

# The Memory Process

Neuroscientific and Humanistic Perspectives

edited by Suzanne Nalbantian, Paul M. Matthews, and James L. McClelland

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## 16 Memory in Art: History and the Neuroscience of Response

David Freedberg

At the center of this chapter stands a historical work of art, one of the great masterpieces of fifteenth-century Flemish painting, Rogier van der Weyden's *Descent from the Cross*. It raises issues that relate to many other historical and contemporary artworks. Like almost all visual images, it poses a large number of difficult questions about the nature and varieties of memory.<sup>1</sup> My current work on the neural bases of empathy and the relationship between emotional and felt motor responses to works of visual art suggests some new ways of thinking about memory, and about the relationship between declarative and procedural memory in particular.

The broader context for this study is provided by recent developments in the neuroscience of the bodily consequences of sight of movement and emotion,<sup>2</sup> and the specific context, by a work of art that effectively illustrates how the question of memory cannot be considered outside the modulating or even preemptive effects of direct (unmediated) and indirect (mediated) responses to such a work. By "direct and indirect" or "unmediated and mediated," I refer to the dialectic between responses which seem to be automatic and predicated on immediate or felt bodily responses, on the one hand, and those which are mediated by concept, reflection, and recollection, on the other.<sup>3</sup> Forms of direct and unmediated response (provisional labels for a variety of immediate and unconscious responses) offer a way of thinking about the continued hold of a centuries-old work of art on contemporary viewers, even in the absence of any particular knowledge or conscious recollection of its subject.<sup>4</sup>

Implicit in this discussion are forms of perception that are either (1) uninflected or uninformed by concept and cognition or (2) cognitive and laden with experience and learning.<sup>5</sup> In the more conventional view, perception is entirely predicated on memory and, more specifically, on stored

schematic knowledge. But memory, as we now know, may be explicit or implicit. Explicit memory includes recollection of events and facts, of the textual sources for particular images, and of whatever may be acquired from the oral tradition (*tradition* being an especially salient term when it comes to explicit memory). The kinds of implicit memory most relevant here include the performance of actions (involving motor cortex and cerebellum) and the feeling of emotions (particularly involving the amygdala) without conscious awareness of drawing on experience or memory.

The central problem concerns the integration of experience and forms of explicit knowledge, on the one hand, with responses to sight of the body in movement, even in small movements (such as those of the corrugator and zygomatic muscles or those of the eyelids during blinks), on the other. When we recall a scene from the Bible, for example, and recognize what the scene represents, whether in whole or part, on the basis of accretions of experience and emotions that arise from our personal historical associations with such a scene, or we may react viscerally and corporeally in ways that seem to precede memory. It is these latter ways which need to be taken into account in dealing with artists' strategies, by no means always explicit or conscious, for arousing attention. In such cases, the neural substrate of the connections between vision and touch, or vision and movement, precede all conscious assessment of the iconography of a scene.<sup>6</sup>

Indeed, it's moot whether forms of declarative memory—even the little-discussed implicit forms of such memory—play much of a role in this transaction. Sometimes bodily reactions may actually refute experience and the varieties of declarative memory. But because implicit, nondeclarative memory is predicated on forms of recall that are embedded in the motor skills that underlie procedural memory, the two forms cannot be conflated as conscious. As became well known after studies of patient HM and the consequences of his mediotemporal lesions,<sup>7</sup> amnesia does not preclude muscular learning—indeed, it generally spares forms of learned and habitual movement. Despite damage to the hippocampus (critical for short-term memory and its conversion to long-term memory),<sup>8</sup> the role of the cerebellum (critical for movement conditioning) remains intact.

Underlying this discussion of memory is a commitment to the view that vision originally evolved in the service of movement rather than of perception.<sup>9</sup> Future research on art and memory will need to take into account the



relations between the mediotemporal and hippocampal substrates of memory, on the one hand, and the role of the parietal cortex in transforming visual signals into motor activity, on the other.<sup>10</sup> Similarly, the connections between limbic areas relating to emotion (the amygdala in particular)<sup>11</sup> and motor and premotor cortices have generally received more attention than the connections between memory (procedural memory in particular) and the reactions that ensue in movement or felt imitation of seen movement. Such reactions always entail and imply emotional responses.

Experimental familiarity with motor responses to the sight of movement and emotion in works of art brings into question many currently held vague notions about “cultural memory.” What follows is a reconception of the problem of memory in the context of past and present emotional responses to a particular work of art, and the felt—and occasionally explicit—motor responses such a work may evoke.

Now that Semir Zeki, who did fundamental work on the areas of the visual cortex in the 1980s and who coined the term *neuroaesthetics* about a decade ago, claims to have found the brain areas dedicated to beauty and love, and Vilayanur S. Ramachandran claims to have identified the neural bases of the principles of art, it remains important not to lose a sense of the historical dimensions of these issues.<sup>12</sup> The functions of both long- and short-term memory must be factored into any consideration of the problems not just of behavioral and emotional responses, but also of the ways in which these might be integrated into whatever it is that people call “the aesthetic.” We might also hope to go beyond Jean-Pierre Changeux’s stimulating but broad-brush accounts of neuronal networks to account for the individuality that lies at the core of much of what we call “art.”<sup>13</sup>

The traditional divide between the sciences and the humanities has long been seen in terms of the tension between naturalist and materialist views, on the one hand, and sensitivity to contextual and social constraints, on the other. But this conventional dichotomy collapses in the face of the evidence for the neural bases of empathetic engagement with works of art. We are in a better position to understand how prefrontal modulation of lower-level cerebral responses offers more flexible and inventive ways of thinking about the relationship between automaticity and experience. Recent research on memory confounds the separation of history and experience from the corporeal and psychological entailments of beholding a visual image, and a work of art in particular. The

subject of embodied responses—much discussed in recent years by humanist scholars—now stands at the intersection of several fields within the cognitive neurosciences.

In *The Power of Images* (1989), I set out to chart both the historical and cross-cultural dimensions of a wide range of psychological and behavioral reactions to images generally, not just to those designated as art.<sup>14</sup> I became aware of how much art history had neglected the emotions—or rather, of how systematically it had disregarded them, as though they would run amok if acknowledged. Indeed, in *The Principles of Art* (1938), R. G. Collingwood had specifically excluded the emotions as a constitutive factor of art,<sup>15</sup> a position derived of course from Kant's *Third Critique*, with its firm exclusion of desire and other elements of interest and value from the definition of art and beauty. In addition, it seemed to me that empathy had also fallen by the wayside in art history. In the late nineteenth century, writers such as Robert Vischer and Heinrich Wölfflin dedicated a great deal of attention to their theories of how viewers of images become physically involved with what they see, or rather of how visual stimuli from works of art and architecture engender a sense of embodied involvement in their viewers.<sup>16</sup> A few years later, Theodor Lipps's briefly influential work took up the still older theme of the understanding of the emotions through bodily movement.<sup>17</sup> For a long time, these positions were regarded with skepticism, though they were implicit in much critical writing and were influentially developed by the phenomenological writers on art. Most notable among these was Maurice Merleau-Ponty, for whom the body was always implicit in perception, and in the aesthetic qualities that derive from the corporeal sense made of even abstract imagery, achieved through the body and the body's perception of movement.<sup>18</sup> It is not hard to understand why Merleau-Ponty's writings have been so important for students of cubism, for example, as well as for those interested in making sense of the act of marking two-dimensional surfaces.

In *Descartes' Error* (1994), Antonio Damasio set out his descriptions of the neural substrate of the bodily basis of emotion.<sup>19</sup> As William James had before him,<sup>20</sup> Damasio argued for the ways in which physical responses—and movement in particular—do not just accompany but actually generate emotional awareness. Here and in his later books, *The Feeling of What*

*Happens* (1999) and *Looking for Spinoza* (2003), he developed his neurally grounded theory of the integration of cognition and bodily feeling. Critical to it was his concept of the *as-if body loop*, Damasio's term for the cortical circuits underlying our internally simulated somatic reactions to what we see.<sup>21</sup> Damasio argued that, in observing the physical and emotional behavior of others, our brains—and in particular the somatosensory cortices of their right hemisphere—reorganize themselves in such a way as to assume the same state they *would have been if* we were engaged in the same actions—or underwent the same emotions—ourselves. The appeal of such a theory for the understanding of viewers' sense of physical engagement either with the actors in a painted scene, or as subjects of the vicissitudes depicted in a scene (say a stormy seascape) did not escape Damasio, and he briefly suggested the relevance of such as-if responses to a theory of empathy. More specifically, Damasio outlined how the prefrontal cortex (especially the ventromedial prefrontal cortex) and the amygdala (or other relevant limbic region, such as the anterior insula in cases of disgust) signal directly to the somatosensory cortices to organize themselves in the explicit activity pattern they would have assumed had the body actually been placed in the same state. Thus when we see a dramatic action or a dramatic scene in which a body is involved, or even a scene implying bodily movement, the very parts of our motor and somatosensory cortices are activated that would be if we were involved in the scene *ourselves*, even if we do *not actually move*.<sup>22</sup>

But it was the discovery of “mirror neurons” by Giacomo Rizzolatti and colleagues in their Parma laboratory that revolutionized the understanding of embodied responses to the observation of the actions of others, whether in life or in art.<sup>23</sup> Whereas Damasio had left the cortical circuits between vision, motion, and emotion unclear, the initial findings by Rizzolatti and his colleagues Luciano Fadiga, Leonardo Fogassi, and Vittorio Gallese about a class of visuomotor neurons located chiefly in the premotor cortex of the brain—mirror neurons seemed to be fundamental for the understanding of our responses to art.<sup>24</sup>

Although mirror neurons cannot live up to many of the claims currently made on their behalf, they do offer a clearer hold on felt engagement with images than Damasio's body-loop systems. Beyond the viewer's corporeal and emotional involvement with what is seen, there is more specifically the question of the felt imitation of bodily movement and gesture. It is

precisely in this domain that the relationship between memory and movement as factors in aesthetic response becomes critically apparent.

After their initial experiments with monkeys, the researchers of Rizzolatti's Parma laboratory proceeded to study mirror circuits in the human brain, which they found in the functional equivalent of monkey F5, that is, in the parietal lobule and frontal operculum of the premotor cortex, and specifically, more or less, in Brodmann's 44, which overlaps with Broca's area, the language region of the brain.<sup>25</sup> At this point, Vittorio Gallese took the implications of the discovery still further. First of all, he realized the implications of mirror responses for the understanding not just of the actions of others, but also of the intentions behind them.<sup>26</sup> He then developed his influential theory of what he called "embodied simulation" to encompass the whole class of imitative sensations felt in the body, whose neural substrate he believed it was now possible to identify.<sup>27</sup> Finally, Gallese, Christian Keysers, and others began to look at the mirror circuits underlying responses to the viewing of touch.<sup>28</sup>

All this took the empathetic implications of mirror theory directly into areas relevant to art. Damasio's hypothesis had already provided a framework for thinking about the viewer's physical involvement with the bodily reactions of the actors in a picture—whether imitating their gestures, having a sense of bodily weight in beholding certain postures, or seeing the objects that bear down, or threaten to bear down, on the protagonists of the scene. Gallese and Keysers, in describing the activation of the secondary somatosensory cortex when their subjects both viewed and experienced touch, raised questions about the kinds of empathetic pain that seem instantly to follow upon the sight of needles piercing the flesh or of even more cutting insults to the body.<sup>29</sup> This seemed to open new perspectives on the kind of sudden start that sometimes occurs when looking at pictures of martyrdom, or at the wounds of Christ in paintings of the Passion. The same sharp sense of empathetic understanding of physical pain may well occur, for example, in response to several of the etchings in Goya's *Desastres de la Guerra*—to say nothing of the photographic images from Abu Ghraib and the war zones of our times and those of others.<sup>30</sup>

But let us turn to a work of art that may serve to focus our attention on some of the key issues at stake: the relationship between bodily movement and the expression of emotion; the ways in which visual perception can



turn into a viewer's sense of the weight, feel, and movements of represented bodies; and how emotion can be derived from its expression through movement. The central question is how adopting a perspective predicated on sight, movement, and emotion—rather than one predicated on memory of the story alone—allows for the integration of phenomenological responses with the *historical* claims for physical engagement with the artwork itself.

Rogier van der Weyden's *Descent from the Cross* was painted in the second half of the 1430s for the chapel of the Crossbowmen in the Church of Our Lady outside the Walls in Louvain, Belgium (figure 16.1).<sup>31</sup> On the face of it, the iconography is straightforward enough. Christ's body slumps down from the Cross. Nicodemus holds Him beneath His arms; Joseph of Arimathea lightly holds up His feet; and, from a ladder behind the Cross, a swarthy boy gently holds up His left arm. The Virgin Mary, supported

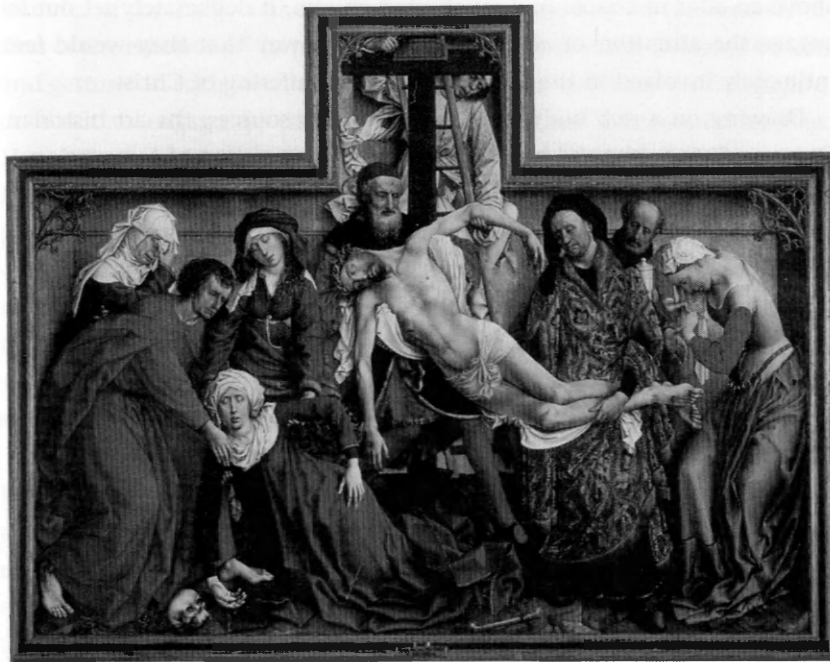


Figure 16.1

Rogier van der Weyden's *Descent from the Cross*. Deposition, ca 1436. Museo del Prado, Madrid, Spain.

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by John the Evangelist and Mary Cleophas, collapses in grief before Him; Mary Salome presses a handkerchief to her tears. On the right, the aged Joseph looks on, while Mary Magdalene, identified by the pot of unguent with which she washed Christ's feet, tightly clasps her hands together in an effort to contain her grief.

There can be no doubt about the artist's skill exhibited in the painting. The folds of every piece of cloth—but especially the whites—are painted with crisp precision; the variety of colors, some saturated, others delicate and subtle (like the lilacs and greens of the Magdalene's garments), testify to the technical prowess of a painter who paints almost every head of hair, every beard in a different way. But it is, above all, his command of the representation of the human body and his ability to convey emotion through bodily and facial expression that signal both Rogier's pictorial skill and the brilliance of his vision. Of course, such a painting was not just meant to impress with its art, but to arouse emotion as well. Made to go above an altar in chapel in a much-used church, it deliberately set out to engage the attention of *all* viewers in such a way that they would feel intimately involved in the scene, in the very suffering of Christ.

Drawing on a rich body of fifteenth-century sources, the art historian Otto von Simson showed how the then prevailing notion of compassion—literally “co-suffering”—was central to the interpretation of the *Descent from the Cross*. At the time it was painted, writers from Dionysius the Carthusian to Bernardino of Siena emphasized over and over again the physical and emotional involvement of the Virgin with the suffering of her Son.<sup>32</sup> Just a few years before the *Descent* was commissioned, a festival of the Compassion of the Virgin was established in Cologne, some 100 miles to the east. It institutionalized centuries of prayer and meditation on the subject of physical and mental compassion for the suffering of Christ.<sup>33</sup> In this tradition, Christ's torments became those of His mother, and writers constantly insisted, in the most graphic ways possible, on the Virgin's corporeal response, precisely in order to elicit the devotees' own affective responses.<sup>34</sup>

The painting shows how emotion can only be fully expressed through the body itself. Previously, painters had shown the Virgin standing or kneeling beside the cross, but in the *Descent*, she collapses in exactly the way Christ descends from the Cross. Rogier gave literal and physical expression to centuries of sentiment about her *compassio*, her sympathetic

grieving for her Son by showing how she feels the wounds to His body in her own. Today the *Descent* hangs in the Early Flemish galleries of the Prado. In every respect, it is far from its original context—yet it continues to exert a powerful hold on its viewers. It is surely the sense of bodily presence (of Christ in particular), along with the gestural and physiognomic indices of emotion those bodies so powerfully convey, that continues to draw the attention of viewers of this work. When we see Christ's body slumping down from the Cross, we sense a slumping in our own bodies, and we notice how precisely the Virgin reenacts that same movement, as if to express her grief at the sight of her Son. Furthermore, when we see the gamut of emotions that are so poignantly registered both by the tears on the faces of protagonists of this drama and by the movements of their hands and limbs, we have an immediate sense of the muscular forces that drive these expressions of emotion.

It is often claimed that Rogier exceeded even Jan van Eyck, the great founder of the Early Netherlandish School of painting, in the representation of the emotions.<sup>35</sup> In particular, Rogier had the ability to paint actions and gestures in such a way as to make viewers feel as if they were engaging, or about to engage in, the very same actions and gestures themselves. Hence, for today's viewers, it may not just be the technical skill with which Rogier draws and handles the medium of paint that makes them feel so powerfully engaged in the scene. Instead it is also his ability to convey the outward signs of emotion on the faces of the participants in this drama, in such a way as to make viewers feel as if they are participating in the same emotions and movements themselves. They have no difficulty in recognizing the emotions quite precisely. They do not need to remember even fragmentary details of the story.

How might the new work on mirror neurons, on the corporeal bases of emotional response, and on the felt imitation of the actions of others contribute to a better understanding of the effects of Rogier's picture, especially in terms of viewers' understanding of the emotions of others (and specifically of those represented)? Its hold on its viewers, even in the fifteenth century, would most likely not have depended on knowledge of its subject matter, or even on personal experiences related to the emotional connotations of the scene or of the story represented. Rather, it would have depended, just as it does today, on a set of cortical responses that have

little to do with context, whether historical or connotative, but everything to do with the connection between sight of the bodies and movements of others and the viewers' sense of their own bodies and movements. Such responses may well enhance emotional engagement in a way that in turn enhances memory.<sup>36</sup> In this regard, following Shaun Gallagher, the body shapes whatever it is that we call "mind."<sup>37</sup>

How the emotions can either disrupt or reinforce memory has been much discussed both as a neuroscientific and as a psychological issue, the latter in terms of repressed or exaggerated (retrospectively heightened) recollection of trauma.<sup>38</sup> Painters intuitively knew that, by arousing the emotions through the body, they could reinforce the forms of declarative memory on which knowledge, say, of a biblical story depended. What is significant in all such cases is the role of felt corporeal response in the generation and sustenance of appropriate emotion. It was here that Rogier excelled. By means of his skills in evoking empathetic response, his work performed the first of Thomas Aquinas's three functions of art, present in every aspect of medieval art and theory, namely, to reinforce memory.<sup>39</sup> The efficacy of the visual arts (especially but not exclusively the static visual arts) stems not just from the priming possibilities they offer (and the consequent facilitation of implicit memory), but also, *mutatis mutandis*, from their ability to elicit the motoric bases of emotional response.

Whatever the formal and decorative attractions of Rogier's work, and whatever the power its narrative draws from the biblical texts, the range of emotion it evokes through bodily movement and posture remains its most compelling feature. Such evocation is not predicated on knowledge or recollection of the subject of the painting. It would have been activated, then as now, by clear and unconfused awareness of the emotional expression of the actors in the scene (assuming, of course, that the picture was well painted). This awareness depends on the activation (through selective firing of neurons) of the same areas of the motor cortex as those which *would have been* activated if the painted actors had been living beings themselves. Understood from this perspective, action understanding, embodied simulation, and immediate emotional awareness are more important than declarative memory, the memory of the details of the story.

Here two questions emerge: How is implicit procedural memory activated by vision? And how might emotional response be reinforced—rather

than activated—by the *combination* of long-term memory and what is now called “emotional memory”?<sup>40</sup> In both cases, deep cortical structures play a critical role: the amygdala in the case of emotional learning, and the cerebellum in the case of motor learning. At stake are not only the roles of the mediotemporal cortex and the hippocampus in memory storage, but the ways in which signals from them, just as those from the amygdala, are processed in the prefrontal cortex. Nevertheless, when it comes to the *continuing* effects of a work of art such as *Descent from the Cross*, what is significant is less the cognitive, prefrontally modulated aspects of memory than the direct amygdalar processing of visual signals (via the superior colliculus) and the multiple ways in which visuomotor signals are processed in the parietal cortex, in the cerebellum, and in the motor cortices—all prior to prefrontal modulation.

A crucial part of Rogier’s skill lay in his ability to make his viewers instantly recognize the sadness of those whom he portrays by the evocation of corresponding feelings through the excitation of those parts of the brain responsible for the activation of corresponding movements of the body. In this way, the phenomenology of compassion meets—and reinforces—its iconography. It may be that the effectiveness of the image depends on how knowledge of the suffering of Christ and the recollection of similar (but never, in such scenes, equivalent) forms of travail reinforce preconceptual, precognitive forms of response in which no memory other than perhaps procedural plays a role. Here lies one of the most critical questions raised by the new cognitive neurosciences for the assessment of artistic skill: Does the success of an artwork such as *Descent from the Cross* depend on the artist’s ability to evoke our direct emotional responses, irrespective of our historical knowledge? We might say that such an ability is a measure, not of the aesthetic, but rather of all effective images, artistic or not. But to consider the aesthetic independently of how cognition modulates the motoric dimensions of vision is to leave out a critical part of the story. The degree of an artist’s skill in conveying conscious or unconscious bodily knowledge is not just a marker of efficacy but an aesthetic one as well.

In 1949, Donald Hebb suggested that emotion results when novel circumstances prevent completion of cued behavior. “Affects,” wrote Peter Lang and Margaret Bradley, “are more often *dispositions* to action, than they are the acts themselves.”<sup>41</sup> Lesser artists may simply be less good at



evoking the motor responses that underlie appropriate emotion. Although a fair experiment might show how artists differ in their ability to use the same actions to arouse their correlative effects—or how the degree of arousal caused by the same actions differs in the hands of different artists—such effects are not confined to verisimilitudinous representations alone. Naturalism is not in itself a criterion of aesthetic quality or effectiveness. Indeed, it may even be an obstacle to it. After all, the suggestiveness of representation does not have to do with the realism of a work of art.

Moreover, there is another, rather different—yet not unrelated—argument against the role of verisimilitude and naturalism in the efficacy of images. It is certainly the case that the phenomenological claims about felt involvement in pictures have never been applied to verisimilitudinous representation alone. Merleau-Ponty devoted many pages to bodily responses to the implied forms of Cézanne's cubism. A strong case can now also be made for embodied responses to works by artists like Jackson Pollock and Lucio Fontana. What is at stake are the implied actions that lie behind—or, rather, that were necessary to execute—the traces of artists' actions on the canvas. A sense of felt bodily response arises not from any seen actions, but from implied ones, where the trace on the canvas or sculpture evokes a response that is predicated on the very actions that produced it. Many viewers have a sense of corporeal engagement with the implied movement of the brushstrokes on many of Pollock's canvases, as well as a felt reaction to Fontana's slashed and punctured canvases.

As for the defining question of gesture, in looking at Rogier's painting, and any number of other visual works, both religious or secular, two issues about the felt imitation of observed movement arise. The first concerns the emulative sense we have of the postures of others, of whole body movement and the consequent emotional feelings that such emulation may arouse or reinforce in ourselves. The second relates to the recognition of particular gestures as invested with particular emotions. The continued understanding of the meaning of such gestures, without any necessary knowledge of story or original function, poses a critical question about the relationship between human motoric capacity and culture.

Many of the non-goal-directed movements like the gestures in Rogier's painting seem to occur almost formulaically across the whole history of art. The question that arises is whether the emotions conveyed by such

gestures are culturally conditioned, or whether—and this might explain why the gestures recur so frequently—their particular emotional and connotative freight is prior to and beyond cultural specificity. Examples come to mind: hands thrown up in distress (or sometimes in triumph), palms pressed together in supplication or prayer, the back of the hand wiped across the saddened or tear-filled eye—such as by the angels above Giotto's Padua *Lamentation*, in Claus Sluter's *Well of Moses*, and, to some degree, in Rogier's Louvain altarpiece. This last gesture seems entirely natural and spontaneous. We see it and immediately feel the grief that lies behind it. Thus what many scholars call "cultural memory" may have less to do with the conscious emotional understanding of such gestures than the embodied responses of mirror circuits to an action that is not goal-directed in the way that reaching for food or using an instrument may be.

One of the key concepts outlined by Aby Warburg was that of *Pathosformeln*, the ways in which the outward movements of the whole body were used in works of art to convey inner emotion—as suggested, for example, by Leon Battista Alberti and exemplified by Sandro Botticelli.<sup>42</sup> Warburg gave examples, on the basis of his reading of some remarkable passages about bodily movement in Alberti, of the ways in which the swaying bodies, vigorously flowing drapery, and hair flying in the breeze, conveyed inner states of psychic excitation.<sup>43</sup> Such formulaic movements can be traced back to ancient statues and reliefs, such as those showing the Maenads, the drunken followers of Bacchus. But the notion of *Pathosformeln* was then extended to the variety of apparently repeated gestures that seem to occur throughout the history of art.

Here we can see a role for Gallese's notion of embodied simulation, a form of simulation he regards as preconceptual.<sup>44</sup> Take, for example, Caravaggio's *Entombment of Christ*, in which (as is almost always the case with Caravaggio) emotional effect is significantly predicated on embodied responses. These are evoked by a variety of pictorial strategies, including the way in which the elbow of Joseph of Arimathea juts out into the spectator's space, for example (if you stand before this, you recognize it immediately), and thus commands attention. But what is perhaps most striking are the arms of the Virgin thrown up in a gesture of despair and grief. Does the impact of this gesture lie in its occurring so frequently in the history of art, or in its peculiarly effective way of arousing a sense of inward imitation? The gesture is easily recognizable not only from images

of the *Entombment* and *Lamentation*, but also from images such as Goya's famous *Third May, 1808*.<sup>45</sup> It's the inverse of this gesture in, for example, the frontispiece to Goya's *Desastres* or Tyler Hicks's 1997 photograph of a mourning mother in Bosnia and raises similar questions about the relationship between the cultural freight of a gesture and the ways in which it is understood through the body.

For some time now, Fortunato Battaglia and I have been examining the corticomotor networks involved in responses to the sight of particular gestures. That the inward simulation of gestures was not covered by the mirror research led us to design a series of experiments investigating responses to the sight of represented movements. We used single- and paired-pulse transcranial magnetic stimulation (TMS) and more recently electroencephalograms (EEGs) to explore easily locatable cortical responses to the sight of a simple action, like the raising of the wrist.<sup>46</sup> It was then possible to examine subjects' cortical responses to the raising, for example, of Adam's hand in his confrontation with the Angel in Michelangelo's *Expulsion from Eden* in the Sistine Chapel.<sup>47</sup>

We showed subjects the painting itself, a photograph of the identical action, and then a movie of it, and found that sight of the painting and of the movie alone was sufficient to stimulate the same action. In other words, sight of the action in the painting or the movie enhanced the movement-evoked potential (MEP) of the muscle concerned. The effect was considerably weaker in the case of the photograph than in that of either the movie or Michelangelo's painting. We repeated the experiment with artworks that represent a high pitch of emotion—Bellini's *Dead Christ with Angels* in Santi Giovanni e Paolo in Venice, for example—but that show, not a tensed wrist, but a relaxed one. The fact that the movement-evoked potential (MEP) was lower in this case than in that of the Michelangelo painting was sufficient to demonstrate that the responses we found to Adam's gesture could be attributed to sight of the activated wrist alone, and not simply to emotional arousal.

Such experiments as well as a wide variety of phenomenological reports suggest that embodied simulation occurs abundantly in both goal-directed and non-goal-directed movements, such as those found in gestures in real life and as represented in art. What is critical here is not so much the emotional valence of gestures, but the very fact that sight of a gesture activates the same muscles in the viewer as in those of the

figures represented, and that the same may be taken for the artist's marks on pictures and sculptures (because of the gestures they imply). Long-term memory is essential for the emotional valence of all gestures; but it is the inevitability of the activation that is crucial. Without this, the valence of the gesture would be limited. The kinds of felt imitation of movement described here suggest how traditional art historical views of imitation as representational mimesis might be expanded and reformulated.<sup>48</sup> For Ernst Gombrich, the ability to imitate pictorially depended on the retention of basic artistic schemata handed down by the tradition. These schemata formed the inevitable and indispensable basis for imitation conceived of as representational mimesis. But the kinds of imitation arising from sight of a work that implies movement were not anticipated by Gombrich—or by any earlier theorist. It is here that we must seek not only the roots of creativity but also ways of integrating into aesthetic experience a response that is liberated from the shackles of historical memory and personal experience. Despite the pressures of nostalgia, devotion, erudition, and a host of other factors that enter into any appreciation of a work of art, it is in this form of felt imitation and engagement of the cortical correlates of movement that some of the most redemptive qualities of art may lie.

This reformulation of the role of memory in aesthetics raises a series of potentially fruitful possibilities and opens up new areas of research. Most of the aesthetic questions remain. If we were to ask to what degree impairment of the classical cortical structures of memory—hippocampal, medio-temporal, even prefrontal—would impair emotional recognition (which I still consider, *pace* Collingwood, to be critical to the aesthetic assessment of a work of art), we would have to admit that the consequences would be significant. No one could reasonably exclude experience from aesthetics. But it becomes clear that the fruits of declarative memory might to some degree be dispensable when it comes to aesthetic experience and that it is in the domain of muscular possibility that we may discover what it is that makes certain images transcend the constraints of context and time. The question of procedural memory is fundamental here since implicit memory of bodily possibilities clearly plays a role in felt responses to what is seen in representation. Recently, Beatriz Calvo-Merino and colleagues described the distinctions between expert and nonexpert responses to dance, and to videos of dance, and made it clear that the effects of viewing on motoric

circuits are enhanced by prior skill and training.<sup>49</sup> But they only briefly alluded to the ameliorative role that viewing might play on the enhancement of skills. This possibility is suggested by a multitude of other findings, beginning with those from Ramachandran's research on plasticity in the case of phantom limbs, where stimulation of somatosensory regions adjacent to those once associated with working limbs allows for the sensation of movement as if the lost limb itself were operant and functional.<sup>50</sup>

When phenomenology trumps iconography, so action recognition trumps memory—certainly declarative memory, possibly even implicit memory. Memory may often shape embodied responses, but the body shapes memory as well. In these processes, vision plays a central role. It is not just that vision can restore or refresh declarative long-term memory, whether in the case of a picture of Christ's Passion, for example, or a photo of a lost loved one. Even the ancients knew that sight could activate the other senses, but we now have a much clearer idea of how this happens. Thanks to the polymodal consequences of sight, viewing a work of art also restores some of what is truly lost—the vitality of body and hand—and endows movement with the possibilities of emotion. The analysis of how this happens helps to make sense of the relationship between art, memory, and the forces that move the body.

#### Notes

1. Of course, research on the nature and varieties of memory is vast. For up-to-date accounts of the neuroscience of memory, see *The Cognitive Neurosciences*, 3rd ed., ed. Michael S. Gazzaniga (Cambridge, MA: MIT Press, 2004), chaps. 47–53—a volume that includes a fine brief introduction by Daniel Schacter, whose crucial work on priming and memory is implicit throughout this chapter. See also Larry R. Squire and Eric R. Kandel, *Memory: From Mind to Molecules* (New York: Roberts, 2008).
2. For a survey of the neuroscience of such consequences, see David Freedberg, "Empathy, Motion and Emotion," in *Wie sich Gefühle Ausdruck verschaffen: Emotionen in Nahsicht*, ed. Klaus Herding and Antje Krause Wahl (Berlin: Driesen, 2007), 17–51. For a deeply knowledgeable introduction to some of the philosophical issues at stake on the basis of recent neuroscientific research, see Shaun Gallagher, *How the Body Shapes the Mind* (Oxford: Clarendon Press, 2005).
3. To some extent, the dialectic between these two kinds of responses is reflected in Walter Benjamin's famous remarks on the distinction between *Erfahrung* and *Erlebnis*. See Walter Benjamin, "On Some Motifs in Baudelaire," in *Selected Writings*, vol. 4, 1938–1940, ed. Howard Eiland and Michael W. Jennings, trans. Edmund



Jephcott et al. (Cambridge, MA: Harvard University Press, 2003), 314 and 329–331, and the discussions in Jonathan Crary, *Suspensions of Perception: Attention, Spectacle, and Modern Culture* (Cambridge, MA: MIT Press, 2001). For a history of the concept of cultural memory, see also Miriam B. Hansen, "Room-for-Play: Benjamin's Gamble with Cinema," *October* 109 (2004): 3–45.

4. Of course, this in turn raises the question of fragmentary recollection, clearly relevant in the case of widely known biblical stories whose *details* have dropped from common memory.

5. For an excellent general introduction to the biology of learning, see Eric R. Kandel, *In Search of Memory: The Emergence of a New Science of Mind* (New York: Norton, 2006), chaps. 10–14.

6. By *iconography*, I mean all the varieties of iconographic understanding. For a basic summary of the possibilities, see Erwin Panofsky's famous introductory essay "Iconography and Iconology," in *Studies in Iconology: Humanistic Themes in the Art of the Renaissance* (Oxford: Oxford University Press, 1939), reprinted as the first chapter in Erwin Panofsky, *Meaning in the Visual Arts* (New York: Doubleday, 1955).

7. The classic study of patient HM is William B. Scoville and Brenda Milner, "Loss of Recent Memory after Bilateral Hippocampal Lesions," *Journal of Neurology, Neurosurgery and Psychiatry* 20 (1957): 1–21.

8. For good overviews of the biological bases of the conversion of short- to long-term memory, see Linda L. Chao and Alex Martin, "Representation of Manipulable Manmade Objects in the Dorsal Stream," *NeuroImage* 12 (2000): 478–484; Larry R. Squire and Eric R. Kandel, *Memory: From Mind to Molecules*, 2nd ed. (New York: Roberts, 2008).

9. See A. David Milner and Melvyn A. Goodale, *The Visual Brain in Action* (Oxford: Oxford University Press, 1995); Melvyn A. Goodale, "Perceiving the World and Grasping It: Dissociations between Conscious and Unconscious Processing," in *The Cognitive Neurosciences*, 1159–1172.

10. Already at the end of the nineteenth century, William James insisted on the interconnectedness of bodily movement and emotion, a theme taken up in a variety of illuminating and convincing ways by Antonio Damasio at the end of the twentieth. See William James, *The Principles of Psychology* (New York: Holt, 1890), 2: 738–766.

11. This, of course, is now an immensely rich and well-studied field. For groundbreaking, accessible accounts, see Joseph E. LeDoux, "Emotion and the Amygdala," in *The Amygdala: Neurobiological Aspects of Emotion, Memory and Mental Dysfunction*, ed. John P. Aggleton (New York: Wiley-Liss, 1992), 339–351; Joseph E. LeDoux, *The Emotional Brain. The Mysterious Underpinnings of Emotional Life* (New York: Simon & Schuster, 1996).

12. See Semir Zeki, *Inner Vision. An Exploration of Art and the Brain* (Oxford: Oxford University Press, 1999); Semir Zeki, "Neural Concept Formation and Art: Dante, Michelangelo, Wagner," *Journal of Consciousness Studies* 9 (2000): 53–76; Vilayanur S. Ramachandran, "The Science of Art: A Neurological Theory of Aesthetic Experience," *Journal of Consciousness Studies* 6 (1999): 6–7; Vilayanur S. Ramachandran, *A Brief Tour of Human Consciousness* (New York: Pi Press, 2004).
13. Changeux was one of the real pioneers in discussing the relationship between art and neuroscience. See Jean-Pierre Changeux, "Art and Neuroscience," *Leonardo* 27 (Fall 1994): 189–201; Jean-Pierre Changeux, *Raison et plaisir* (Paris: Odile Jacob, 1994); Jean-Pierre Changeux, *Du vrai, du beau, du bien* (Paris: Odile Jacob, 2008).
14. See David Freedberg, *The Power of Images: Studies in the History and Theory of Response* (Chicago: University of Chicago Press, 1989). Although *The Power of Images* was indeed about emotional and corporeal responses to works of art, its chief concern was the *symptoms* of such responses. It was not specifically about the relations between how things looked and how people responded to them, especially in light of so much new research about the activity of polymodal neurons, in particular, visuomotor and visuotactile neurons. See the brief outline in David Freedberg and Vittorio Gallese, "Motion, Emotion and Empathy in Aesthetic Experience," *Trends in Cognitive Science* 11 (2007): 197–203.
15. But the views of art historians on the role of emotion in art are rapidly changing. Among the many efforts at reintegration, see Klaus Herding and Bernhard Stumpfhaus, *Pathos, Affekt, Gefühl: Die Emotionen in den Künsten* (Berlin: De Gruyter, 2004); D. Freedberg, "Empathy, Motion and Emotion."
16. The work of Robert Vischer and Heinrich Wölfflin on the subject of empathy is now easily accessible in *Empathy, Form, and Space: Problems in German Aesthetics, 1873–1893*, ed. Harry F. Mallgrave and Eleftherios Ikonomou (Santa Monica, CA: Getty Center, 1994), 89–117, and 149–167. But see also the discussion in D. Freedberg, "Empathy, Motion and Emotion"; Juliet Koss, "On the Limits of Empathy," *Art Bulletin* 88 (2006): 139–157.
17. Theodor Lipps, "Einfühlung, innere Nachahmung, und Organempfindungen," *Archiv für die gesamte Psychologie* 1 (1903–1906): 185–204.
18. See Maurice Merleau-Ponty, *Phénoménologie de la perception* (Paris: Gallimard, 1945).
19. Antonio R. Damasio, *Descartes' Error: Emotion, Reason, and the Human Brain* (New York: Grosset/Putnam, 1994).
20. William James, *The Principles of Psychology* (New York: Holt, 1890).
21. Antonio R. Damasio, *The Feeling of What Happens: Body and Emotion in the Making of Consciousness* (Orlando, FL: Harcourt, 1999): 280–283; Antonio Damasio, *Looking for Spinoza: Joy, Sorrow and the Feeling Brain* (Orlando, FL: Harcourt, 2003), 115–118.

"As-if" responses seem to be fundamental to any aesthetic inquiry; for some stimulating comments on this possibility, see Nicholas Humphrey, *Seeing Red: A Study in Consciousness* (Cambridge, MA: Harvard University Press, 2006).

22. A. Damasio, *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*; Vittorio Gallese, "The 'Shared Manifold' Hypothesis: From Mirror Neurons to Empathy," *Journal of Consciousness Studies* 8 (2001): 33–50. My own sense is that the concept of empathy were better confined to physical empathy—precisely because this may be predicated on procedural memory rather than just on episodic and semantic memory.

23. On the Parma group's initial discoveries, see Giacomo Rizzolatti et al., "Premotor Cortex and the Recognition of Motor Actions," *Cognitive Brain Research* 3 (1996): 131–141; Vittorio Gallese et al., "Action Recognition in the Premotor Cortex," *Brain* 119 (1996): 593–609. On the implications of these discoveries for art, see D. Freedberg and V. Gallese, "Motion, Emotion and Empathy in Aesthetic Experience." One of the very first neuroscientists to appreciate the importance of the discovery of mirror neurons for art was Jean-Pierre Changeux. See note 13.

24. G. Rizzolatti et al., "Premotor Cortex and the Recognition of Motor Actions"; V. Gallese et al., "Action Recognition in the Premotor Cortex." See also *Mirror Neurons and the Evolution of Brain and Language*, ed. Maxim I. Stamenov and Vittorio Gallese (Amsterdam: John Benjamins, 2002).

25. See Giacomo Rizzolatti, "Neurophysiological Mechanisms Underlying the Understanding of Action," *Nature Neuroscience Reviews* 2 (2001): 661–670; see also Giacomo Rizzolatti and Laila Craighero, "The Mirror Neuron System," *Annual Review of Neuroscience* 27 (2004): 169–192.

26. See Vittorio Gallese et al., "The Mirror Matching System: A Shared Manifold for Intersubjectivity," *Behavioral and Brain Sciences* 25 (2002): 35–36; Vittorio Gallese, Christian Keysers, and Giacomo Rizzolatti, "A Unifying View of the Basis of Social Cognition," *Trends in Cognitive Science* 8 (2004): 396–403.

27. Vittorio Gallese, "Embodied Simulation: From Neurons to Phenomenal Experience," *Phenomenology Cognitive Science* 4 (2005): 23–48.

28. Christian Keysers et al., "A Touching Sight: SII/PV Activation during the Observation and Experience of Touch," *Neuron* 42 (2004): 336–346. See also Sarah J. Blakemore et al., "Somatosensory Activations during the Observation of Touch and a Case of Vision-Touch Synaesthesia," *Brain* 128 (2005): 1571–1583.

29. C. Keysers et al., "A Touching Sight: SII/PV Activation during the Observation and Experience of Touch": 342–343.

30. In addition to the discussions by Antonio Damasio (see note 22), a vast literature on empathy has developed in recent years. For a useful discussion when viewing art, see Jean Decety and Philip L. Jackson, "The Functional Architecture of Human

Empathy," *Behavioral Cognitive Neuroscience Review* 3 (2004): 71–100; Philip L. Jackson, Andrew N. Meltzoff, and Jean Decety, "How Do We Perceive the Pain of Others? A Window into the Neural Processes Involved in Empathy," *NeuroImage* 24 (2005): 771–779. A vigorous debate has arisen in the last few years, led by researchers such as Tanya Singer and Chris Frith, about whether the neural substrate of viewers' physical responses to images evoking empathetic pain are located in the specific somatosensory areas correlative to the ones seen, or whether their responses are more generalized affective reactions. See Tania Singer et al., "Empathy for Pain Involves the Affective but Not Sensory Components of Pain," *Science* 303 (2004): 1157–1162. For earlier discussions of experiencing the pain of others, see Elaine Scarry, *The Body in Pain: The Making and Unmaking of the World* (New York: Oxford University Press, 1985); Susan Sontag, *Regarding the Pain of Others* (New York: Farrar, Straus and Giroux, 2003). But these works do not deal in any way with the specific effects of images, or the possibility of distinguishing the aesthetic markers of different kinds of images of emotion and pain. Nor do they consider the reinforcing effects of the memory of other images or iconographies, or the relationship between automatic, immediate, and spontaneous responses unmodulated by prefrontal assessment, on the one hand, and the recollection of similar images, on the other.

31. For a good modern monograph on Rogier, see Dirk de Vos, *Rogier van der Weyden: The Complete Works* (New York: Abrams, 1999).

32. See Otto G. von Simson, "Compassion and Co-redemption in Rogier van der Weyden's *Descent from the Cross*," *Art Bulletin* 35 (1953): 9–16.

33. For a summary of the various festivals and liturgical developments related to the compassion and sufferings of the Virgin, see Carol M. Schuler, "The Seven Sorrows of the Virgin: Popular Culture and Cultic Imagery in Pre-Reformation Europe," *Simiolus* 21 (1992): 5–28.

34. See also Sixten Ringbom, "Devotional Images and Imaginative Devotions," *Gazette des Beaux Arts* 73 (1969): 159–70; Sixten Ringbom, *Icon to Narrative: The Rise of the Dramatic Close-Up in Fifteenth Century Devotional Painting* (Doornspijk, Netherlands: Davaco, 1985).

35. There are other paintings in which Rogier's expressive skill is strongly manifest, such as the *Miraflores* altarpiece, where he shows the sad surprise of the Virgin upon encountering Christ after His resurrection or the great *Crucifixion* in Vienna, where he signs John, the swooning Virgin, and the sobbing Magdalene with the outward marks of grief.

36. For a recent summary and discussion of research on bodily responses and emotion, see Kevin S. La Bar and Roberto Cabeza, "Cognitive Neuroscience of Emotional Memory," *Nature Reviews Neuroscience* 7 (2006): 54–64; and, more generally, *Memory and Emotion: Interdisciplinary Perspectives*, ed. Bob Uttl, Nobua Ohta, and Amy Siegenthaler (Oxford: Blackwell, 2006).

37. See Shaun Gallagher, *How the Body Shapes the Mind* (Oxford: Clarendon Press, 2005).
38. For a review of the memory-enhancing effects of emotional arousal, see Kevin S. La Bar and Roberto Cabeza, "Cognitive Neuroscience of Emotional Memory," *Nature Reviews Neuroscience* 7 (2006): 54–64.
39. For versions of this position, see, for example, Jean Wirth, *L'image médiévale, naissance et développements, VI–XV siècle* (Paris: Méridiens Klincksieck, 1989); Jean Wirth, *L'image à l'époque romane* (Paris: Cerf, 1999).
40. See K. S. La Bar and R. Cabeza, "Cognitive Neuroscience of Emotional Memory"; see also Florin Dolcos, Kevin S. LaBar, and Roberto Cabeza, "The Memory Enhancing Effect of Emotion: Functional Neuroimaging Evidence," in *Memory and Emotion: Interdisciplinary Perspectives*, 107–134.
41. Peter J. Lang et al., "Motivated Attention: Affect, Activation and Action" in: Peter J. Lang, Robert F. Sions, and Marie Balaban, *Attention and Orienting: Sensory and Motivational Processes*, (Hillsdale, N.J.: Lawrence Erlbaum Associates, 1997). See also in this connection Margaret M. Bradley et al., "Remembering Pictures: Pleasure and Arousal in Memory," *Journal of Experimental Psychology: Learning, Memory and Cognition* 18 (1992): 379–390.
42. Aby Warburg, "Sandro Botticellis 'Geburt der Venus' und 'Frühling,'" in *The Renewal of Pagan Antiquity: Contributions to the Cultural History of the European Renaissance*, trans. David Brett (Los Angeles: Getty Research Institute for the History of Art and the Humanities, 1999), 95–156; on *Pathosformeln*, see Aby Warburg, "Francesco Sassetti's Last Injunctions to His Sons of 1907," in *The Renewal of Pagan Antiquity: Contributions to the Cultural History of the European Renaissance* (Los Angeles: Getty Research Institute for the History of Art and the Humanities, 1999), where *Pathosformeln* is simply translated as "emotive formulas."
43. For the passages from Alberti's *Della Pittura* of 1435, see A. Warburg, "Sandro Botticellis 'Geburt der Venus' und 'Frühling,'" 95–196.
44. V. Gallese, "Embodied Simulation: From Neurons to Phenomenal Experience."
45. To what degree can we draw a necessary connection between the gesture and the emotion, irrespective of its social and historical context? Standard gestures for standard emotions, in the manner implied by both Charles Darwin and Paul Ekman, may offer a significantly useful tool for the interpretation of works of art, especially in the absence of further knowledge about them, and in images where the only memories evoked are procedural and implicit.
46. As described in Fortunato Battaglia and David Freedberg, "Art, Imagination and Reality: The Cortical Motor Networks" (forthcoming); the EEG results are presented in Daria Arienzo et al., "Functional Networks Underlying Motor Facilitation during Movement Observation" (forthcoming). See also Fausto Baldissera et al.,



"Modulation of Spinal Excitability during Observation of Hand Actions in Humans." *European Journal of Neuroscience* 13 (2001): 190–194.

47. My hope was to examine a more complex movement, such as the raising of arms in despair or joy, or even still more complex sets of movements, such as those of figures engaged in dance, but testing for felt imitative responses by means of transcranial magnetic stimulation (TMS) would almost certainly be too difficult—there were simply too many different somatotopic areas to locate.

48. See Martin Kemp, "From 'Mimesis' to 'Fantasia': The Quattrocento Vocabulary of Creation, Inspiration and genius in the Visual Arts," *Viator* 8 (1977): 347–398; D. Freedberg, "Imitation and Its Discontents," in *Künstlerischer Austausch / Artistic Exchange: Akten des XVIII Internationalen Kongresses für Kunstgeschichte, Berlin, 1992*, ed. Thomas W. Gaehtgens (Berlin: Akademie Verlag, 1993), 483–491. For a survey of current views on the felt imitation of observed movement, see the excellent volume *Perspectives on Imitation: From Neuroscience to Social Science*, ed. Susan Hurley and Nick Chater (Cambridge, MA: MIT Press, 2005).

49. Beatriz Calvo-Merino et al., "Action Observation and Acquired Motor Skills: An fMRI Study with Expert Dancers," *Cerebral Cortex* 15 (2004): 1243–1249; see also Beatriz Calvo-Merino et al., "Configural and Local Processing of Human Body in Visual and Motor Areas," *2006 Neuroscience Meeting Planner* (Society for Neuroscience Online, 2006, program number 438.5/H2) at <http://www.sfn.org/am2006/>, who note, "The greater familiarity of experts with their own movement style may lead to stronger activation of brain mechanisms of episodic memory, even when watching another person."

50. See Vilayanur S. Ramachandran and William Hirstein, "The Perception of Phantom Limbs," *Brain* 121 (1998): 1603–1630; Vilayanur S. Ramachandran and Diane Rogers-Ramachandran, "Phantom Limbs and Neural Plasticity," *Archives of Neurology* 57 (2000): 317–320.