010).

Although currently characterized at a "low-tech" level, the Rorschach Inkblot Method could offer a promising means for integrating real-time cognitive and emotional processing with neuroimaging assessment. The research on the neuroscience of M, as well as other codes and indexes, might help to pave the way in reversing the direction of research in psychopathology that traditionally focuses on syndromes first, rather than on underlying mechanisms. Today there is a prominent controversy about the nature of diagnosis in psychiatry, with opposing positions debating the essence of the diagnostic process (Kirmayer & Crafa, 2014). On the one hand, there is the classical diagnostic approach based on presenting signs and symptoms, which is represented by the latest edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM–5;* American Psychiatric Association, 2013). On the other hand, there is an alternative view of diagnosis, which integrates genetics, neuroimaging, and cognitive science into future diagnostic schemes based on behavioral dimensions and neural systems. This newer approach is represented by the National Institute of Mental Health's Research Domain Criteria (RDoC; Cuthbert, 2014). Both approaches, however, are disappointing from the perspective of clinical psychology for a variety of reasons that go beyond the scope of this article. Criticism toward the *DSM–5* is well known among psychologists. Also, RDoC criteria have been criticized because they do not consider at all psychological functioning among the units-of-analysis scheme of the five basic domains (see Kirmayer & Crafa, 2014; Wakefield, 2014).

It has been suggested that we refrain from associating symptoms with diagnostic labels and begin associating neuroanatomical networks and psychopathological syndromes with emotional and cognitive empathy, with the hypothesis that an empathy-based comprehensive classification might be much more explicative than a simple categorization of overt symptoms (Gonzalez-Liencres et al., 2013). Within the context of this article, the suggestion coming from the neuroscientific investigation might be to invert the traditional direction and to investigate the neuropsychological mechanisms underlying Rorschach responses and variables, rather than investigating Rorschach variables in different clinical groups.

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References

Acklin, M. A., & Wu-Holt, P. (1996). Contributions of cognitive science to the Rorschach technique: Cognitive and neuropsychological correlates of the response process. *Journal of Personality Assessment*, *67*, 169–178.

Adolphs, R. (2003). Cognitive neuroscience of human social behaviour. *Nature Reviews Neuroscience*, *4*, 165–178.

Akavia, N. (2013). *Subjectivity in motion: Life, art and movement in the work of Hermann Rorschach*. New York, NY: Routledge.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: APA Press.

Arnheim, R. (1951). Perceptual and aesthetic aspects of the movement response. *Journal of Personality*, *19*, 265–281.

Asari, T., Konishi, S., Jimura, K., Chikazoe, J., Nakamura, N., & Miyashita, Y. (2008). Right temporopolar activation associated with unique perception. *Neuroimage*, *41*, 145–152.

Asari, T., Konishi, S., Jimura, K., Chikazoe, J., Nakamura, N., & Miyashita, Y. (2010). Amygdalar enlargement associated with unique perception. *Cortex*, *46*, 94–99.

Bendick, M. R., & Klopfer, W. G. (1964). The effects of sensory deprivation and motor inhibition on Rorschach movement responses. *Journal of Projective Techniques and Personality Assessment*, *28*, 261–264.

Bucci, W. (1997). *Psychoanalysis and cognitive science: A multiple code theory*. New York, NY: Guilford.

Carr, L., Iacoboni, M., Dubeau, M. C., Mazziotta, J. C., & Lenzi, G. L. (2003). Neural mechanisms of empathy in humans: A relay from neural system to imitation to limbic areas. *Proceedings of the National Academy of Sciences*, *100*, 5497–5502.

Chalmers, D. J. (1996). *The conscious mind*. Oxford, UK: Oxford University Press.

Cuthbert, B. N. (2014). The RDoC framework: Facilitating transition from ICD/DSM to dimensional approaches that integrate neuroscience and psychopathology. *World Psychiatry*, *13*, 28–35.

Damasio, A. (1999). *The feeling of what happens: Body and emotion in the making of consciousness*. New York, NY: Harcourt Brace.

Damasio, A. (2010). *Self comes to mind*. New York, NY: Pantheon.

Damasio, A., & Carvalho, G. B. (2013). The nature of feelings: Evolutionary and neurobiological origins. *Nature Reviews Neuroscience*, *14*, 143–152.

Decety, J. (Ed.). (2012). *Empathy from bench to bedside*. Cambridge, MA: MIT Press.

Exner, J. E. (1969). *The Rorschach system*. New York, NY: Grune & Stratton.

Exner, J. E. (2003). *The Rorschach: A Comprehensive System: Vol. 1. Basic foundations and principles of interpretation* (4th ed.). New York, NY: Wiley.

Exner, J. E., & Erdberg, P. (2005). *The Rorschach: A Comprehensive System: Vol. 2. Advanced interpretation* (3rd ed.). New York, NY: Wiley.

Fan, Y., Duncan, N. W., de Greck, M., & Northoff, G. (2011). Is there a core neural network in empathy? An fMRI based quantitative meta-analysis. *Neuroscience and Biobehavioral Reviews*, *35*, 903–911.

Fonagy, P., Gergely, G., Jurist, E. L., & Target, M. (2004). *Affect regulation, mentalization and the development of the self*. London, UK: Karnac Books.

Freedberg, D., & Gallese, V. (2007). Motion, emotion and empathy in aesthetic experience. *Trends in Cognitive Sciences*, *11*, 197–203.

Gallese, V. (2001). The "shared manifold hypothesis": From mirror neurons to empathy. *Journal of Consciousness Studies*, *8*, 33–50.

Gallese, V. (2003). The roots of empathy: The shared manifold hypothesis and the neural basis of intersubjectivity. *Psychopathology*, *36*, 171–180.

Gallese, V. (2009). Mirror neurons, embodied simulation, and the neural basis of social identification. *Psychoanalytic Dialogues*, *19*, 519–536.

Gallese, V. (2014). Bodily selves in relation: Embodied simulation as second-person perspective on intersubjectivity. *Philosophical Transactions of the Royal Society B*, *369*, 20130177. doi:10.1098/rstb.2013.0177

Gallese, V., Keysers, C., & Rizzolatti, G. (2004). A unifying view of the basis of social cognition. *Trends in Cognitive Science*, *8*, 396–403.

Gibson, E. J., & Walk, R. D. (1960). The visual cliff. *Scientific American*, *202*, 64–70.

Giromini, L., Porcelli, P., Viglione, D. J., Parolin, L., & Pineda, J. A. (2010). The feeling of movement: EEG evidence for mirroring activity during the observations of static, ambiguous stimuli in the Rorschach cards. *Biological Psychology*, *85*, 233–241.

Goldman, A., & de Vignemont, F. (2009). Is social cognition embodied. *Trends in Cognitive Science*, *13*, 154–159.

Gonzalez-Liencres, C., Shamay-Tsoory, S. G., & Brüne, M. (2013). Towards a neuroscience of empathy: Ontogeny, phylogeny, brain mechanisms, context and psychopathology. *Neuroscience and Biobehavioral Reviews*, *37*, 1537–1548.

Greenberg, R. P., & Fisher, S. (1973). A muscle awareness model for changes in Rorschach human movement responses. *Journal of Personality Assessment*, *37*, 512–518.

Keysers, C., Kaas, J. H., & Gazzola, V. (2010). Somatosensation in social perception. *Nature Reviews Neuroscience*, *11*, 417–428.

Kilner, J. M., & Lemon, R. N. (2013). What we currently know about mirror neurons. *Current Biology*, *23*, 1057–1062.

King, G. F. A. (1958). A theoretical and experimental consideration of the Rorschach human movement response. *Psychological Monographs*, *72*, 1–23.

Kirmayer, L. J., & Crafa, D. (2014). What kind of science for psychiatry? *Frontiers in Human Neuroscience*, *8*, 435. doi:10.3389/fnhum.2014.00435

Kleiger, J. H. (1992). A conceptual critique of the EA-es comparison in the Comprehensive Rorschach System. *Psychological Assessment*, *4*, 288–296.

Kourtzi, Z., & Kanwisher, N. (2000). Activation in human MT/MST by static images with implied motion. *Journal of Cognitive Neuroscience*, *12*, 48–55.

Llinas, R. R. (2014). Intrinsic electrical properties of mammalian neurons and CNS function: A historical perspective. *Frontiers in Cellular Neuroscience*, *8*, 320. doi:10.3389/fncel.2014.00320

Lombardo, M. V., Chakrabarti, B., Bullmore, E. T., Wheelwright, S. J., Sadek, S. A., Suckling, J., … Baron-Cohen, S. (2010). Shared neural circuits for mentalizing about the self and others. *Journal of Cognitive Neuroscience*, *22*, 1623–1635.

Luciani, M., Cecchini, M., Altavilla, D., Palumbo, L., Aceto, P., Ruggeri, G., … Lai, C. (2014). Neural correlates of the projection of mental states on the non-structured visual stimuli. *Neuroscience Letters*, *573*, 24–29.

Malmgren, H. (2000). Rorschach's idea of a "movement" response in the light of recent philosophy and psychology of perception. *Rorschachiana*, *24*, 1–27.

Mayman, M. (1977). A multidimensional view of the Rorschach movement response. In M. A. Rickers-Ovsiankina (Ed.), *Rorschach psychology* (2nd ed., pp. 229–250). Huntington, NY: Krieger.

Menary, R. (2010). *The extended mind*. Cambridge, MA: MIT Press.

Merleau-Ponty, M. (1962). *Phenomenology of perception*. London, UK: Routledge. (Original work published 1945)

Meyer, G. J., Viglione, D. J., Mihura, J. L., Erard, R. E., & Erdberg, P. (2011). *Rorschach Performance Assessment System: Administration, coding, interpretation, and technical manual*. Toledo, OH: Rorschach Performance Assessment System.

Mihura, J. L., Meyer, G. J., Dumitrascu, N., & Bombel, G. (2013). The validity of individual Rorschach variables: Systematic reviews and meta-analyses of the Comprehensive System. *Psychological Bulletin*, *139*, 548–605.

Molenberghs, P., Cunnington, R., & Mattingley, J. B. (2012). Brain regions with mirror properties: A meta-analysis of 125 human fMRI studies. *Neuroscience and Biobehavioral Reviews*, *36*, 341–349.

Needleman, J. (Ed.). (1963). *Being in the world: Selected papers of Ludwig Binswanger*. New York, NY: Basic Books.

Nemiah, J. C., Freyberger, H., & Sifneos, P. E. (1976). Alexithymia: A view of the psychosomatic process. In O. W. Hill (Ed.), *Modern trends in psychosomatic medicine* (Vol. 3, pp. 430–439). London, UK: Butterworths.

Northoff, G. (2014). *Minding the brain: A guide to philosophy and neuroscience*. New York, NY: Palgrave Macmillan.

Northoff, G., Bermpohl, F., Schoeneich, F., & Boeker, H. (2007). How does our brain constitute defense mechanisms? First-person neuroscience and psychoanalysis, *Psychotherapy and Psychosomatics*, *76*, 141–153.

Opaas, M., & Hartmann, E. (2013). Rorschach assessment of traumatized refugees: An exploratory factor analysis. *Journal of Personality Assessment*, *95*, 457–470.

Panksepp, J. (1998). *Affective neuroscience*. New York, NY: Oxford University Press.

Panksepp, J. (2005). Affective consciousness: Core emotional feelings in animals and humans. *Consciousness and Cognition*, *14*, 30–80.

Pineda, J. A. (2008). Sensorimotor cortex as a critical component of an "extended" mirror neuron system: Does it solve the development, correspondence, and control problems in mirroring? *Behavioral and Brain Functions*, *4*, 47.

Pineda, J. A., Giromini, L., Porcelli, P., Parolin, L., & Viglione, D. J. (2011). Mu suppression and human movement responses to the Rorschach test. *NeuroReport*, *22*, 223–226.

Piotrowski, Z. A. (1977). The movement response. In M. A. Rickers-Ovsiankina (Ed.), *Rorschach psychology* (2nd ed., pp. 189–227). Huntington, NY: Krieger.

Porcelli, P. (2004). *Psychosomatic medicine and the Rorschach test*. Madrid, Spain: Psimatica.

Porcelli, P., Giromini, L., Parolin, L., Pineda, J. A., & Viglione, D. J. (2013). Mirroring activity in the brain and movement determinant in the Rorschach test. *Journal of Personality Assessment*, *95*, 444–456.

Porcelli, P., & Mayer, G. J. (2002). Construct validity of Rorschach variables for alexithymia. *Psychosomatics*, *43*, 360–369.

Porcelli, P., & Mihura, J. L. (2010). Assessment of alexithymia with the Rorschach Comprehensive System: The Rorschach Alexithymia Scale (RAS). *Journal of Personality Assessment*, *92*, 128–136.

Rapaport, D., Gill, M., & Schafer, R. (1946). *Diagnostic psychological testing*. Chicago, IL: Yearbook.

Rizzolatti, G., & Fogassi, L. (2014). The mirror mechanism: Recent findings and perspectives. *Philosophical Transactions of the Royal Society B*, *369*, 20130420.

Rizzolatti, G., Fogassi, L., & Gallese, V. (2001). Neurophysiological mechanisms underlying the understanding and imitation of action. *Nature Reviews Neuroscience*, *2*, 661–670.

Rorschach, H. (1942). *Psychodiagnostics* (5th ed.), P. Lemkau & B. Kronenberg (Trans.). New York, NY: Grune & Stratton. (Original work published 1921)

Rorschach, H., & Oberholzer, E. (1923). Zur Auswertung des Formdeutversuchs für die Psychoanalyses [The evaluation of the form interpretation test for psychoanalysis]. *Zeitschrift für die Gesame Neurologie und Psychiatrie*, *82*, 240–274.

Sbriscia-Fioretti, B., Berchio, C., Freedberg, D., Gallese, V., & Umiltà, M. A. (2013). ERP modulation during observation of abstract paintings by Franz Kline. *PLoS One*, *8*, e75241. doi:10.1371/journal.pone.0075241

Schachtel, E. (1959). *Experiential foundation of Rorschach's test*. New York, NY: Basic Books.

Schafer, R. (1954). *Psychoanalytic interpretation in Rorschach testing*. New York, NY: Grune & Stratton.

Schott, G. D. (2014). Revisiting the Rorschach ink-blots: From iconography and psychology to neuroscience. *Journal of Neurology, Neurosurgery and Psychiatry*, *85*, 699–706.

Singer, T., Seymour, B., O'Doherty, J., Kaube, H., Dolan, R. J., & Frith, C. D. (2004). Empathy for pain involves the affective but not sensory components of pain. *Science*, *303*, 1157–1162.

Solms, M., & Turnbull, O. (2002). *The brain and the inner world*. New York, NY: Other Press.

Steele, N. M., & Kahn, M. W. (1969). Kinesthesis and the Rorschach *M* response. *Journal of Projective Techniques and Personality Assessment*, *33*, 5–10.

Taylor, G. J. (2010). Affects, trauma, and mechanisms of symptom formation: A tribute to John C. Nemiah, MD (1918–2009). *Psychotherapy and Psychosomatics*, *79*, 339–349.

Taylor, G. J., Bagby, R. M., & Luminet, O. (2000). Assessment of alexithymia: Self-report and observer-rated measures. In R. Bar-On & J. D. A. Parker (Eds.), *The handbook of emotional intelligence: Theory, development, assessment, and application at home, school, and in the workplace* (pp. 301–319). San Francisco, CA: Jossey-Bass/Pfeiffer.

Taylor, G. J., Bagby, R. M., & Parker, J. D. A. (1997). *Disorders of affect regulation*. Cambridge, UK: Cambridge University Press.

Umiltà, M. A., Berchio, C., Sestito, M. T., Freedberg, D., & Gallese, V. (2012). Abstract art and cortical motor activation: An EEG study. *Frontiers in Human Neuroscience*, *6*, 311. doi:10.3389/fnhum.2012.00311

Umiltà, M. A., Kohler, E., Gallese, V., Fogassi, L., Fadiga, L., Keysers, C., & Rizzolatti, G. (2001). "I know what you are doing": A neurophysiological study. *Neuron*, *32*, 91–101.

Urgesi, C., Moro, V., Candidi, M., & Aglioti, S. (2006). Mapping implied body actions in the human motor system. *Journal of Neuroscience*, *26*, 7942–7949.

Urist, J. (1976). Some structural considerations in the relationship between *M* and empathy. *Journal of Personality Assessment*, *40*, 573–578.

Wakefield, J. C. (2014). Wittgenstein's nightmare: Why the RDoC grid needs a conceptual dimension. *World Psychiatry*, *13*, 38–40.
Weiner, I. B. (1966). *Psychodiagnosis in schizophrenia*. New York, NY: Wiley.
Weiner, I. B. (2003). *Principles of Rorschach interpretation* (2nd ed.). Mahwah, NJ: Erlbaum.
Wicker, B., Keysers, C., Plailly, J., Royet, J. P., Gallese, V., & Rizzolatti, G. (2003). Both of us disgusted in my insula: The common neural basis of seeing and feeling disgust. *Neuron*, *40*, 655–664.
Zaki, J., & Ochsner, K. (2012). The neuroscience of empathy: Progress, pitfalls and promise. *Nature Neuroscience*, *15*, 675–680.