

Rorschach's Idea of a "Movement" Response in the Light of Recent Philosophy and Psychology of Perception

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Introduction

The proper definition of the kinesthetic or movement (M) category has been the subject of many controversies within the Rorschach community; see, for example, the discussion between Kramer and Exner (Kramer, 1991; Exner, 1991). The present paper elucidates the nature of movement responses by means of a theoretical analysis of some of the key concepts involved. This analysis in part will be of a philosophical character, but I will also bring in several recent results from the psychology and neurophysiology of perception which in my opinion are crucial to a correct understanding of the movement responses.

The next two parts of the essay describe the basic controversy between those Rorschach theorists who – like Hermann Rorschach himself and Ewald Bohm – hold that kinesthetic identification is a necessary ingredient in any movement response, and those – like John Exner – who want to drop this condition from the definition. This controversy is shown to involve another fundamental issue, namely: In what sense is movement a *determinant*, and what should be meant by a determinant? The third section also discusses a main objection against keeping Rorschach's original definition: its reliance on introspective criteria. The fourth part takes a historical perspective, describing the philosophical and psychological tradition called associationism, discussing certain ideas concerning kinesthetic sensibility brought forward within that tradition, and finally analyzing the nature and extent of Hermann Rorschach's commitment to associationism, especially as manifested in his doctoral dissertation. Some main elements of the 20th-century psychological and philosophical critique of associationism are outlined in Sections 5–6, and the relevance of this critique for the definition of a movement response is explained. Converging evidence from different sources, such as child psychology and clinical and primate neuropsychology, is then brought together in Section 7 to show that recent work on perception supports Hermann Rorschach's basic intuition about the M category. In Section 8, a new definition of movement responses is given in terms of *practical perception* and *immediate visuo-motor couplings*. Finally, in Section 9, the possible use of Rorschach data in the experimental analysis of motion-from-form perception is pointed out.

Rorschach's Definition of M, and Movement as a Determinant

As a background, let us first have a look at two quotes from Hermann Rorschach's own basic characterization of the movement responses.

The "movement responses" – in the following designated M – are those interpretations concerning which it can be ascertained that beside the form of the blots, kinesthetic engrams (memory images of earlier seen, imagined or performed movements) have had a determining influence. The subject imagines the "seen" object as moving. (Rorschach, 1972, p. 23; my translation)

Rorschach then tells us that the presence of a movement response is often revealed in the behavior of the subject, who tends to imitate the movement seen. In the following paragraphs, he emphasizes that not every movement seen, even if human and even if demonstrated in behavior, is a movement *response*. In other words, the last line of the above quote, which characterizes movement responses in terms of *seeing something as moving*, is not meant to be a sufficient criterion. Nor does Rorschach intend it to be used as a necessary criterion, since the object (the human being) need not be seen as actually moving; see the example of two fallen humans on plate V (Rorschach, 1972, p. 159). The decisive mark of an M response is instead the *influence of the kinesthetic engram*.

Here is another formula:

But it is not always a matter of M responses even when human beings are mentioned. The question is always: Does the movement mentioned take a *primary part* in the determination of the response? Is there really *a feeling of the movement*, and not only an apprehension of form which is only secondarily interpreted as moving? (Rorschach, 1972, p. 25)

A brief comment on the so-called secondary M:s is necessary here. Rorschach and many later authors uphold a distinction between primary and secondary movement responses. If form is seen first and movement is added later, then the response is a secondary M. From the last-quoted passage, however, it would seem that such a response should not be classified as M at all. But Rorschach usually scores a secondarily seen movement as M (see Rorschach, 1972, p. 28), as does Bohm (Bohm, 1972, p. 47). This practice suggests that the presence of a "feeling of the movement" was meant to be sufficient for an M score even if this feeling comes *after* the apprehension of form. Such an explanation also seems to be in line with our interpretation of the previous quotation.

Note, however, the switch of terminology between the two quotations: from "kinesthetic engrams" to "feelings of movement". The kinesthetic engrams are defined in the first quotation as memories of movements seen, imagined, or performed earlier. But what is a "feeling of

movement”? We will have more to say about the concept in a while, but let us provisionally characterize a feeling of movement as the kind of bodily experience a person typically gets when she herself moves. Now, it is far from self-evident why having memory images of earlier seen movements should entail having bodily experiences of this kind. Indeed, Rorschach’s use of the “feelings of movement” terminology as an alternative to the “kinesthetic engram” idiom tells us that he holds a certain theory about movement perception, namely, the *kinesthetic identification* theory: Seeing another human being move – and, consequently, remembering seeing that person move – typically involves feeling *as if one moved oneself*. Another aspect of the same theory is, of course, given by the remark that subjects who give M responses tend to imitate the seen movements. To sum up, an M response involves a kind of identification with the figure seen, an identification that manifests itself both as feelings of movement and as a tendency to move.

The above quotations from Hermann Rorschach – especially the second one – provoke some intriguing questions even when, as here, the most obvious ambiguities have been resolved. The first of these questions is the epistemological and methodological one,

— How, when scoring a Rorschach test, shall one decide whether the required “feelings of movement” were present in the subject in the determining phase of the response?

Many theorists are of the opinion that this question has no satisfactory answer within an empirically oriented approach to the Rorschach method. The “feelings of movement” criterion cannot be operationalized, hence we have to do without it. I will return to this important methodological topic later (Section 3). It is intimately connected with our second question:

— What is the nature of kinesthetic “feelings”, “images”, and “engrams” and which are the relations between these phenomena?

This question will be treated at length in Sections 4 and 6.

The third question concerns another aspect of the determination process:

— What is the role of form in (true) movement responses?

From the first quotation above it is clear that Rorschach gives *some* determining role to form in all movement responses, even in the primary ones. But then, how do form and kinesthetic memory interact in producing a true M response? It seems reasonable to suppose that it is always the shape of the blot that, by activating a kinesthetic engram, gives rise to the kinesthetic feeling. But is there any essential difference between such a process and what happens when the shape of the blot, by activating a bat-gram, gives rise to a perception of a

bat? This argument in effect says that M ought to be treated as a content category with F (form) as the real determinant. This will be given due attention later (Sections 2 and 10).

I will instead continue my inquiry with a discussion of yet another question raised by the latter quote. Rorschach seems to be saying there that *movement itself* can take part in the determination of a response. But is such a thing at all possible? This question concerns the very status of M as a determinant category:

— If movement is a determinant, what can we mean by a determinant?

Several Rorschach theorists have explicitly defined the concept of a determinant in terms of *determining stimulus properties*. However, it has also been noted several times that such a restricted definition is logically inconsistent with the view that (real) movement is a determinant. The blots do not move, hence no movement in the stimulus ever determines any response. How shall we handle this conceptual situation?

Hermann Rorschach does not himself use the term “determinant”. The section in the *Psychodiagnostik* concerned with the determinants is headed “Form, kinesthetic, and color moments as interrelated in the perceptual process” (Rorschach, 1972, p. 22). But of course he does use a general idea that can justifiably be called his concept of a determinant, and that can to a considerable extent be reconstructed from the text. One only has to take another look at Rorschach’s characterization of the movement responses (in the first quote above) to see that his idea of a determinant cannot be restricted to the stimulus properties of the blots. It allows response determination to occur also by *intervening mental processes*, more specifically, by what he refers to as the “kinesthetic engrams”. These engrams are certainly not properties of the stimuli.

But neither are they real movements, of course: They are only memories of movements. How, then, shall we interpret the paragraph where Rorschach seems to be saying that *real* movement is a determinant? One might point to the fact that every memory of a movement was itself once caused by the perception of a moving object. Hence, there is after all a kind of “remote” stimulus co-determination by *actual* movement in the M responses, and one could argue that in this way the symmetry between M and the other determinants is restored. But the argument solves one problem only to create new ones. Think, for example, of this one: how, when scoring a Rorschach protocol, could we ever decide which properties of objects seen by the subject in a distant past have actually influenced the response? Although the mentioned idea is in line with Rorschach’s general associationism (cf. below) and may possibly have influenced his way of formulating, it does not lead us to a useful interpretation of his concept of a determinant.

There is actually something peculiar with the very idea of *determining stimulus properties*. Suppose that two subjects respond to the same part of a Rorschach card (say, the butterfly on II) with responses having different determinants: F (form) and C (color), respectively. The

important thing to note is that the stimulus properties cannot *by themselves* determine these determinants (if the latter expression is allowed). Obviously, since the stimulus properties are the same for the two different responses, some mental factor must vary in order to create the difference in determinant! In the present case, this mental factor could, for example, be a selective attitude of the subject towards the one or the other perceptual modality – or it could be some other kind of *intervening perceptual process*.

Postulating an intervening perceptual process as the basis for varying determinants is not inconsistent with ascribing varying causal roles to the stimulus properties. Important aspects of selective perceptual attitudes can be described in terms of *letting* certain stimulus properties, for example, the shape of the stimulus, influence the organism more than others (cf Malmgren & Östensson, 1989).¹ Such perceptual processes *bestow* different causal roles on different aspects of the stimulus. On the other hand, focussing on mental processes as the basis for determinant differences also opens up the possibility that at least *some* determinants can be defined without any mention of stimulus modalities. This remark is of course especially relevant to the discussion of M as a determinant.

Now, the main thrust of Rorschach's discussion of the response process is towards a general definition of determinant in terms of intervening perceptual processes. It should, for example, be noted that in the discussion of the *form* responses, he describes response determination both in terms of determination by stimulus properties ("the shape of the blots"), in terms of intervening mental processes, and in terms of the finished percept (what is seen):

By far most interpretations by healthy as well as sick persons are determined by the *shape* of the blots alone. The subject selects among his or her visual memory images the one which comes nearest to the image of the whole or a part of the original with respect to form, and especially with respect to contour. In this, the subject conceives the "seen" object not as moving, but as unmoving form. (Rorschach, 1972, p. 24; my translation)

If we take the second part of this quote, instead of the first, as expressing Rorschach's basic idea of a determinant, we can again attain a symmetry between the F and the M cases: Just as the M responses are the ones determined by a certain use of kinesthetic engrams, F responses can be defined as those determined by a certain use of visual memories. This possibility is seldom (if ever) emphasized by Rorschach's interpreters; but, if my arguments are valid, it is the only reasonable way of extracting a consistent concept of determinant from his writings. According to this concept, it is the nature of the intervening perceptual processes and nothing else – hence neither the stimulus properties nor the character of what is seen – that decides which determinant should be scored.

¹ Selective perception can probably never be *fully* described in terms of letting certain stimulus properties predominate. This is because selecting a *perceptual* modality is not the same thing as selecting a *stimulus* dimension. But that is another issue.

Movement Responses in the Comprehensive System

Let us now instead have a look at the definitions offered by John Exner. In his textbook, the concept of response determinant(s) is explicitly characterized as:

...the blot features that have contributed to the formation of the concept (Exner, 1993, p. 103)

and a little later, an alternative formula is presented:

The numerous ways in which the stimulus characteristics of the blots can be used to create responses... (Exner, 1993, loc. cit.)

Even if the second formula does leave room for mental processes (“can be used to...”), both seem to give an essential role to stimulus properties. But we have just noted that neither real movements nor memories of movements are among the stimulus characteristics of the blot. How, then, does Exner manage to make a determinant category out of the M responses? He offers a table of criteria for determinant scoring; while the criterion for F explicitly refers to the determining properties of the blot, it is stated that M is

...to be used for responses involving the kinesthetic activity of a human, or of an animal or fictional character in human-like activity (Exner, 1993, loc. cit.)

As Kramer (1991, p. 34) noted, this criterion concerns *content* only since it requires kinesthesia in the *seen* figure, not in the responding subject. Why, then, does Exner hold that M is a determinant? It seems that a more logical conclusion would be to count M as another content category (namely, the category of kinesthetic contents).

In a later chapter, Exner – deviating from his own definition of a determinant – presents the outlines of an intervening mental process he takes as essential for the M category. The common element in all M responses is, he says, a kind of *projection*. Since the blots do not move,

...the formation of a movement answer must include features that are mentally created by the subject and attributed to the stimulus field. (Exner, 1993, p. 416)

But I am not convinced that this criterion, as such, establishes M as a determinant rather than as a content. There are no animals in the blots either, so any animal features have to be mentally created by the subject. Yet A (Animal) is a content category and not a determinant.

According to the Comprehensive System, kinesthetic feelings or activity *in the subject* are not explicitly required for a response to be scored M. This means that even though Exner tentatively suggests an intervening perceptual process as the common element in M responses, the process he suggests is not obviously the same as the one Hermann Rorschach believed in. On the other hand, Exner has told us in another context (Exner, 1991, p. 38) that he holds Rorschach's own analysis of the movement responses to be essentially correct. Why, then, does he not suggest in his textbook that a feeling of movement specifically is what is being "projected" when an M response is given? One possible cause of Exner's seeming ambivalence in this matter is that a reference to such a feeling would entail a too strong reliance on introspective data. Let us discuss this point in more detail.

We rely heavily on introspective data in many phases of any Rorschach testing. Indeed, every primary response as well as every *Inquiry* answer is an introspective report in itself, since it is a description of what the subject experiences (or has experienced a while ago). Some may want to waive this argument by saying that instead of taking these perceptual reports at their face value, we can just regard the Rorschach protocol as a sample of verbal behavior in a certain stimulus situation. But why, then, insisting on trying (in the *Inquiry*) to see the blots as the subject saw them (cf. Exner, 1993, p. 75)? The "verbal-behavior" approach implies that any attempt at really understanding what the subject sees is foreign to the Rorschach procedure, and I think that few Rorschach practitioners would today agree with such a description of their method.

The present "argument against introspection" – which is supposed to lead from the premise that feelings of movement are introspective data to the conclusion that M responses must not be defined with reference to such feelings – is not convincing. True, it is probably easier to know *what one was seeing a while ago* than it is to know *what one was feeling in one's body when the visual percept was formed*, but this is only a matter of degree. Having said this, I must add that I believe there *is* a good point in the above argument against introspection as applied to the M responses. The point is that the argument alerts us to the question of the *nature* of the so-called "feelings of movement". As we will see later, it is far from clear that the bodily experiences we have when moving around are analogous to ordinary feelings and sensations (say, to feelings of cold or sensations of pain). The typical experience of movement is not simply a sensation stemming from some kind of bodily irritation; rather, it is mixed with our direct awareness of *what we intend to do*. This awareness reflects a neural command to act, and the tendency to move, which the neural command also gives rise to, can in turn be observed by other than introspective means. But let us save some of the conclusions until the end!

The rest of this paper is devoted to a detailed presentation of a modernized Rorschachian theory about the genesis of the M responses. Although (as just hinted) this theory gives a less prominent role to movement *feelings* (in the proper sense of this word) than does Hermann Rorschach's original theory, it stresses the elements of *motor tendencies* and *kinesthetic*

identification in perception even more than Rorschach does. I will support my theory with considerations from philosophy, experimental psychology, and neurophysiology. (The emphasis will be on Rorschach's intellectual heritage and on recent theories and findings, which means that I skip certain well-known sources from the first and middle parts of the 20th century (for example, Piaget). For some of these sources, cf Bohm (1972), pp. 43 f.) Let me note now already that, although my arguments will tend to show that some of Rorschach's detailed formulations were wrong, they will also tend to show that – on a more basic level – he was not only completely right but also much ahead of his time.

Associationism and the Nature of Kinesthetic Sensibility

Hermann Rorschach's main teacher was the famous Swiss psychiatrist Eugen Bleuler, and from Bleuler (cf. Bleuler, 1921, especially pp. 217 ff.) he also seems to have received his pre-Gestalt, associationist psychology. Had Rorschach lived longer, his biographer speculates (Ellenberger, 1993, p. 230), he would have developed his theory in line with phenomenology and Gestalt psychology. As it turned out, he left it to others to lay a modern foundation for his method.

Associationism is the thesis that the whole of our psychical life consists of mental elements that are essentially unordered at birth, but become structured by the learning that occurs as a result of our on-going experience of the world. Thus, associationism does not allow for innate perceptual organization. The general form of the explanations which it favors for complex perceptual phenomena is *present sensations plus memories of earlier sensations*. In other words, the only central perceptual mechanism which it recognizes is combination stemming from learning.

Associationism, the traditions of which go back to Aristotle, dominated philosophy and early psychological science at least until the second decade of the present century. It was first formulated in a systematic way by the great British empiricist philosophers in the 17th and 18th centuries, Locke, Berkeley, and Hume. The British empiricists hold that through learning, visual experiences may become associated with other visual experiences as well as with bodily feelings. To take an example from Berkeley, this eminent philosopher argues that we cannot see three-dimensional space directly since the retina receives only a two-dimensional image. We have a conception of three-dimensional space, he believes, only because associations were learned early in life between visual data and bodily experiences deriving from the eyes, such as the feelings of convergence and accommodation (Berkeley, 1901, p. 131 ff.).

Berkeley also offers some interesting speculations to the effect that “tangible ideas” derived from moving around and touching objects are involved in our ordinary conception of space:

...I believe whoever will look narrowly into his own thoughts, and examine what he means by saying he sees this or that thing at a distance, will agree with me, that what he sees only suggests to his understanding that, after having passed at a certain distance, to be measured by the motion of his body, which is perceivable by touch, he shall come to perceive such and such tangible ideas, which have been usually connected with such and such visible ideas. (Berkeley, 1901, pp. 148 f.)

As Scheerer (1987) and others have pointed out, before 1800 perceptions of one's own movements were universally classified as belonging to the sense of touch. At the beginning of the 19th century, a specific "muscle sense" had gradually become recognized and differentiated from touch (see also Lasslop, 1976). Muscle sense – in a wide sense, which is today often called "proprioception" – is now a well-established component of the human perceptual system. Considerable research has shown that impulses from muscle spindles and joint receptors are essential for our knowledge and experience of limb positions and movement (for a recent example see Helms Tillery et al, 1996).

However, from experiments and everyday observations, many 19th century scientists also came to the conclusion that not *all* bodily feelings associated with movement stem from sensory receptors in the limbs. They also felt obliged to postulate that the brain's central motor command for action gives rise to a corresponding experience of the movement to be performed. There are two rather compelling pieces of everyday evidence for such "sensations of innervation". First, we know by introspection what we are about to do before we have done it. To fully explain this fact with the existence of peripheral feedback from muscles and joints is a very demanding task. The second pertinent everyday fact is that we seem to know from our bodily experiences whether we succeeded or not in performing an intended movement, for example, raising an arm. The idea that we can compare the actual state of the arm with (a memory image of) a centrally generated sensation of innervation comes very handily here.

Among the foremost 19th century proponents of the "sensations of innervation" hypothesis were Helmholtz and Wundt. It should be noted that in the hands of 19th-century physiologists, talking about "sensations" was often just another way of talking about neural processes. In this way, the hypothesis about sensations of innervation could be made independent of the existence of *conscious* such sensations. But in its physiological as well as in its psychological form, the centralist hypothesis was put under heavy fire by several influential thinkers toward the end of the 19th century, for example the arch-associationist Titchener. Hence, when Bastian (1880) introduced the notion of *kinesthesia*, he analyzed it in terms of peripheral sensations and their memory traces. In this he was followed by most psychologists who used the new concept (see Scheerer, 1987, p. 192). The popularity of the sensations-of-innervation theory reached a low-water mark at the beginning of the 20th century. Sherrington, for one, did not believe in it.

With this brief conceptual history as a background, let us have a look at Hermann Rorschach's doctoral dissertation (Rorschach, 1912), which was written under Bleuler's

guidance. There, Hermann Rorschach describes several cases of so-called “kinesthetic-optic” and “optic-kinesthetic reflex hallucinations”. These are cases where a visual hallucination is conditioned by kinesthetic impressions or other bodily experiences, or a kinesthetic/somatosensory hallucination is caused by visual stimuli. The first kind is exemplified when a schizophrenic patient who is performing rowing movements starts hallucinating first a lake and then a whole fleet of war ships. An example of the second kind is when another schizophrenic subject reports that he *feels* that he has been transformed into the animal or inanimate object which he sees (Rorschach, 1912, pp. 374, 364). The dissertation abounds with illustrative examples of reflex hallucinations, also involving other sensory modalities.

Rorschach’s doctoral work was partly inspired by the investigations of the Norwegian philosopher and psychologist John Mourly Vold, who had performed extensive and systematic studies of the influence of tactile and kinesthetic stimuli on the contents of dreams (Mourly Vold, 1900; cf also Mourly Vold, 1910–12). He found, for example, that people who have had their feet tied very often dream of walking, climbing, and so on. These dreams usually involve the dreamer herself, but sometimes another person instead is seen climbing – and sometimes the dream just contains a “climbable” object (Mourly Vold, 1900, pp. 838 f.) Mourly Vold himself also extended his research and theorizing to cases of hallucinations. Rorschach (as well as Mourly Vold) points out the similarity between optic-kinesthetic and kinesthetic-optic hallucinations or dreams on the one hand, and everyday cases of connections between kinesthetic and visual experiences on the other. When moving a limb in the dark, we often vividly visualize it; we also tend to feel the postures and movements of people which we see depicted in paintings. Many people use kinesthetic means to better visualize an object: When one visually remembers a posture better by imitating it, a “sensation of co-movement” (*Mitbewegungsempfindung*) is involved, whereas if the active drawing of an object enhances its visual image, the effective factor is what Rorschach calls “the myopsychic elements of form” (Rorschach, 1912, p. 369).²

Concerning the role of learning in the genesis of reflex hallucinations, Rorschach makes a distinction between “associative” and other cases (Rorschach, 1912, p. 397; see also Mourly Vold, 1900, p. 861).³ However, even for the latter kind of cases he seeks explanations in terms

² Remarkably, Rorschach seems to put an equation mark between using the myopsychic elements of form and using “the principle of form seeing” (*das Prinzip des Formensehens*)! One is of course reminded of Berkeley’s ideas about the element of touch in vision (cf. above), and maybe one should also remember this discussion of Rorschach’s when trying to understand *form* as a determinant. I will however not go deeper into the latter issue here.

³ The patient who *sees* himself as being a horse because a compress is put on his back must, says Rorschach, have made use of an associative connection (saddle – horse) (p. 373 f.). Other cases are not in themselves based on association (although they are as a fact always mixed-up with associative elements); these are the “reflex hallucinations in the narrow sense”. To this latter group belongs the dreamer with tied-up feet who dreams that he is walking (although if he dreams that *Nansen* is walking, this is associative). In the nonassociative cases, Rorschach says, an “optical-kinesthetic parallel process” is instead at work. Regrettably, it is not clear what Rorschach means by “association”; in one natural reading he uses the term only for *temporally extended* sequences.

of *learning*. Thus, he tries to explain experiences of “impossible” movements (e.g., in dreams of flying) by means of generalization from earlier, similar experiences. The explanations he gives are vague and speculative, not to say contrived. It seems rather implausible that Rorschach’s own famous dream of feeling his brain being cut in slices had much to do with his experiences when having a haircut (Rorschach, 1912, pp. 362 f.)! Be that as it may; there is no doubt but that Rorschach here made a serious attempt to keep the phenomena of reflex hallucinations within the classical associationist frame.

What about the nature of kinesthetic sensations, and the “sensations of innervation”? Rorschach does not even mention the latter notion, and what he does say can always be given a natural interpretation in which it does not figure. For example, again discussing the problem of “impossible sensations”, he asks (Rorschach, 1912, p. 390) how it is possible that feelings of movement come to be localized in parts of the body where no actual movements are possible. To elucidate the issue, he makes an analogy with perceptual illusions in which an auditory sensation is being “misplaced”, such as for example when one expects to hear a Zeppelin and therefore takes any buzzing sound as coming from above. The analogy is most easily interpreted as an argument to the effect that the “impossible” kinesthetic feelings are misplaced memories of peripheral sensations, originally stemming from such parts of the body as can actually be moved (and have been moved).

As Ellenberger has plausibly argued, Rorschach’s dissertation provides an essential clue for understanding his later theory of movement responses. He emphasizes (Ellenberger, 1993, p. 200) the associationist bias of the work. I would like to add that the dissertation also tends to take a peripheralist position about the nature of kinesthetic experiences. If we are to understand the true nature of the movement responses, both associationism and peripheralism have to be rejected. Some of the evidence for such a rejection is summarized in the next section.

Innate Sensory-Motor Mechanisms and Corollary Discharge

Associationism came under heavy attack from experimental and theoretical psychologists from the turn of the present century. The foremost of the critics became known as the Gestalt psychologists, who – as we all know – insist that much of human knowledge and perception is innate.⁴ Although the reputation of Gestalt psychology experienced a temporary decline during the behaviorist era in psychology, many of their basic teachings have again become common ground in today's psychology, and nobody would deny today that there is a strong inborn element in perceptual organization. Let me just mention three cases in which strong evidence for innateness has recently been presented. For reasons which will become clear soon, I have chosen examples involving both perception and action, rather than subjective perception only.

The now classical so-called “visual cliff” experiments by Eleanor Gibson and her co-workers (Gibson & Walk, 1960) concern the ability to perceive the three-dimensionality of space, and prove that Berkeley was wrong. Very young animals who are put on a glass, under half of which the lower-lying bottom of the cage is visible, strictly avoid walking into that half although they have never had any experience of falling. This avoidance reaction is evidently *not* based on any learned association between vision and proprioception. The experiment has also been performed with human infants, with similar results.

Another set of examples is given by the research on the “time-to-contact” mechanism (for a review, see Bruce, Green & Georgeson, 1996, pp. 281 ff.). Quickly moving animals – especially birds and insects – seem to have a wonderful ability to judge the distance to the place where they are going to land, or, in the case of a diving gannet, the distance to the sea surface where she must have streamlined her wings. However, it has been shown that a simple neuronal circuitry could calculate the remaining time to contact with an approaching surface *without* calculating the distance to it. This is the time-to-contact mechanism, and there is much evidence that many animals, including the gannet and the human species, actually use it. (Sports psychology offers a lot of examples; see for example Bardy & Warren, 1997.) But of course it is not possible for the individual gannet to *learn* when to fold her wings (she would very soon break them), so the mechanism must be mainly innate. The visual cliff and time-to-contact experiments thus both highlight a very important fact about the central nervous system, be it human or otherwise animal: *many biologically important perception-action connections are hardwired in the brain and do not depend on learning.*

⁴ I am deliberately simplifying the Gestaltist position when characterizing it only in terms of the learned/innate distinction. The Gestalt psychologists did recognize the importance of experience for the detailed shaping of both perceptual and other responses. However, they did not accept the associationists' general description of the learning process as being a combining of mental elements (sensations, images and so on); consequently they did not agree that every mature perceptual process can be described in terms of an inference from the present sensation. Hence, even to the degree that the Gestaltist were not nativists, they were surely anti-associationists. Similar remarks apply to Gibson's ecological optics (cf. below).

The well-known research by Meltzoff & Moore (1995) and others on imitation in very young infants is yet another example which, furthermore, involves the visual perception of other people. This research has shown beyond much doubt that newborn babies have the ability to imitate actions which they have never seen themselves perform, such as for example sticking out their tongue at the left side of the mouth when the investigator does so. The baby's ability in this respect cannot be based on a learned association between the sight of her own tongue and her kinesthetic experiences. Although grown-up imitators can refine their abilities by looking at themselves in a mirror and noting the connections between what they see there and what they feel in their muscles, the baby has done no such thing. She has never seen her own tongue. Hence, innate direct visuo-motor couplings must be involved, here as in the behavior of the diving gannet.

Like the universal associationist principle, the peripheralist explanation of kinesthetic sensibility has been overturned by new findings. Around the mid-20th century the centralist theory again began to re-emerge, although under new names. Today the (physiological correlates of) sensations of innervation are often spoken of as "corollary discharge" (Sperry, 1959) or "efference copy" (von Holst & Mittelstadt, 1950), and modern neurophysiological research has shown beyond reasonable doubt that centrally-generated information about motor commands is important in modifying somatosensory perception, as for example in the perception of muscular effort. (For a very informative and conceptually clear overview see McCloskey, 1981; for a useful recent review see Nelson, 1996.) It is hardly any longer controversial to say that the bodily experiences which one has when moving are partly determined by the central impulse to act. The idea of corollary discharge also plays a central role in several recent neural-networks theories about motor control (see for example Bullock, Cisek & Grossberg, 1998).

Turning to the phenomenological aspect, it has been repeatedly emphasized by philosophers (Merleau-Ponty, 1962, pp. 93 f.; Wittgenstein, 1967, pp. 102 ff.; Wittgenstein, 1968, pp. 185f., Bermudez, 1998, ch. 6) that kinesthetic experience is different in many respects from bodily sensations like pain. Although this is not the same issue as the central/peripheral discussion in physiology, an emphasis on the non-sensory nature of kinesthetic experience accords well with a centralist theory (cf also above, and next section).

Before turning to another set of relevant recent results in the physiology and psychology of perception-action, let us make a philosophical-psychological excursus into the topics of practical knowledge and practical perception.

Practical Knowledge, the Body Schema, and Ecological Optics

Late twentieth-century philosophy and psychology have gradually come to appreciate the importance of *practical knowledge*. Practical knowledge primarily expresses itself directly in actions – it is a knowledge *how* – while theoretical knowledge, or knowledge *that*, typically expresses itself in thinking, speaking and writing.⁵ Practical and theoretical knowledge are to a large extent dissociated from each other. We know how to walk without being able to describe in detail how it is done; and as modern neuropsychologists have shown, *non-declarative* or *procedural* memory and knowledge is not affected in the same way by brain lesions as is declarative memory and knowledge (see Goldstein, 1995; Lindqvist & Malmgren, 1990, p. 222). If practical knowledge is being directly based on perception, we may speak about *practical perception*. Seeing *how* to bring down a certain apple from one's apple tree by reaching for it and grasping it is one example. What the above-cited research on the visual cliff and time-to-contact shows is, then, that several practical-perceptual abilities have a strong innate basis.

There is an obvious connection between psychological research on innate sensory-motor mechanisms, the concept of practical perception and the theory of the “body schema” as formulated by the French philosopher-psychologist Merleau-Ponty (1945, 1962).⁶ A major part of our knowledge of our own body has an immediate and practical character; for example, when it itches we immediately know, in the practical sense, *where* to scratch the skin. The body schema in Merleau-Ponty's sense *is* nothing but this fundamental system of practical knowledge. Our perceptual knowledge of close external space, he says, is to a large part similar in nature: we immediately see *how to do* in order to reach an object, to avoid it, or to grasp it. Hence the body schema includes not only the body, but also a part of the environment. Merleau-Ponty's (1962, pp. 254 ff.) highly original and suggestive comments on the nature of perceived depth must be read with these theses in mind.

The body schema also plays a central role in Merleau-Ponty's account of spontaneous imitation. The person who imitates need not see herself – the translation of the seen pattern into imitation is instead performed “automatically”, using a coordinate transformation of the immediate, practical knowledge embodied in the imitator's body schema (op. cit., p. 141).

⁵ Subtract the conditions of truth and justification from practical knowledge; what remains can be called *practical apprehension* or *pragmatic intentionality*. To explain the same thing by means of a simple example: if I seriously try to fly by jumping from a cliff and then performing swimming movements, I manifest a certain *practical* (though useless) *apprehension of how to fly*. For philosophical aspects see also Millikan (1996).

⁶ For my choice of the term “body schema” rather than “body image”, cf. Gallagher (1995).

There is also an interesting connection with the “ecological optics” of Eleanor and James J. Gibson. Gibson’s concept of *affordance*, which he⁷ borrowed from the Gestalt psychologist Kurt Lewin (1935), is central to ecological optics. In metaphorical terms, a perceptual *affordance* is what an object invites you to do with it when you perceive it – for example, walking on it. Non-metaphorically, the affordance of *being walkable* is the tendency of an object to give rise to practical perceptions of the fact that one can walk on it. Gibson stresses the point that perception of affordances is usually direct; “directness” has a number of connotations in Gibson’s psychology but a central one is *not being based on an inference* (cf. also footnote 4).

What is important for our present endeavor is that there are *social* affordances (Gibson, 1979, p. 42; see also Bruce et al, 1996, ch. 16). An approaching enemy can, and should, be seen as *somebody to flee from*, while an approaching conspecific of the opposite sex may sometimes be seen as *somebody to mate*. There are also affordances of being *somebody to cooperate with* in specific ways. Applying our definition above, we can say that all these affordances must correspond to tendencies to translate certain perceptual stimuli into socially directed actions.

James J. Gibson is not very explicit about social affordances; hence I will fill in with some arguments of my own. One distinguishing mark of social interactions is that the required action depends on what can be predicted about the partner(s). Such a prediction of a partner’s behavior can, in principle, be made using two very different mechanisms. One may use the same method as when judging the movements of an inanimate object, as for example in catching an approaching ball. Or, which is usually much more effective, one may try to see from the partner’s perspective what he/she intends to do. The latter strategy usually results in a more biologically adequate prediction: a heavyweight fighter probably stays upright longer if he tries to sense the other guy’s intentions than if he simply calculates time-to-contact with the approaching fist.

The above argument was phrased in terms borrowed from the domain of theoretical, declarative knowledge (“judging”, “calculating” and so on). But it would be more consistent with the general tenor of Gibson’s work to suggest that the whole process of perceiving a social affordance can be described in terms of practical perceptions. More specifically, I suggest that *the perception of the act which the other is performing is embodied in the perceiver’s tendency to perform the same act – it is a latent imitation*. The subject’s own actual reaction is then *another* motor pattern. If this description is correct, latent imitation is involved in all truly social interactions, and manifest imitation is just the special case (probably useful for general social training) where the two generated motor patterns are the same.

⁷ The Gibsons were close collaborators and developed similar but not identical ideas. See Redström, 1998. However, when speaking about “Gibson” here, I refer to the explicit views of James J. Gibson.

After this brief survey of some connected themes in psychology and philosophy which are relevant for understanding the M responses, we will go into some especially pertinent empirical findings from recent neuropsychological research.

Direct Visuo-Motor Couplings in the Central Nervous System

During the very last decades, much effort has been put into research on the neural mechanisms of action and the couplings between perception and action. For an excellent recent overview, see Jeannerod, 1997. In addition to the fact that there are inborn such couplings, it has emerged that *to an astonishingly large degree, the neural systems subserving action are separate from the neural systems for conscious knowledge*. The psychological aspect of this is that adaptive behavior, and even intelligent action, is not nearly as dependent on conscious knowledge as was believed earlier. Some of these recent findings are highly relevant not only for the understanding of how perception gives rise to action, but also for our understanding of what it is to *see another person move*. Let me describe a few crucial experiments.

It has been known for a long time in neurophysiology that there are subcortically mediated visuo-motor reactions which we are not always conscious of. The blinking reflex is a case in point. But recent research on the visual system has shown that many such reactions are much more complicated and much more “intelligent” than the blinking reflex. They are also to a large extent cortically mediated. Very schematically, one can distinguish between a ventral visual system which terminates in the inferior temporal lobes, and a dorsal route which involves several subcortical areas and finally leads to the parietal cortex. It seems that the ventral pathways mainly subserve conscious vision and visual recognition of objects, while the dorsal pathways are more involved in practical visuo-motor reactions which are not necessarily conscious.

For example, experiments have been done (Goodale et al, 1991; Carey et al, 1998) on subjects whose brain lesions have mainly affected the ventral pathways. One of these patients, when presented with a small object at armlength’s distance, could grasp the object in an adequate way, but when she was instead asked to show between her thumb and index finger how big the object was, she could not do so even nearly correctly. So, the visual system which informs her grasping hand so well is not able to inform the system responsible for conscious perceptual judgement. *Her hand knows more than her conscious mind*, and not only that: it obviously has enough good sense to act without consulting the conscious mind.

Perhaps the findings in normal subjects are even more relevant for our present purpose. In a number of fascinating experiments (e.g. Aglioti et al, 1995; Haffenden & Goodale, 1998), it has been shown that some well-known visual illusions need not deceive the hand. In yet another series of experiments, normal subjects were presented with a set of objects and were asked to

reach for one of the objects when it was illuminated (Paulignan et al, 1991). In some of the trials, when a subject started the reaching movement, the illumination was switched to another object. The subjects quickly corrected their movements before reaching the wrong bulb. By means of signals during the trial and a retrospective questioning of the subjects, it became clear that they did not consciously perceive the change until well after starting the correction of the movement – sometimes even after having reached the correct object. It seems that although in this experiment the visual system did pass the essential information to consciousness, the hand received it first. In other words, *intelligent actions may precede the conscious perception of the situation on which one acts.*

The third set of findings which I want to describe are those which concern the so-called mirror neurons (Di Pellegrino et al, 1992). It is interesting, but perhaps not sensational, that many of the same neurons which fire when a big ape reaches for a banana also tend to fire when she just *sees* the banana. The obvious interpretation of this finding is that perceiving the banana involves an implicit preparation for action towards it. But the one really amazing result in this context is that a certain subset of the neurons which fire when an ape reaches for an object also fire when the ape instead sees *another* ape (or a human being) reach for an object in the same way! These are the mirror neurons.

One very natural interpretation of the last-mentioned findings is that the mirror neurons signal a preparation for a special form of *imitation* – a preparation which is directly released by the sight of an action. It is therefore highly relevant to connect the results concerning mirror neurons with the above-mentioned results on imitation in infants (cf. above). Furthermore, the findings support the idea that all social perception involves coding the understanding of the other's actions as a latent imitation.

A New Characterization of the M Responses

Now we have come around full circle. The neuropsychological research on corollary discharge and on fast, essentially nonconscious perception-action chains, the finding of a common neural base for perceiving an action and performing it, and finally the evidence from child psychology for the innateness of the imitation reaction, provide us with the building blocks for a new hypothesis about the nature of the movement responses in the Rorschach test:

A movement, or kinesthetic, response is one where a fast, mainly innate, direct, essentially unconscious visuo-motor imitation tendency is primarily involved in determining perceptual content. The so-called "feeling of movement" is the conscious manifestation of a corollary discharge, informing other brain centers about the motor impulse.

This hypothesis is thoroughly nonassociationistic not only in its use of the innateness hypothesis, but also since it plays down the role of conscious elements – such as kinesthetic feelings – in the determination of the content. According to the new hypothesis, the brain directly translates the visual neural information into an imitation tendency. The “feelings of movement” are secondary to this already embodied apprehension of a movement – not its cause or reason.

At the same time I think we can say confidently that we stick to Rorschach’s basic intentions since he, too, strongly emphasizes the tendency to imitate the seen movement. The new hypothesis establishes a sound theoretical starting-point for explaining the remarkable connection which seems to exist between motor inhibition and M responses (for recent evidence, see Alin, 1994), and which is central to Rorschach’s theory about the diagnostic significance of M (Rorschach, 1972, pp. 74 ff.). It leaves room for Rorschach’s distinction between primary and secondary movement responses: in the latter kind of response, the conscious mind infers the movement before the body knows it. Finally, the hypothesis offers a remedy for the methodological worries about introspection. Since the kinesthetic feelings are now seen to be secondary to an *immediate tendency to act*, what we should look for in the first place is this tendency. Although introspection is *one* way to find out what one is about to do, action tendencies can certainly also be studied in more objective ways.

Movement from Form

Let me close this paper with a suggestion for how the concept of a movement response in the Rorschach test could be made relevant for modern experimental psychology. Above, I have mainly emphasized the converse connection: the possibility of using data from recent experimental research to find a reasonable interpretation of Rorschach’s ideas. But I also think that we may soon see a common use of his method and of accumulated Rorschach data in the service of experimental psychology and neurophysiology. The specific suggestion which I will now make is also directly relevant to one of the questions which I posed at the beginning, namely: Which is the role of form in a movement response?

Gunnar Johansson’s path-breaking research on the perception of movement showed that high-level optical invariants rather than low-level features are exploited when we see biological motion (Johansson, 1973; for a more recent experiment see Williams, 1988). A moving display consisting of very few point-light sources can easily be identified as a moving person. Since the movement is crucial for identifying the object here, the research tradition from Johansson is sometimes referred to as the “form-from-movement” paradigm. More recently, an experimental tradition which can be called “movement-from-form” has gained some momentum. Its commonest experimental paradigm is that of *apparent motion*. This experimental design, which historically goes back to Wertheimer (1912; for a review and

discussion of some pertinent early results see Arnheim, 1974, pp. 387 ff.), means that two somewhat dissimilar static pictures are tachistoscopically presented in close succession so that an illusion of continuous change is achieved. In this paradigm, a lot of research has been done to find out which factors influence the seen path of movement. One such factor is whether the static pictures give the impression of representing solid objects; if so, the seen movement tends to respect the seen solidity.

However, the most interesting results from our present viewpoint concern the nature of the apparent motion produced by human-like displays, as opposed to that produced by non-human-like ones. In a series of experiments it has been shown (Chatterjee et al., 1996) that the use of pictures of human figures has a strong tendency to give rise to biologically realistic apparent motions, which deviate much from the visually shortest path. The same effect is seen with displays which have the same general overall organization of “body” and “limbs” as a human figure, although they are not similar in detail. The effect is however *not* seen when realistic details of a human being, such as an isolated arm close to an inanimate object, is used as the display.

It is not difficult to see the relevance of this motion-from-form research to Rorschach theory. Like Johansson’s findings, the results suggest that M responses should be correlated with blot parts which have an overall, rather than a piecemeal, similarity with the human body. This would mean *not* that the M:s are a special kind of F responses (the overall F:s), but that some aspect of overall form is the effective factor in controlling the specific visuo-motor reaction which is involved in every M response. Such a statement is of course consonant with what Rorschach himself says *à propos* the common M on plate III: the kinesthetic component is what bridges the otherwise conspicuous visual gap between the “body” and the “legs” (Rorschach, 1972, p. 27). What is more, the parallel between the described experiments and that perception-psychological experiment which is called the Rorschach test points to the possibility of systematically exploiting Rorschach data in order to learn more about the motion-from-form mechanisms. Just collecting statistics on which blot parts are most often seen as M would give us a lot of information.

With this comment, I end my tour.

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