stehung spiegelt. Zwar verengt die erst seit 1923 geläufige Bezeichnung *Einsamer Baum* den Bildsinn, doch ist unbestritten, dass der Baum im Emporstreben wie im Absterben seiner oberen Äste Friedrichs Weltbild emotional wiedergibt. Für die historische Emotionsforschung ist im übrigen auch von Interesse, dass die Mitleid und Trost suchende Bezeichnung *Einsamer Baum* gerade in den Jahren nach dem Ersten Weltkrieg aufkam.

[10] Es liegt nicht im Sinne dieser Einleitung, die kaum mehr überschaubare Fülle der Literatur zur Emotionsforschung einer kritischen Würdigung zu unterziehen. Es sei jedoch verwiesen auf Thomas Anz, *Emotional Turn? Beobachtungen zur Gefühlsforschung*, in *literaturkritik.de* 8/12 (2006) <http://www.literaturkritik.de/public/rezension.php?rez_id=10267>.

David Freedberg

Empathy, Motion and Emotion*

I

Take two subjects often by encountered by historians of art: the *Conversion of St Paul* and the *Ecstasy of St Teresa*. In their pathfinding article on sudden religious conversions in cases of temporal lobe epilepsy, Dewhurst and Baird recalled the suggestion, first made by Lombroso in 1864, that St Paul's conversion, with its auditory hallucinations, photism, and temporary blindness, was the result not of a mystical experience (whatever that may involve), but of an epileptic seizure.[1] They believed that St Teresa of Avila's visions, chronic headaches and transient losses of consciousness could be attributed to temporal lobe epilepsy.[2] In the case of St Paul, William James was appropriately sceptical about what he called "medical materialism", and of physical explanations of Paul's conversion in terms of "a 'discharging lesion' of the occipital cortex" (as an alternative to the mystical hypothesis).[3] Significantly, Dewhurst and Beard preferred to overlook his scepticism. Others suggested that St Paul's hallucinations may simply have resulted from the fact that he was a tired traveller who had neglected his midday siesta; or that his conscience was possibly complicated by a "migraine-like syndrome".[4]

Neurology informs history. One does not need to be a medical materialist to acknowledge the possibility. Purely historical contextual factors are unlikely to be adequate to a full account of the syndromes demonstrated by the behaviors of St Paul and St Teresa.[5] Given the vast amount of recent research dedicated to understanding the neural substrate of corporeal and emotional responses, it ought no longer to be possible to speak of the social construction of behavior in terms that are uninflected by attention to the anatomy, biology and chemistry of the human brain, or to its mechanisms, routes and deficits. It is important, I think, to take heed of recent advances in the neurosciences, without believing that to say "human" jeopardizes our individuality or overlooks the social and political pressures that contribute to its social construction.

Much of the resistance in the humanities to general statements about the human brain is based on the fear that to embrace the findings of science might entail the surrender of context, whether social or historical. But it need not. The

convention of excluding biology from the understanding of historical behaviors has outlived its usefulness. For how can one speak of context in the absence of knowledge of the limits and possibilities of those aspects of human behavior that lie beyond conscious control? Or without considering the growing evidence for automatic aspects of somatic and emotional responses?

II

Charles Darwin's last work *The Expression of the Emotions in Man and Animals* of 1872 has been underappreciated until recently.[6] It offers a rich field for historians of art. By now it should have entered much more prominently into the long history of the subject of the expression of the emotions.[7] The critical underlying hypothesis in Darwin was that the emotions are not only to be understood in terms of geographical and cultural constraints, but rather that there is a fixed relation between the outward expression of emotion and the particular emotion underlying that expression (an idea that art historians know from the works of Charles Le Brun, Marin Cureau de la Chambre and Lavater, but has now found its most vigorous exponent in Paul Ekman).[8] The very fact that the emotions were capable of classification had a direct bearing, as Darwin put it, on "the unity of man".

The Expression of the Emotions in Man and Animals is the only extensively illustrated work by Darwin. The significance of his turn to pictures is manifold. Darwin's book made use of photography in order to illustrate the classification of the emotions. Photography had only recently achieved the ability to freeze figures in movement, and the essential mobility of expressions and gestures too.[9] It was thus eminently useful for the purposes of classification, since classification is an approach to understanding the world that is predicated on forms of fixity. It places things, phenomena, and expressions in boxes, in limited spaces, in categories and classes, precisely in order to establish sensible relationships.[10] For centuries this had been one of the chief ways of grasping the world.

But the principles of evolution and natural selection, as earlier set out by Darwin, subverted the primacy of classification, and made it seem less central a task in the early life sciences. Evolution stood at odds with the possibility of the time-denying spaces of traditional systems of classification. Towards the end of his life, in his study of the emotions, Darwin came

round to classification as a heuristic principle once more; and he seems instantly to have realized the indispensability of pictures to that task. All this, of course, implies that the emotions, and the expression of emotions, are indeed capable of classification in the first (or last) place.[11]

III

In *The Power of Images* I described a variety of emotional and bodily responses to works of art that seemed to be recurrent across time and geography. Perhaps it was the very idea recurrence that led to the sharp allegations of having prioritized *innate* responses (even though I barely used the word), as if "innate" were somehow a word at odds with the sacrosanct notions of context and the social construction of responses. But it is not; and in an illuminating example in his book, Darwin suggests why. As always he took an example predicated on the body and on bodily needs: We Europeans are so accustomed to kissing as a mark of affection, that it might be thought to be innate in mankind; but this is not the case. Steele was mistaken when he said "Nature was its author, and it began with the first courtship." Jemmy Button, the Fuegian, told me that this practice was unknown in his land. It is equally unknown with the New Zealanders, Tahitians, Papuans, Australians, Somals of Africa, and the Esquimaux. But it is so far innate or natural that it apparently depends on pleasure from close contact with a beloved person; and it is replaced in various parts of the world, by the rubbing of noses, as with the New Zealanders and Laplanders, by the rubbing or patting of the arms, breasts, or stomachs, or by one man striking his own face with the hands or feet of another. Perhaps the practice of blowing, as a mark of affection, on various parts of the body may depend on the same principle.[12]

A universal expression of affection – contact of body to body – is modified by culture. The first of Darwin's three principles of expression was that of *serviceable associated habits*, which he elaborated as follows: Certain complex actions are of direct or indirect service under certain states of the mind, in order to relieve or gratify certain sensations, desires, &c.; and whenever the same state of mind is induced, however feebly, there is a tendency through the force of habit and association for the same movements to be performed, though they may not then be of the least use.[13]

For Darwin the principal issue was the relationship between force of habit and heredity; but the relevance of these words for the notion of empathy – whether in late nineteenth century or early twenty-first century writers – can easily be deduced. In this essay, I will set out some of the new principles of the relationship between physical movement and emotion (indeed, Darwin's first principle specifically "applies to the nerves of motion and sensation, as well as to those connected with the act of thinking"). If actions so "readily become associated with other actions and with various states of mind,"[14] one must surely consider what happens when one sees actions performed by others, whether in reality or in pictures, that bring to mind habitual actions of one's own. I say "bring to mind", because of the ways in which the premotor and somatosensory cortices are directly and effectively activated by observation of the actions or movements of others. And while Darwin was concerned with the expressive movement of the muscles (say of the face), the present discussion will be centred on *felt movement of the body* rather than on actual movements, and on the emotions that ensue but are not necessarily expressed.

In summarizing his first principle, Darwin made it clear that "serviceable actions become habitual in association with certain states of mind, and are performed whether or not of service in each case".[15] The question of whether states of mind precede actions or vice-versa was also addressed by William James and others[16], but in this instance Darwin was pointing to the possibility of the automatic or unconscious responses as the result of habit or association, or, more precisely, of the induction of particular states of mind as a result of those habits or associations.

Already in his first principle Darwin noted that "some physical change is produced in nerve cells or nerves which are habitually used", and that "this applies to the nerves of motion and sensation, as well as to those connected with the act of thinking". Even more explicitly, he observed that "when our minds are much affected so are the movements of our bodies".[17] And in his third principle of expression, "that of the direct action of the nervous system" he turned directly to the role of the latter. He elaborated it as *The principle of actions due to the constitution of the Nervous System, independently from the Will, and independently to a certain extent of Habit.*[18] From this, Darwin could proceed to the biological and bodily manifestations of emotion in a way that strongly prefigures current work on empathy.

IV

For many years I made three proposals to fellow historians of art in particular and to scholars of the humanities in general. The first was to consider the potential of drawing connections between how pictures look and how beholders respond to them on the level of emotions and feeling.[19] In 1987 I suggested the possibility of determining what I then referred to as the neurophysiology of visual and psychological responses to particular forms; and implied that this might entail the assumption of certain biological and psychological invariances across cultures.[20] This was not a claim against difference; it was quite precisely in favor of considering the ways in which responses might be culturally and historically inflected. Yet the resistance was profound. Art historians stood back from the challenge laid down by the cognitive neuroscientists, including those who who had begun to set out aspects of the specific work of the brain in the creation of and responses to works of art.[21] It was a deep challenge, since it involved a reconsideration of traditional scepticism about the possibilities of bridging the disciplinary gap. It meant acknowledging the hermeneutic potential of the relationship between the neuronal bases of response and their historical and cultural inflection. Even these days, when the evidence for genetic and evolutionarily determined responses has grown so substantially, little seems to shake the resistance to understanding the neurobiology of behaviors, particularly corporeal behavior [22] The standard social sciences model continues to prevail in the humanities,[23] and the dominant mode in the study of the history of art remains the social history of art. Other approaches continue to be anathematized, as if social history and biology were doomed to be at eternal odds with each other. [24] But they are not.

My second proposal was that the emotions might indeed be classifiable. The common position in the humanities has continued to be that the emotions are too ragged and too specific – personally, culturally and historically – to be capable of definition in transcultural terms.[25] Ekman's research in particular suggested the possibility of identifiying a number of basic emotions, in terms of both feeling and expression.[26] Over and over again I suggested that however culturally variable or contextually determined some responses might appear to be, it was important to take into account the increasing evidence for the identification of particular areas and neural networks in the brain responsible for

particular feelings and emotions.[27]. As the work of Klaus Herding and his colleagues has recently made clear, art historians are at last also beginning to give the emotions their due (or rather, since the emotions have always been taken more or less seriously in popular criticism, their epistemological due). [28] But the notion that some responses to works of art might be automatic or directly dependent on the structure and neural networks of the brain has remained hard to accept outside the cognitive sciences.

My third claim, which now encounters less resistance (because of the fashion for "the body"), was that it was impossible, as Darwin and James already insisted, to conceive of the emotions apart from the body, and in particular apart form the movement of the body. It is probably this intimate nexus between body and emotion that for so long lay at the basis of the intellectual unfashionability of the emotions, since the body remained an embarrassment for pleasures that were allegedly (and in retrospect preposterously) uncorporeal. Detachment from the body remains for many the hallmark of the esthetic.

V

For much of the twentieth century the emotions were excluded from the history and philosophy of art. These days old-fashioned art historians acknowledge that while it may be true that pictures arouse emotions and desire, this is not what art history is about. They – and most philosophers – maintain that when they go to a gallery they know that a painting is a just a painting, the sculpture just a sculpture, and that one doesn't respond to a work as if it were real. Or they might say that one doesn't *really* respond to it as if it were real – and maybe that one oughtn't to either.

R.G. Collingwood's often-admired book *The Principles of Art* of 1938 bluntly put forward the view that art has nothing whatsoever to do with the arousal of emotion.[29] In his view, genuine artists do not strive after the production of emotional effects. This, he asserted, was best left to entertainers and magicians (not to be confused with artists!). And he deplored those "numerous cases in which somebody claiming the title of artist deliberately set himself to arouse certain states of mind in his audience".[30]

Collingwood cannot have recalled the case of Nicolas Poussin, who wrote explicitly to Chantelou in 1647 that paintings, like music, should be put together in such a way as to arouse the souls of those who behold it to

different passions, *induire l'âme des regardants à diverses passions*.[31] Of course one could say, with regard to Collingwood, that Englishmen have always been notorious (according to the national cliché) for their inability fully to express their feelings and emotions.[32]

Moreover, the strain of German art theory in the second half of the nineteenth and early twentieth century that concerned itself deeply with the issue of emotional responses to art[33] was almost entirely ignored by the German scholars who dominated twentieth century art history. For the most part, they were high rationalists, fearful of superstition and emotion. The emotions were felt to be too random, too embarrassing and too incidental to the transcendental value of art. The three dominant modes in twentieth century art history thus came to be formalism, connoisseurship, and contextual studies of one kind or another. All excluded the emotions. Instead of attempting to discover relationships between the formal aspects of a work and the specific psychic efforts they generate, formalism remained purposeless; and both it and connoisseurship were placed disparagingly alongside each other, or replaced by contextual studies. From the late 1960s this became the main paradigm for art historical investigation. When I declared some time ago that I was planning a book entitled *Mind, Body and Emotion in the History of Art*, I was written off both by progressive and by reactionary colleagues.

Yet more than ever it seems legitimate to interrogate the relationships between the formal aspects of an image and the emotional responses they evoke; and to examine what might be codifiable or capable of correlation. But this idea has found surprisingly little resonance. One might think that to leave the emotions out of art was to suck art dry; but art history had first to be made academic – and therefore non-emotional. It is significant that E.H. Gombrich's *Art and Illusion*, perhaps the finest attempt ever made to bring art and scientific psychology together, scarcely referred to the emotions -- and made no mention at all of the German tradition which did, and which bound physicality to emotion.

Though I addressed some of these issues in my work on iconoclasm,[34] and then in *The Power of Images*, my concerns were with symptoms, not with explanations. These concerns were neither neuroscientific nor much involved with approaches from cognitive psychology (then much more detached from the neurosciences than it has since become). It has only been with the work

of neuroscientists, such as Antonio Damasio, Joseph LeDoux, Giacomo Rizzolatti and his team from Parma, that some vindication has come. Before them, the only thinker to have seen the problem clearly – though with different theoretical and epistemological aims – was Nelson Goodman. In *Languages of Art*, Goodman attacked what he called "the domineering dichotomy between the cognitive and the emotive". "On the one side", he wrote in his typically vivid fashion, we put sensation, perception, inference, conjecture, all nerveless inspection and investigation, fact, and truth; on the other, pleasure, pain, interest, saisfaction, disappointment, all brainless affective response, liking , and loathing. This pretty effectively keeps us from seeing that in esthetic experience the emotions function cognitively.[35]

Here is a writer whom Damasio, with his own project of combining reason and emotion,[36] might have cited with profit. More recently, a few art historians have begun to take the emotions seriously, most notably James Elkins. But neither his *Pictures of the Body, Pain and Metamorphosis*, full of the most compelling illustrations,[37] nor his *Pictures and Tears: How a painting can make you cry*,[38] deal with the neural substrate of emotional response. These books are all about the emotions generated by pictures, and yet they offer no sense of how such emotions might arise (other than the vague idea that they are related to corporeal involvement), nor where they come from, nor what the connection might be between the look of a picture and the emotional response it triggers. In the Preface to *Pictures of the Body,* Elkins trenchantly remarks that "because the body intromits thought, important aspects of my reponses to a picture of a body might not even be cognized."[39] This, in slightly different terms, is one of the fundamental points of the present paper, namely that the body's handling of the visual information it receives via the brain may in many cases be precognitive. Yet in neither work does Elkins show any awareness of the remarkable work being done on the relationship between art, emotion, body and brain.[40]

VI

In what follows I will concentrate on aspects of neuroscientific research relevant to the old question of the relations between motion and emotion. In doing so I will touch on questions not only of apparently automatic behaviors (and of the brain correlates thereof), but also of the complex

question of embodied simulation and simulations that are felt rather than expressed through behavior.[41] In other words, I will deal with the sense of reacting *as if* one were behaving in physical ways without actually thus behaving. This form of reaction, it seems to me, is of particular relevance to the ways in which one responds not only to other beings, but also to paintings and sculptures. I will be moving away from the kinds of visceral and outward emotional behaviours described at length in the *Power of Images* to their neural correlates. For the most part, the focus will be on recent work relating to the identification of specific cortical areas responsible for both our motor actions and our simulated actions.

The question of the relations between inner and outward movement has a long history in the history of art and esthetics, from the famous controversy about the meaning of Rembrandt's phrase "die meeste en de naetuereelste beweechgelickheit" in his 1639 letter to Constantijn Huygens[42] to Aby Warburg's 1893 Botticelli dissertation[43] and the notion of the *Pathosformel*,[44] via the writings of Robert Vischer, Hermann Lotze, Theodor Lipps, Johannes Volkelt and so on.[45] The satisfaction will be to discover the neuroscientific resolution (or at least refinement) of some older intuitions, hypotheses and theories.

How does a picture or sculpture engage the body, and what are the emotional responses that may ensue?[46] It is now possible to be more precise than ever before about the relations and correlations between corporeal and emotional responses.

VII

In 1936/37 Virginia Woolf wrote about her responses to some terrible photographs of the Spanish Civil War. This morning's collection contains the photograph of what might be a man's body, or a woman's; it is so mutilated that it might, on the other hand, be the body of a pig. But those certainly are dead children, and that undoubtedly is the section of a house. A bomb has torn open the side; there is still a birdcage hanging.[47]

In reading these lines it is impossible not to think of any one of the thousands of photographs that have poured forth from the war zones in Ruanda, Bosnia, Palestine, Afghanistan and Iraq.

Woolf had no doubt at all about the universal disgust and horror which she believed such pictures must surely provoke. "Our sensations", she insisted, are the same, "however different the education, the traditions behind us".[48]

In 2003, in her book on war photography entitled *Regarding the Pain of Others*, Susan Sontag took issue with Woolf. She resisted the assumptions that lay behind that "our" and that "us". She felt that it was mistaken to suggest that photographs, however shocking, could somehow offer a universal basis for opposition to war, and that in any case, "we" could never suffer so much as the people shown in the photographs, or experience what the photographs showed.[49] All this is banally true – but it misses the point. "Not to be pained by these pictures" Sontag continued, not to recoil from them, not to strive to abolish what causes this havoc, this carnage – these, for Woolf, would be the reactions of a moral monster. And, she is saying, we are not monsters, we members of the educated class. Our failure is one of imagination, of empathy; we have failed to hold this reality in mind.[50]

It is the core of both Woolf's and Sontag's arguments that require examination, not the conclusions they draw from them, with which it would be impossible to disagree. In fact, Sontag and Woolf are in accord about the immediate effects of the photographs of war and suffering. They are images that provoke horror and disgust. We are pained and recoil from them. And "we" can hardly bear to look at these photographs not just because of the obvious political and moral indignation they arouse, but because they touch on more basic, more visceral, more immediate and automatic levels of response. Sontag suggests that if we fail to be shocked by these images, it is a failure of both imagination and what she calls empathy. She uses the term "empathy" in the popular sense of a deep sympathy for those who are shown suffering. It is the sense that beholders often have of feeling that they somehow and to some degree can partake in the suffering of others. Sontag does not define the term at all. But it is capable of closer definition, along lines that bring us close to some of the fundamental ways in which humans relate to the images they see.[51]

The leitmotif of Sontag's discussion is Robert Capa's famous 1937 photograph of a Republican soldier falling backwards – or is it sideways? – at the very moment he is hit by an enemy bullet. In looking at this picture, grainy as it is, the phenomenology of spectatorial engagement with it seems relatively clear. Somehow one feels in ones *own* body the instability of the dying soldier. One seems to be falling oneself, off-balance, and yet vainly trying to keep oneself upright. It is almost as if, looking at this

picture, one has to stop oneself from flinging one's own arm backwards, as if one were about to lose that recently-held gun oneself. (I will shortly discuss these "as if's). The utter precariousness of the man's physical state seems, momentarily, to be projected on to his beholders; or perhaps it would be better to say, becomes part of their own physical sensations. It is almost a relief to find that one is still seated – "normally", one begins to say, but somehow not "normally" at all – as one looks at this image. One seems to feel in one's bones (as we say – but perhaps in one's head, as we shall see) that one is engaged in this picture. Our bodies respond to it as if *that* body, somehow, were our own. Momentarily we are left with a slight feeling of anxiety and desperation. Physical engagement with a picture like this, physical empathy, translates very swiftly into emotion.[52]

The tradition of empathy theory that was so prominent in German art theory in the second half of the nineteenth century merits reevaluation.[53] It is of more than simple historical or even epistemological interest. For many years little attention was devoted to the notion that felt corporeal involvement in a painting or with a sculpture, or even in architecture, enables both physical and emotional empathetic responses.[54] But recently there has been a certain renewal of interest in the subject[55] – without any awareness of the contemporary evidence for the embodied simulation of observed actions and movements.[56]

In *Das optische Formgefühl* of 1873, Robert Vischer distinguished between sensation and feeling in a way that anticipates recent neuroscientific distinctions between emotions and conscious feelings.[57] Being at a lower stage in the perceptual process, sensations are more intuitive and precede conscious feeling – which in turn precedes empathetic feeling with the form of the object. Each of these stages, for Vischer, has to do with what he called the stimulation of "motor nerve function" and the relationship between the form of the object and our own bodily form.[58] By *Einfühlung* Visscher meant physical responses generated by the observation of forms within paintings. He set out at length how particular forms aroused particular responsive feelings, depending on their conformity to the design and function of the muscles of the body, from those of the eyes to the limbs and to to bodily posture as a whole. Developing Visscher's ideas, the young Wölfflin outlined his views on the ways in which the observation of speci-

fic architectural forms engage the beholder's bodily responses.[59] August Schmarsow wrote of the experiences of architecture in terms of muscular sensation, the sensitivity of the skin, and the structure of the body. Already before Vischer, Herman Lotze had argued that one invests every visual impression with emotional experience as a result of our understanding of thee physical motion within the image we see. Just before the century turned, Aby Warburg, adapting Vischer's notions of *Einfühlung* developed his own theory of the *Pathosformel*, whereby the outward forms of movement in a work of Renaissance art (say the hair or flowing draperies of a paintings by Botticelli or Ghirlandaio) revealed the inner emotions of the figure concerned.[60] Already by then Theodor Lipps was developing his views of the relationship between esthetic enjoyment and bodily enagement with space, in architecture as well as in the other arts.[61] All these writers believed that the feeling of physical involvement in a piece of painting, sculpture or architecture not only provoked a sense of imitating the motion either seen or implicit in the work, but also elicited or even enhanced the emotional responses of the spectator. Wilhelm Worringer's *Abstraction and Empathy* approached the problem rather differently from the other works mentioned here. Although it was concerned ways in which form is allegedly invested with life, it set the processes of empathy against what for Worringer was the opposing notion of abstraction, and thus led to his insistence on the superiority of the latter on the grounds that it was somehow purer for its distance from empathetic feeling. By then William James had also articulated the broader question of the relations between bodily action and emotion,[62] while at the core of all of Maurice Merleau-Ponty's work from the 1940s on lies a profound concern with the ways in which beholders are and become corporeally involved in works of art, and in particular with the problem of felt movement in response to them.

Current images from war zones provide no shortage of examples. To look, for instance, at the heart-rending 2001 photograph by Tyler Hicks of three Iraqi women grieving with their whole bodies over the lifeless body of their daughters, is to have a sense of simulating each one of their movements. It is to open ones own mouth (or to have a sense of doing so) in a similar form of the expression of sorrow, and to wish to cast outward ones own arms in grief in almost exactly the way the mother does. As ones eyes

traverse the scene, it seems as if ones own body is overcome by a kind of emulatory slump, as if in some attempted imitation of the prostrate position of the dead child (it is almost the same feeling of keenly empathetic slump as that provoked by the famous 1968 photograph by Don McCullin of the collapsed body of a North Vietnamese soldier). How easily one seems to grasp the pain of these figures through feeling the gesture of the woman clutching her hands over her chest in the background, or the desperation of the way in which the woman next to her moves her arms outward in grief!

All these figures serve as trenchant reminders of the importance of Warburg's notion of the *Pathosformel*. Not only do the gestures ring humanly true, one also knows immediately how often one has seen them in art (in particular that of the wailing mother with her arms oustretched in sorrow, recalling the classic gestures of the *Pietà*). It is perfectly true that these are formulaic bodily expressions of grief, and that they form part of a repertoire of emotional expression via the body used by generations of sculptors and painters, or deliberately draw on yet more ancient vestiges (as in the all too well-known cases of Renaissance artists copying from antiquity). But these examples are so convincing because they *feel* – not just look – so convincing. It is not just case of having seen these gestures before, of knowing these particular cultural correlations between gesture and the expression of emotion. They are convincing because these are gestures that are predicated on a deep and intuitive body-knowledge linking movement to emotion. The better the artist is at conveying such body-knowledge, the more effective the beholder's identification with it, and the better her understanding of the emotions such gestures and movements of the body are intended to convey. It is not, in the first instance, a matter of cultural knowledge; it is a matter of intuitive recognition via the body.[63]

Examples of just this conflation of intuitive body-knowledge and the long traditions of emotional expression through the body are legion. They include Giotto's St John in the *Lamentation* in the Arena Chapel, the unforgettable terracotta group of Niccolo dell'Arca's *Lamentation* in Santa Maria della Vita in Bologna, Rosso's *Pietà* in the Louvre, the upraised arms of the Mary – as well as the slumped body of Christ – in Caravaggio's Vatican *Entombment,* the opening page of Goya's *Desastres de la guerra*, tellingly entitled *Tristes Presentimientos*. Anyone seeing the many modern images of war,

loss, destruction and grief, will immediately think of a host of similar examples from both the present and the past. The very fact that so many examples of this kind do indeed leap forward and present themselves to the mind's eye is striking evidence of the peculiar trenchancy of certain classes of gesture, of specific types of physical movement. Another example – to take one of many possible instances from the history of art and now repeated in modern images of grief and atrocity – is the wiping of tears from the eyes with the back of the hand, such as Giotto so strikingly depicted above the *Lamentation* in the Arena Chapel, and Claus Sluter carved beneath the *Crucifixion* above his great *Well of Moses* in Dijon. All such movements, actions, and gestures strike deep chords within us – and it has now become possible to speak more clearly about what we mean when we say just this.

It is not just a matter of the activation of cortical areas relating to memory, of the fact that responses to the Tylor Hicks photograph are somehow predicated on recollection of similar images, or of a visual repertoire of forms. Ones responses are more basic than that; less cognitive, so to speak, more unconscious. They have to do with the activity of areas of the brain dedicated to the imitation of specific forms of movement in others. It is now possible to describe the neuronal bases of just this form of embodied simulation.[64] The topic of empathy needs no longer to be regarded as a matter of sentimentality, or of armchair intuition. It can be shown to be predicated on a particularly striking form of the cortical representation of action.

The idea that one might be able to describe the processes of empathy with any degree of precision is likely to meet with scepticism. Like emotion-talk it has long been disdained. For the most part, it has always been regarded as too intuitive, too individual, too variable. How could one ever adequately describe viewers' identification with what they see in pictures – surely one step beyond any form of identification with living actors? Michael Fried[65] and James Elkins[66] have long made a case for beholders' identification with the bodies in pictures, such as occurs, for example, when a figure is seen from behind. Another clear instance of bodily empathy occurs when one looks at figures bent over to carry the weight that presses down on them, or at bodies such as the all-too human atlantes that appear to support – with almost palpable strain – the Romanesque pulpit on Isola San Giulio, or the Bishop's Throne in San Nicola in Bari, or the portal columns at Piacenza. So too with the keen sense of a

physical need for liberation and disentanglement from the bonds that so forcefully restrain bodies in sculptures such as the *Laocoon* or Michelangelo's *Slaves*, or with the general stirrings of discomfort one feels in looking at the extreme poses frequently encountered in Romanesque art. Such forms of identification have never been set out in anything but the vaguest terms; and whatever strength of argument there has seemed to be has been purely rhetorical.

Philosophers have endlessly discussed the problem of whether it is possible to feel the pain of others.[67] The preponderant view has been a sceptical one. Most cling to the notion that we can only know very little about other minds, and that it is impossible to feel the pain of others – let alone the minds and pain of others *in pictures* (or sculptures). But it is precisely pictures – as much as experience – that give the lie to all this. Virginia Woolf's vivid description of the horror and disgust any spectator is likely to feel upon looking at images of what might be a man's body, or woman's, or one, indeed, so mutilated that it might be a pig's, rings all too true. It becomes hard to discredit our intuitions in cases such as these. The body in the picture commands our attention. This emerges even more clearly in the case of mutilated bodies, where two very strong sensations seem to be at work: a sharply enhanced awareness of our own body parts when those of others are missing or damaged;[68] and the felt desire to reconstitute the body in the picture. It is very likely that the same desire for reconstitution and completion also applies to pictures of damaged buildings (especially given our psychological and evolutionary sense of the shelter buildings offer); while there is clearly far too much of an associative burden to remain indifferent to dead children, let alone the poignancy of a birdcage hanging empty in a bombed-out house.[69] All this is too evocative; it plays on the seat of the imagination, to use archaic terms; and it provokes what we loosely call our empathy.

VIII

Much good cognitive work has also been done in the last dozen years or so on affective responses to pictures, both pleasant and unpleasant. Teams under researchers such as Peter Lang (one of the pioneers of the study of emotional reactions to pictures) and Richard Davidson have done an array of experiments involving eyeblink startle magnitude and corrugator and zygomatic muscle responses to pictures,[70] while relatively simple heart rate and skin

conductance measurements may be obtained for visceral reactions.[71] The imaging method of choice is now functional magnetic resonance imaging (fMRI), but PET (positron emission tomography) measurements of regional cerebral blood flow (rCBF) in the case of both pleasant and unpleasant visual (as well as auditory and olfactory) stimuli have also been made.[72]

To this array of work chiefly on negative responses one can now to add the very large amount of recent research on the amygdala.[73] Its role in the neurophysiology of fear responses in particular, and of many other emotional reactions as well, is now well documented. The usual and most striking examples offered are of fear responses to snakes, but amygdalic responses to threatening faces and masks, animals baying and displaying their teeth, are of a similar order. The neural networks involved in the instinct for self-preservation overlap with that of the emotions. The effectiveness of apotropaia depends on this kind of instinctive knowledge as much as on the cultural connotations of what it represents. New knowledge of amygdalic processes and their interaction with the prefrontal cortex will further refine older views of evolutionary and biological responses to fear signals.

One sees a snake and, startled, one runs away from it. One sees a picture of a snake, and thinking it real, wants to run away from it too; or we are startled or repulsed by the horrid look of a monstrous face or mask. Unfortunately, little neuroscientific work has so far been dedicated to this elision between reality and representation, to the distinction between responses to a snake and to a picture of a snake – or of a dog whose teeth are threateningly bared, or of a picture of some such.[74] Images such as those that issued from Abu Ghraib make all too clear the effectiveness of the latter. There is a fair amount of art historical evidence for fear responses to pictures of snakes, as in Vasari's account of Leonardo's shield, which tells of how as an adolescent he carefully painted a piece of wood with snakes and all kinds of other monsters and carefully choreographed its display in order to frighten his father.[75] Recalling Caravaggio's *Medusa*, Constantijn Huygens used his painting of Rubens's *Medusa* with similar effects to those which Leonardo produced.[76] It is hard not to start back as one sees the bared teeth of Copley's shark (in *Watson and the Shark*) or to feel some form of empathetic response to the terrrified look of the young man in the water. In all such cases, one has an intuitive sense of the critical relationship between emotion and bodily movement.

Of course the question of the extent to which fear responses are top-down or bottom-up arises. One sees a snake or a picture of a snake; the signal goes via the thalamus to V1 (the primary visual area) where this visual information is processed. Ledoux claims that the fear stimulus may even go directly from the thalamic projections to the amygdala, bypassing the neocortex.[77] But Damasio takes a slightly different view. He notes that the appraisal and definition of the emotionally competent stimulus, in this case fear, occurs in the sensory association and higher order cerebral cortices, which then passes to the emotion triggering sites, not only the amygdala (in the case of fear) but also to the ventromedial prefrontal and cingulate cortices. Each of these sites cause subsequent activity in other sites, such as the basal forebrain, the hypothalamus or the nuclei of the brain stem tegmentum, via a complex system of neural connections.[78] Chemicals released directly into the bloodstream chiefly by the hypothalamus cause the changes in the internal milieu, the viscera, the musculoskeletal system, and various specific behaviours. Those who remain sceptical about the automaticity of certain emotional responses ought to bear in mind that there are more projections from the amygdala to the visual cortices than vice-versa.[79]

To the abundant work on the amygdala should now be added a series of still more recent studies examining the role of another of the second major emotional workhorse, the insula, and in particular the anterior insula in reactions and expressions of disgust, a rich topic often related to fear. [80] The anterior cingulate cortex also plays a significant role in awareness of these emotions.

Following the lead of Ekman's work on the correlations between particular emotions and their facial expression,[81] a good deal of information is now available about the role of the facial fusiform area (FFA) in the right hemisphere of the occipito-temporal cortex. fMRI scans have identified neurons in this area that respond in this area respond selectively to human faces.[82] Signals go directly from the visual cortex to the FFA, long before they arrive at the prefrontal cortex, where contextual factors are processed. Thanks to Ekman's work on facial expressions, and Nancy Kanwisher's and others' work on the FFA,[83] it is now possible to be clear about the distinction between the identification and the interpretation of facial expression.

In another difficult recent example with clear resonance for the history of art, a comparison of the terrible images shown on *Al-Jazeera* of Margaret Hassan immediately prior to her execution in 2004 and earlier photographs of

her smiling leaves one with no doubt at all about the possibility of identifying constants of emotional expression. The fear and the cheerfulness are instantly and indisputably identifiable as such. Indeed, images such as these force one to rethink what for a long time had been regarded as a rather ponderously schematic, if not wholly aberrant, chapter in the history of art and physiognomics. They oblige one to take seriously the historical studies of the outward facial indicators of inner emotion, which Charles Le Brun perhaps most famously attempted to codify;[84] and to acknowledge the similarities betweeen the zygomatic indicators on the faces of those in extreme fear in the presence of their captors and executioners and the engravings Le Brun used to illustrate his own work on the facial expression of the emotions.[85]

As for the face, so too, perhaps even more significantly, for the body. The extrastriate body area (EBA), a neural system specifically dedicated to the visual perception of the body, and of the human body in particular, has recently been identified in the right lateral occipitotemporal cortex.[86] When subjects are shown still photographs of human bodies and body parts there is a significantly stronger response in this body-selective area than when they view other other inanimate objects and object parts, and signficantly, than when they view the body parts of animals.[87]

The question of whether the EBA, as well as the FFA, and the parahippocampal place area (PPA)[88] – another exceptionally relevant topic for picture response theory – is largely specified in the genome, or whether they primarily derive from the extensive lifetime experience an individual has with faces, places and bodies, is still open.[89] It is not a simple question of brain wiring and geography *versus* the pressures of history and context. To describe the dedicated functions of underlying structures of the brain is not to exclude differential symptomology, or even individual modulations of feeling. Functional segregation does not stand at odds with any evidence for cortical plasticity and the possibilities for reassignment of functions and responses within the brain.

IX

The central problem of this paper is this: how might it be possible to describe more rigorously and less intuitively the ways in which the inward imitation of movement and action occurs and how does it issue in emotion? An important body of literature has been dedicated to the phenomenon

known as response facilitation, that is, the automatic tendency to reproduce an observed movement, whether with or without understanding (as in the case of Meltzoff and Moore's well-known work on the imitative buccal and manual movements of babies). [90]

Ever since the mid-1980s, a number of studies implicated regions of the superior temporal sulcus (STS) in the perception of biological motion, while about ten years ago Perrett and others identified neurons in the parts of the STS of monkeys that respond selectively not only to the appearance of the body and the face, but also ones that specifically discharge when the monkey observes movements such as walking, turning the head, bending the torso and moving the arms.[91] It was not long before similar areas were identified in humans too. The discovery of single neurons in the STS that fire when biological actions are observed was interesting enough, but it did not go as far as one might have thought possible in terms of the relationship between observation and physical empathy.

In his excellent surveys of the neuroscience of the emotions, Damasio attempted to deal with the problem of how to explain observers' corporeal involvement with pictures of things (not just bodies in motion), and to assess the emotional consequences of such involvement. He emphasized the impossibility of feeling an emotion without a sense of ones own body and bodily involvement in what one observes.[92]

In the course of these books, Damasio developed his "somatic marker hypothesis", into an extended description of what he called the "as-if body loop".[93] He set out his view of how when one looks at paintings that arouse strong responses such as fear, the body itself is bypassed and the prefrontal cortices (especially the ventromedial prefrontal cortices) and amygdala merely tell the somatosensory cortex to organize itself in the explicit activity pattern that it *would have* assumed had the body been placed in the desired state and signaled upward accordingly [94] In *The Feeling of What Happens* (and again in *Looking for Spinoza*), Damasio developed this "somatic marker hypothesis" into his concept of the "as-if body loop", that is, that route by which the somatosensory cortex reacts *as if* it would have done if the body were actually present.[95] He wanted to show how feelings – the conscious awareness of emotions – are related to neural mappings of the body state. [96]

The anterior insula in particular plays a critical role in the translation of information about body states into a variety of different emotions.[97] Also critical to the understanding of observers' physical involvement with pictures, and felt emulation of the activities of other bodies, is the fact that in observing the bodily movements of others (and *mutatis mutandis* the represented bodily movements of others) the brain momentarily creates a set of body-maps that do not correspond exactly to the current reality of the body. This, of course is where the "as-if body loop" comes in.[98] It is clear that the concept of *as if* responses is central to study of beholder's sense of physical involvement with pictures and sculptures, indeed any form of visual representation. Recent neuroscientific work on the once neglected area of action understanding is strongly relevant to the problem of empathy. If ever there were a field for serious interdisciplinary discussion it is this.[99]

About seventeen years ago, Giacomo Rizzolatti and his team of researchers in Parma discovered a particular group of visuomotor neurons in the rostral part of the ventral premotor cortex of macaque monkeys, area F5.[100] Some of these, which respond chiefly to size and shape Rizzolatti called "canonical neurons", but the ones that are of most interest in the present context are those he named "mirror neurons", which discharge when the monkey observes an action as well as when it executes it.[101] In other words, when this system is activated, the observation of an action – and in particular a goal-oriented action – leads to the activation of the very same parts of the neural network in the premotor cortex that is active during its execution.[102] The congruence between the visual and motor responses of these neurons suggests that every time an action is observed there is an activation of the motor circuits of the observer.[103] It was then discovered that these same neurons also fire when the monkey observes such an action but does not actually imitate it.

One can now begin to understand the basis for physical empathy with a picture, and therefore with the emotions shown in a picture. After the initial discovery in monkeys, a mirror system was also identified in humans, chiefly in the rostral part of the inferior parietal lobule, the caudal sector of the inferior frontal gyrus, and, of course, the adjacent part of the premotor cortex,[104] a region overlapping Broca's area. This takes one into speculations about the relationships between visual responses, corporeal reactions and language that cannot be pursued here.[105] As in the case of area F5 in monkeys, when humans observe the actions of individuals or of figures in pictures, the motor representations of these actions are automatically retrieved in the same parts of the brain as when they are actually executed. As Gallese et al have most recently put it, these mirror mechanisms allow direct understanding of the meaning of the actions and emotions of others "by internally replicating or "simulating" them without any explicit reflective mediation".[106] They emphasize that conceptual reasoning is not necessary for this form of action understanding.[107] Although we do not overtly reproduce the observed action ourselves, the same part of our premotor cortex becomes active "as if" we were executing the very same action one observes.[108]

Furthermore, in humans, even in the case of actions that are not directed towards an object, the relevant somatotopic activations may be observed in the premotor cortex and in the posterior parietal lobe, similar to that of the classical motor cortex homunculus.[109] In this way visual representation is mapped directly onto motor representation of the observed action.

The applicability of these findings to the ways in which beholders' engage bodily with pictures is immense. In the case of the research on monkeys, mirror neurons responded more to goal-oriented or transitive actions like a hand grasping an apple, or reaching for a tool, or kicking an object.[110] But it has now been demonstrated that the human mirror system in fact responds to a much wider range of actions than the monkeys.[111] In humans, activation occurs during the observation of intransitive and mimed actions as well, and the facilitation of motor-evoked potentials recorded from the observer's muscles is present in the case of apparently meaningless hand/arm gestures, as well as when we observe a transitive action.[112] The implications of this for aesthetic as well as empathetic responses are substantial, since the imaginative completion of actions in pictures may now also be understood in terms of the automaticity of simulated body response to them.

Goya's *Desastres de la Guerra* provides an outstanding repertoire of test-cases. Almost every one of these images is predicated on bodily engagement and the emotions that ensue when beholders of these works feel themselves emulating or actually imitating the same gestures of despair and grief as the victims, or somehow participating in the actions of executioners. The very opening page of the *Desastres* offers an ancient *Pathosformel*. It is not just a cultural manifestation of an emotional expression; it produces in its beholders

a strong sense of bodily simulation of arms outstretched in despair. On page after page, emotions and actions represented generate a response that is simulatory and clearly corporeal. To look at these images is to become aware of how much more occurs in the act of looking than simply registering the eyes cast upwards in some seemingly fruitless appeal, or the corners of the mouth helplessly turned down. In all such cases one feels prey to the emotions that ensue upon action. With *Lo mismo* (No. 3), one has a sense of raising ones own arms to bring down the hatchet; but then, noticing the upraised hand, outstretched fingers and wide-eyed look of the fur-capped figure who begins to ward off the blow, one also seems to want to stop oneself from bringing down that mortal instrument.

Both this sense of restraint and of engagement enhance the esthetic effectiveness of the image here. It is at the very tips of ones fingers that one understands better how the female hands in *No queren* (No. 9) stretch into and scratch the face of an assailant. A similar empathetic feeling surely occurs in the case of the desperate clawings of the mothers in Rubens's newly-discovered *Massacre of the Innocents* as they try to protect their children from being murdered; and it is combined with a further powerful feeling of self-restraint as one feels ones arms beginning to rise in imitation of the action of the soldier on the right, but then stops oneself in the realization that its consequence is the smashing of an infant to earth.

Throughout Goya's series, the emotional effectiveness of the image is predicated on the evocation of corporeal identification: the shudder in ones bones upon perceiving the nakedness of the bodies cast awkwardly, but in too exposed a way, into the ditch in *Caridad* (No. 27); or the objects thrust up anuses (in *Populacho*, No. 28, or *Esto es pejor*, No. 38); or groins are sawn into, or necks garrotted, and so on. We hunch down or tightly clasp our hands in terror, we cover our eyes as we would in fear or grief, just as all these protagonists do; we teeter in precarious places, with an actual physical sensation accompanying even the visual representation of the threat of danger – before, as it were, being hurled into the pit, or carried off naked in a cart (as in *Carretadas al cementerio*, No. 64; even though that figure is already dead, it is the imminent exposure of her pudenda that so vividly evokes a real sense of bodily threat). And throughout it all one experiences the embodied simulation of gestures, even if not actually executed.

In looking at these images, however, one realizes the force of the notion of the *Pathosformel*, and that Goya, like so many great artists, touches us not only in our minds but in our bodies; not just via our prefrontal cortex but also via the premotor cortex, often unmediated by the frontal area of the brain. It is the activation of neural networks in the premotor and motor cortices that make us feel that we are actually engaging in the same action or reaction that *we would have made or felt* had we been in the same situations as those we see only represented.

But there is also a point, as just noted, at which we seem to stop ourselves from overt imitative bodily action. Anyone concerned with the effectiveness of pictures will grasp the relevance of the findings of Baldissera et al. in which they describe the mechanism at spinal cord level that prevents actual execution of seen actions, thus leaving the cortical mechanisms described here free to "re-act" the observed movements without risk of overt movement generation.[113] From this it ought also to be possible towards to a deeper understanding of the phenomenon of "gating", whereby whatever emotional response we might otherwise have had to a picture in a gallery, say, is instantly superseded by a more detached aesthetic response, a response normally – and rightly – viewed as entirely cognitive.[114] Such findings, I believe, must surely now be joined to the ways in which one assesses an artist's ability to engage viewer attention and involvement.

But what of other possibilities, such as the imitative feels – to put it perhaps too plainly – that occur, say, in the case of Roger van der Weyden's *Deposition* triptych in the Prado, where a large range of action understandings is involved. These enhance empathetic responses to other more obvious emotional dimensions of the work. The issue is not just one of the emotional responses generated by tears (or bloody body punctures, on which more below); it has to do with the ways in which we feel our bodies engaging in similar actions – or about to engage in similar actions, or inclined to engage in similar actions – to those of the actors in the picture, from the body-slumps of Christ and the Virgin, to the varieties of hand-wringing and cognate gestures of grief. This is a painting that has been shown by the iconographers to be consciously predicated on the medieval notion of compassion,[115] but it depends precisely on the kinds of unconscious knowledge of the imitative movements of beholders that lies at the basis of the conscious skills of painters, such as those possessed, say, by Roger or by Giotto.

The mechanisms whereby one understands the observed actions of others as a result of the activation of ones own neural representations also applies in a number of other areas directly related to the problem of empathy, notably touch, disgust, compassion and, perhaps most importantly, the neural representation of pain affect. The question arises about how to speak of mirror activity that arises in a more overtly sensory context.

The empathetic experience of one or or another variety of touch – for example, the spider that crawls across James Bond's chest, the feel of the finger in Christ's side in Caravaggio's *Doubting Thomas,* or the nail through his hand in Grünewald's Isenheim altarpiece – is common enough. So too are sensations of tingling, pricking or shivering upon seeing the body of another affected in this way, whether in pictures such as these or in the movies.[116] Another recent article from the Parma group has demonstrated that it would be wrong to think of cases such as these as a matter of a visual stimulus followed by a cognitive deduction of what these stimuli mean.[117] Instead, vision of another person being touched automatically activates the cortical network of regions normally involved in the beholder's own experience of being touched. fMRI experiments have shown that when people view others being touched, the same part of the secondary somatosensory cortex (the so-called SII-PV area) is activated as when they themselves are touched.[118] Keysers and his colleagues found that this area, which starts in the depths of the lateral sulcus actually overlaps with the vision of touch area in the visual cortex, and that it is precisely this region of overlap that is activated upon observing another individual's body part being touched by or touching another object.[119]

Significantly, part of the secondary somatosensory area also extends onto the convexity of the inferior parietal lobule,[120] which is so involved in the mirror representation of motor actions.

These overlaps have not yet been adequately discussed in the literature, although it has been noted that SII is a site of polymodal integration of a whole range of sensual responses.[121] The exact route along which SII receives visual stimuli still remains at issue. What is clear is that the automatic non-cognitive activation of touch areas in SII and the cingulate cortex is very similar to the one observed in premotor and posterior parietal cortex during the observation of actions.[122] The same neurons are activated when one sees

someone else pricking their finger as when one does so oneself. This can be extended still further to the feeling of the pain of others. In fact, the term *allodynia* has been proposed for the way in which one sometimes experiences pain in a limb when seeing a sudden trauma – such as a blow – to a corresponding area of another person; and it has been suggested that this hyperesthetic response may possibly be due to damage to areas of the parietal lobule, which, as has been noted, is in fact connected with the ventral premotor cortex, where mirror neurons were first identified.[123]

Of course it is not just a matter of seeing the actual experiences of living others. Viewers of pictures such as Grünewald's *Crucifixion*, or of Goya's *Desastres*, are just as familiar with such forms of shock. Neurons in the EBA fire in response to these images of the tormented human body, and reactions are further reinforced as a result of the process of allodynia. The sense of shock is thus all the more immediate and effective.[124] Hence the peculiar effectiveness of images of damage or mutilation to the body, as in so many of the images in the *Desastres* series, as well as the recurrent pictures of mutilation and torture in our own times.[125] It is impossible not to think of the images from Abu Ghraib in this context, where a sense of bodily empathy and shared threat surely lies at the root of the profound shock they evoke. Indeed, for reasons that I intend to set out elsewhere, this "hyperesthetic response" may be even greater in the case of images than of reality, depending, in the end, on the intuitive understanding artists may have of such possibilities.[126]

What I propose, therefore, is a model of empathy that is not dissimilar from the integrated one recently offered about the emotions by Preston and De Waal.[127] Their main proposal is precisely that observation or imagination of another person in a particular emotional state automatically activates a representation of that state in the observer with its associated autonomic and somatic responses.[128] My own rather obvious suggestion here has been to acknowledge the need to incorporate bodily responses – whether of movement or touch or any other kind of sensual response – into this model.[129]

There are two cortical areas of special relevance in this connection and which ought briefly to be noted. These are the anterior insula and the anterior cingulate. Tania Singer and her London colleagues have shown conclusively that these areas are activated when subjects receive pain and when they receive signals that someone close to them experiences pain.[130] It is these

parts (and to some extent the cerebellum and the brain stem) that seem to be most activated in such cases, and not the entire pain matrix (for example only the anterior insula, and not the posterior). In fact, Singer and colleagues declare quite specifically that rostral ACC and AI constitute the neural basis for our understanding of the feelings of others and ourselves.[131] These are the cortical areas that play a critical role in the representation of internal bodily states of arousal, as well as of emotional awareness.[132]

What is especially significant here – especially in considering some of the emotional overlaps that often occur upon viewing pictures such as those of dead or tormented bodies – is the central role of the insula, and the anterior insula in particular, in feelings of disgust.[133] It is activated not only in the expression of disgust, but also in observing the disgusted facial actions of others, or even in being exposed to disgusting smells.[134] Given that the insula, and the anterior insula in particular, play an integrating role with regard to a number of emotional responses, one may begin to resolve an issue that often occurs when viewing images such as those of wartime atrocities or victims – or even with more extravagant and vulgar images, such as those that are so enthusiastically multiplied in Mel Gibson's *The Passion of Christ* (2004). In cases like these, the apparently conflicting emotions of disgust and compassion effectively combine, in ways that have always been exploited by artists.

Few would make any claim for the artistic qualities of Gibson's film. On the contrary. Nevertheless, while the distinctions between art and non-art are cognitive and cultural, the new discoveries relating to the neural systems that underlie empathetic responses to pictures, even if they do not help much with such distinctions, provide considerable insight into the ways in which artists have unconsciously exploited the kinds of knowledge I have tried to set out in this paper.

This may be one route to understanding the neural bases of what we choose to call art. But this task must be left to others. The main aim of these pages has been to illuminate the role played by our perceptions of the movement and actions of others in responses that are felt to be empathetic. It has also been to try to understand what impels beholders to the seemingly imitative actions that lie at the roots of all empathy.[135] Above all, it has been an attempt to flesh out how we grasp the pain of others, in particular of those represented in pictures and sculptures. That pain, like our esthetic

responses to pictures, can no longer be regarded as inaccessible, as the appalling pictures from Abu Ghraib have taught.[136] The lesson from pictures is that we should no longer refuse to understand the minds of others, on the grounds that they are not ours, or that their condition is always and inevitably different. The further aim is to acknowledge not just the limits but the breadth and possibilities of human understanding.

* This Essay represents a combination of two papers. The first was delivered as as a lecture entitled "Art, Emotion and the Brain: The Historical Dimension" at the Third Annual Conference in Neuroesthetics (organized by Semir Zeki under the auspices of the Minerva Foundation) in Berkeley, January 10, 2004 and then updated in a presentation at the Villa Medici in Rome on May 24 2004. the second was given as "Empathy Motion and Emotion" at the conference on held at Stanford and then again at the conference entitled in in the Universita' degli Studi in Milan on December 8, 2004.

In its present form, this paper still leaves much to be desired. It skates over far too much. It says too much and too little. But it is intended to convey a broad overview of the importance of a number of central areas in current neuroscientific research for the history of the art – and for the humanities in general. My sense of the need to cross these particular disciplinary boundaries, and of the critical role that neuroscientific work has to play in the kinds of problems which art historians once addressed but have neglected for too long, goes back to the early 1980s, when I first began attending to these matters – although my concern with issues relating to iconoclasm evidently goes back much earlier.

I'm grateful to Semir Zeki, Mark Turner, John Bender, Andrea Pinotti and Giovanni Lucignani for their invitations to present these still very inchoate ideas in public, and to assess reactions to them. I'm especially thank Mark Turner and Semir Zeki for their unremitting encouragement of my work investigating the potential of the the neurosciences for the study of art and art history.

[1] K. Dewhurst/ A.W. Beard, *Sudden religious conversions in temporal lobe epilepsy*, in: *Epilepsy and Behavior* 4 (2003), 78-87 (first: *British Journal of Psychiatry* 117 (1970), 497-507) citing Cesare Lombroso's *L'Uomo di Genio* of 1888, from the *The Man of Genius*, London 1891, 189.

[2] "Although details of her illness are too fragmentary to allow a firm diagnosis", add Dewhirst and Baird rather prudently (Dewhurst/Beard [Note 1], 84.) Vita Sackville West, in her biography of St Teresa, agreed with the possibility of an epileptic diagnosis (Vita Sackville-West, *The Eagle and the Dove*. London 1943). Needless to say, St Teresa's symptoms were diagnosed as a form of *grande hystérie* by one of Charcot's students, at a time - and for some while after - when such a diagnosis was all too fashionable (G. Hahn, *Les phénomènes hystériques et les révélations de sainte Thérèse*, in: *Revue des questions scientifiques* (1883), XIII-XIV).

[3] William James, *The Varieties of Religious Experience*, New York 1902, 11 (in Lecture 1, on "Neurology and Religion").

[4] Dewhurst/Baird [note 1], 83-84, citing, *inter alia,* Alfred C. Underwood, *Conversion, Christian and non-Christian*, London 1925 and William G. Lennox, *Epilepsy and Related Orders* II, London 1960.

[5] For a discussion of the experiences of other saints and mystics in the context of possible temporal lobe lesions due to epilepsy, see Dewhurst/Baird [note 1, 84-85, preceded by their discussion of six clear contemporary cases.

[6] Charles Darwin, *The Expression of the Emotions in Man and Animals,* ed. by Paul Ekman, Oxford 1998 (1st ed. 1872).

[7] Much is now available; for a good overview with particular reference to the critical work of Charles Le Brun, see esp. Jennifer Montagu, *The Expression of the Passions. The Origin and Influence of Charles Le Brun's Conférence sur l'expresson générale et particulière*, New Haven/London 1994; but see also the useful Jean-Jacques Courtine/Claudine Haroche, *Histoire du visage. Exprimer et taire ses émotions XVIe-debut XIXe siècle*, Paris 1988. While the whole physiognomic tradition from Giovanni Battista Della Porta on has been well-studied, there still remain a number of historical figures who deserve much more attention than they have received so far in this context, notably the prolific writer on the expression and recognition of the passions, Marin Cureau de la Chambre (1595-1669).

[8] For good summaries of Ekman's work since the late 1960s on basic emotions and on the transcultural expression of emotions, see esp. Paul Ekman, *Emotion in the Human Face*, Cambridge ²1982, *The Nature of Emotion: Fundamental Questions,* ed. by Paul Ekman, Oxford 1994, and Paul Ekman, *Emotions Revealed*, New York 2003. See also R. Adolphs, *Recognizing Emotion From Facial Expressions: Psychological and Neurological Mechanisms*, in: *Behavioral and Cognitive Neuroscience Reviews* 1 (2002), 21-61, for some of the neurological mechanisms underlying the recognition of emotional facial expressions. But see also the high scepticism expressed in Willibald Sauerländer, *Überlegungen zu dem Thema Lavater und die Kunstgeschichte*, in: *Idea*. *Jahrbuch der Hamburger Kunsthalle* 8 (1989), 15-30.

[9] Philippe-Alain Michaud, *Aby Warburg and the Image in Motion*. Translated by Sophie Hawkes, with a foreword by Georges Didi-Huberman, New York 2004, and esp. 45-46 on the early photography of movement in cities (as in the 1859 photographs published by Edward Anthony in New York).

[10] The fundamental work still remains Michel Foucault, *The Order of Things. An Archeology of the Human Sciences*, New York 1973 (*Les mots et les choses*, Paris 1966), where he neatly set out the essential relationship between classification and illustration.

[11] I will not resolve this issue here, although it has received much attention recently. See Montagu for the confession that "when I wrote my thesis in the 1950s [on which Montagu 1994 is based] the consensus was that still images of the face provided little reliable evidence as to emotions…."! (Montagu [note 7], 2). In her note 4 on p. 188 she notes that while she uses the term "basic emotions", she accepts Ortony and Turner's argument that the idea that there are a litmited number of basic emotions is misleading, as well as Russell and Bullock's view that our natural language conception of emotions is fuzzy (Montagu [note 7], 188, citing A. Ortony/T.J. Turner, *What's basic about basic emotions?*, in: *Psychological Review* XCVII (1990), 315-331. A. J. Fridlund, *Evolution and Facial Actions in Reflex, Social Motive, and Paralanguage*, in: *Biological Review* XXXII (1991), 1-100, and J.A. Russell/M. Bullock, "Fuzzy Concepts and the Perception of Emotion in Facial Expressions", in: *Social Cognition* IV (1986), 309-41.

[12] Darwin [note 6], 213-214.

[13] Ibid., 34.

[14] Ibid., 36-37.

[15] Ibid., 3 and 33.

[16] See William James, *The Principles of Psychology*, 2 vol., New York 1950 (first ed. 1890).

[17] Darwin [note 6], 35.

[18] Ibid., 34.

[19] In The *Power of Images* I wrote about emotional and visceral responses to images, but I was writing about *symptoms* of response, rather than about the relationship between how pictures look and the responses they elicit. This is my present concern. But at that point, forgetting my exhortation in David Freedberg, *The Problem of Classicism: Ideology and Power*, in: *Art Journal* XLVII/1 (1988), 1-6, esp. 2, and exasperated with the prevalently aimless formalism of art history, I did not consider the potential of a goal-directed formal analysis as a possible element in the assessment of the relations between how objects look and how people respond to them.

[20] Ibid.. In considering the problem of classicism rather more globally than was then – or is now – either habit or practice, I suggested that particular visual forms and configurations might arouse – or at least be associated with – particular kinds of esthetic and emotional responses.

[21] See, for example, the work by Semir Zeki (following his pioneering work on the visual areas of the brain) in Semir Zeki, *Inner Vision. An Exploration of Art and the Brain*, Oxford/New York 1999 (cf. Semir Zeki, *A Vision of the Brain*, Oxford/New York 1993), as well as Lamberto Maffei's very clear application of the possibilities of the neurosciences for the understanding of the arts – and the visual arts in particular – in Lamberto Maffei/ Adriana Fiorentini, *Arte e Cervello*, Bologna 1995. Such work has been followed by proposals such as those by Ramachandran in Vilayanur S. Ramachandran, *A Brief Tour of Human Consciousness*, New York 2004, 40-60 and elsewhere. While all these essays are extremely suggestive, their relatively superficial consideration of historical complexity makes the need for interdisciplinary work across the border of the sciences and the humanties even more urgent. Yet almost all the outreach has come from the side of the scientists.

[22] When, in my introduction to the collection of essays on classicism, I wrote, perhaps a little acerbically, that "to say that no style is unideological is not, in the end, to say a great deal", and encouraged scholars to look at what was unchanging about the responses to particular styles and

forms rather than on changing tastes, fashions, and pressures, no one took much notice, and each contributor offered meticulous accounts of contextual uses of classical form. There was a reluctance to broach the question of what more precisely it was about particular responses to particular visual configurations that could have been exploited by the ideologists or the hegemonists.

[23] On the "standard social sciences model" and its dangers, see Pinker, *The Language Instinct. How the Mind Creates Language*, New York 1994, 404-415. The notion that certain responses might automatically arise from built-in brain mechanisms, or that they might be localizable in particular areas of the brain was – and continues to be – rejected, despite the vast amount of evidence to the contrary.

[24] No one wished to consider the possibility of considering the ways in which an understanding of the biological bases of response might contribute to the understanding of historical forms.

[25] Cf. Montagu [note 7], 2 and esp. p. 188 note 4 for a brief articulation of the standard (and predictable) position.

[26] See esp. Ekman et al., *Pan-cultural elements in facial displays of emotions*, in: *Science* 164/3875 (1969), 86-88, and Paul Ekman, *Universals and cultural differences in facial expressions of emotion*, in: *Nebraska Symposium on Motivation, 1971*, ed. by James K. Cole, Lincoln 1972, 207-283, as well as the useful summaries of a large amount of subsequent work (with relevant bibliographic references) in Ekman 2003 [note 8].

[27] To use the distinction set out by Antonio R. Damasio, *Descartes Error. Emotion, Reason, and the Human Brain*, New York 1994, esp. on pp. 127-164 (where he emphasizes the idea that emotions precede the feelings of them) and then in Antonio R. Damasio, *The Feeling of What Happens. Body and Emotion in the Making of Consciousness*, New York 1999, where emotions are taken to be preconscious and prior to conscious feeling (cf. esp. 281-295 (where he again insists on the essential body-relatedness of both emotions and feelings).

[28] See now esp. Klaus Herding/Bernhard Stumpfhaus, *Pathos, Affekt, Gefühl. Die Emotionen in den Künsten*, Berlin 2004, for a sign of the growth of interest in the field.

[29] Vigorously set out in Robin G. Collingwood, *The Principles of Art*, Oxford 1938, 19-36.

[30] Ibid., 31.

[31] For the full text of Poussin's famous letter on the modes, in which this phrase occurs, see *Correspondance de Nicolas Poussin*, ed. by Charles Jouanny, Paris 1911 (= *Archives de l'Art Francais* V), 373-374. For discussions not just of the importance of this passage in the history of the expression of the emotions, but also of its relevance for the ways in which we might begin to think about the relationship between how pictures look and the responses they evoke, see David Freedberg, *De l'effet de la musique, aux effets de l'image; ou pourquoi les affetti ne sont pas les modes*, in: *Le Tasse, Actes du Colloque....au Musée du Louvre....13-14 novembre, 1996,* Paris 1999, 311-338, and David Freedberg, *Composition and Emotion: Poussin's Proposal*, in: *The Artful Mind*, ed. by Mark Turner, Oxford/New York 2006, 73-89.

[32] For the distinction – between automatic and physical on the one hand and reflective and congitive on the other – see Damasio 1994 [note 27], esp. on pages 127-164 and Damasio 1999 [note 27], 281-295. See also note 28 above.

[33] In the writings of Herman Lotze, Robert Vischer, Heinrich Wölfflin, and others. Fortunately some of the richest writings are now available in *Empathy, Form and Space. Problems in German Aesthetics 1873-1893*, ed. by Harry F. Mallgrave et al., Los Angeles 1994. On the other hand, the works of writers like Wilhelm Worringer (and even the dubious but compelling and erudite work of Jozef Strzygowski remain relatively unknown and mostly untranslated in the English-speaking countries). See also pp. ooo-ooo below, as well as Herding/Stumpfhaus [note 28].

[34] For a summary of the relevant material until 1987, see David Freedberg, *Iconoclasts and their Motives* (Second Horst Gerson Memorial Lecture, University of Groningen), Maarssen l985 (reprinted in: *Public*, Toronto l993), and David Freedberg, *Iconoclasm and Painting in the Revolt of the Netherlands, 1566-1609*, New York l988 (reprint, with new introduction, of l973 Oxford dissertation) esp. p. IV, note 13.

[35] Nelson Goodman, *Languages of Art. An Approach to a Theory of Symbols*, Indianapolis ²1976, 247-248.

[36] Esp. in Damasio 1994 [note 27], and continued in Damasio 1999 [note 27] and Antonio Damasio, *Looking for Spinoza. Joy, Sorrow and the Feeling Brain*, New York 2003.

[37] James Elkins, Pictures of the Body, Pain and Metamorphosis, Stanford 1999.

[38] James Elkins, Pictures and Tears. How a Painting Can Make You Cry, London 2001.

[39] Elkins 1999 [note 37], vii.
[40] In addition to the work of Ekman, Damasio and LeDoux, see also the pioneering work of Zeki and Maffei and Fiorentini and the subsequent researches of relevant research into emotional responses to observation of others by writers such as Raymond Dolan.
[41] See D. Freedberg/V. Gallese, *Motion, Emotion and Empathy in Aesthetic Experience*, in: *Trends in Cognitive Science*, forthcoming 2007.
[42] Lit. "the most and the most natural movement". But how is movement to be understood here – inner or outer? Much futile ink has been spilt on this phrase. It is not, as scholars have so long argued, either one or the other. Certainly, given the figures in the painting to which it refers, it cannot simply refer to outer movement – or indeed, not simply to "emotion" either; but rather to emotion *and* to the movement of the body that expresses emotion – as is often the case in Renaissance and Baroque art theory, from Alberti on. For the document in which the phrase occurs and a useful discussion of the controversy about it, see Strauss et al., *The Rembrandt Documents*, New York 1979, 160-162.
[43] *Sandro Botticellis "Geburt der Venus" und "Frühling"*; now usefully available in Aby Warburg, *The Renewal of Pagan Antiquity*, translated by David Brett and with an introduction by Kurt W. Forster, Los Angeles 1999, 95-156.
[44] Now very widely discussed. The critical explicit use of the word *Pathosformel* occurs in the essay on *Francesco Sassetti's Last Injunctions to His Sons of 1907*, available now in Ibid., where *Pathosformeln* is simply translated as "emotive formulas". See, for example, Ernst H. Gombrich, *Aby Warburg. An Intellectual Biography*, Chicago/Oxford 1986 (1st edition, London: The Warburg Institute, 1970) , Michaud [note 9] and Georges Didi-Huberman's foreword on 7-19 here, Salvatore Settis, *Pathos und Ethos, Morphologie und Funktion*, in: *Ernst Cassirer und die Bibliothek Warburg*, Berlin 1997 (=*Vorträge aus dem Warburg Haus* I), 31-73, and Kurt Forster's excellent summary in his introduction to Warburg [note 43], esp. 10-21 – *inter multos alios*.
[45] On these writers, see the useful anthology by Mallgrave et al. [note 33], as well as *Estetica ed Empatia*, ed. by Andrea Pinotti, Milan 1997, and notes 33 above and 48 and 53 below.
[46] For a good summary of recent ways of attempting to deal with the first part of this question, see Elkins 1999 [note 37], vii-x and 1-32. The mechanisms of psychic engagement with sculpture are in some crucial very different than with paintings. The topic has a long and complex history, of course, but it is also one in which neuroscientific understanding of the relationship between vision and touch has a great deal to contribute.
[47] Virginia Woolf, *Three Guineas*, New York 1938, 14-15.
[48] Ibid., 15. Woolf justifies her claim thus: "the eye is connected with the brain; the brain with the nervous system. That system sends its messages in a flash through every past memory and present feeling. When we look at those photographs some fusion takes place within us; however different the education, the traditions behind us, our sensations are the same; and they are violent. You, Sir, call them "horror and disgust". We also call them horror and disgust". These are prescient words in the context of this paper.
[49] Susan Sontag, *Regarding the Pain of Others*, New York 2003, 6-7.
[50] Ibid., 8.
[51] To make claims about "fundamental" or about "human" responses has long been unfashionable, on the grounds that to do so is to detract from the individual, from the idiosyncrasy and particular constructions of response; and that it is to overlook difference. Clearly responses to images are modified by context to a greater or lesser degree, but it would be illogical to deny that humans respond to images – and to art – in ways that are generalizable and have to do with our physiological, biological and neurobiological constitution as human beings.
[52] Cf. one of the very final sentences in Carr et al's interesting article on neural mechanisms of empathy in humans: "to empathize we need to invoke the representation of the actions associated with the emotions we are witnessing" (L. Carr et al., *Neural Mechanisms of empathy in humans: A relay from neural systems for imitation to limbic areas*, in: *Proceedings of the National Academy of Sciences* 100/9 (2003), 5497-5502, 5502).
[53] See now also the important articles by Richard Etlin, *Aesthetics and the spatial sense of self*, in: *Journal of Aesthetics and Art Criticism* 56 (1998), 1-19, and Koss, *On the Limits of Empathy*, in: *Art Bulletin* 88 (2006), 139-157.

[54] While the notion received its fullest discussion in the German writers on empathy, it is also present in Bernard Berenson's idea that the degree to which art was "life-enhancing" depended on the extent to which it successfully aroused some kind of physical sensations in viewers that somehow mirrored the possibilities adumbrated by the representation itself. But this is a topic to which I shall also return on another occasion.
[55] Cf., for example, the collection of texts and commentary in Mallgrave et al. [note 33], as well as the interesting articles by Etlin [note 53] and Koss [note 53].
[56] See Freedberg/Gallese [note 47] for an overview of the kinds of scientific work in this domain of possible relevance to the understanding of art.
[57] Cf. notes 28 and 33 above.
[58] Mallgrave et al. [note 33], 95.
[59] In his Inaugural Dissertation entitled *Prolegomena zu einer Psychologie der Architektur* of 1886, available in Mallgrave et al. [note 33], 149-190.
[60] Cf. Kurt Forster's introduction to Warburg [note 43], esp. p. 13.
[61] See esp. Theodor Lipps, *Raumästhetik und geometrisch-optische Täuschungen*, Leipzig 1893-1897, Theodor Lipps, *Einfühlung, innere Nachahmung, und Organempfindungen*, in: *Archiv für die gesamte Psychologie* 1, 1903-1906, 185-204.
[62] In William James, *The Principles of Psychology*, 2 vol., New York 1950 (first ed. 1890), 2.
[63] For a caution about the dangers of this position, precisely on the grounds that the notions of *Einfühlung* and Empathy "often go along with the sweeping away of historical facts", as Klaus Herding has reminded me, see the astringent insights in Sauerländer [note 9].
[64] See V. Gallese/A. Goldman, *Mirror Neurons and the simulation theory of mind-reading*, in: *Trends in Cognitive Science* 2 (1998), 493-501, V. Gallese et al., *A unifying view of the basis of social cognition*, in: *Trends in Cognitive Science* 8/9 (2004), 396-403, and Freedberg/Gallese [note 47].
[65] Esp. in Michael Fried, *Courbet's Realism*, Chicago/London 1990 (cf. pp. 85-147 esp. – although here Fried writes mostly about the painter's identification and merger with the bodies in the pictures he paints, notably in that of Courbet's *Stonebreakers* and *Burial at Ornans*); and Michael Fried, *Menzel's Realism: Art and Embodiment in 19th Century Berlin*, New Haven/London 2002, esp. 13 and 41-57.
[66] As in Elkins 1999 [note 37], in particular (summarizing his positions) vii-x and 1-32 (with many further references to other good and important work on the body in recent art history, from Leo Steinberg through Barbara Stafford and many others).
[67] See the influential summary of the problem in Elaine Scarry, *The Body in Pain*, Oxford/New York 1985.
[68] On this phenomenon, see also H. Oya et al, *Electrophysiological Responses in the Human Amygdala Discriminate Emotion Categories of Complex Visual Stimuli*, in: *Journal of Neuroscience* 22/21 (2002), 9502-9512, P. Wright et al., *Disgust and the insula: fMRI responses to pictures of mutilation and contamination*, *Neuroreport* 15/15 (2004), 2347-2351, J. L. Bradshaw/J. B.Mattingley, *Allodynia: a sensory analogue of motor mirror neurons in a hyperaesthetic patient reporting instantaneous discomfort to another's perceived sudden minor injury?*, in: *Journal of Neurology, Neurosurgery and Psychiatry* 70 (2001), 135a-136, and now C. Keysers et al., *A touching sight: SII:PV activation during the observation and experience of touch*, in: *Neuron* 42 (2004), 336-346.
[69] As in Woolf [note 47], 15, noted above.
[70] These, of course, are symptoms that may be found in much grosser form in the illustrations to Le Brun's treatise on facial expressions (Charles Le Brun, *Conférence de Monsieur Le Brun…..Sur L'Expression générale & particulière. Enrichie de figures gravees par B. Picart*, Amsterdam 1698); cf. the discussion in Montagu [note 7] and the overview in Courtine/Haroche [note 7]. For some of the latest work in this area, see D. C. Jackson et al., *Suppression and enhancement of emotional responses to unpleasant pictures*, in: *Psychophysiology* 37 (2000), 515-522, and P. J. Lang et al., *Looking at Pictures: Affective, facial, visceral and behavioral reactions*, in: *Psychophysiology* 30 (1993), 261-273.
[71] Ibid..
[72] See J.-P.Royet et al., *Emotional Responses to Pleasant and Unpleasant Olfactory, Visual and auditory Stimuli: A Positron Emission Tomography Study*, in: *Journal of Neuroscience* 20/20 (2000), 7752-7759.

and J. Geday et al., *Emotional valence modulates activity in the posterior fusiform gyrus and inferior medial prefrontal cortex in social perception*, in: *Neuroimage* 18 (2003), 675-684. See also R. D. Lane et al., *Neuroanatomical correlates of happiness, sadness and disgust*, in: *American Journal of Psychiatry* 154 (1997), 926-933, for an earlyish effort at establishing the neuroanatomical correlates of happiness, sadness and disgust with the aid of PET scans, as well as K. Luan Phan et al., *Functional Neuroanatomy of Emotion: A Meta-Analysis of Emotion Activation Studies in PET and fMRI*, in: *NeuroImage* 16 (2002), 331-348 and Aalto et al. 2002 for the use of film clips in PET scanning experiments.

[73] For a good overview, see Joseph E. LeDoux, *Emotion and the Amygdala*, in: *The Amygdala: Neurobiological Aspects of Emotion, Memory and Mental Dysfunction*, ed. by John P. Aggleton, New York 1992, 339-351, and Joseph E. LeDoux, *The Emotional Brain. The Mysterious Underpinnings of Emotional Life,* New York 1996, as well as R. Adolphs, *The human amygdala and emotion*, in: *Neuroscientist* 5 (1999) 125-137.

[74] Though see for example H. Kawasaki et al., *Human Prefrontal Cortex and Amydgala Show Correlated single-unit Responses to Emotional Pictures*, in: *Abstract, Eighth Annual Meeting of the Cognitive Neuroscience Society*, 2001, which also deals with distinctions between response to aversive stimuli on the one hand and pleasant or neutral stimuli on the other (greater synchronous activity among prefrontal cortical neurons and between ventromedial prefrontal and amygdala neurons in the case of the former).

[75] Vasari, *Le Vite de' più eccellenti pittori, scultori, ed architettori* ...con nuove annotazioni e commenti di Gaetano Milanesi. Ultima impressione, Florence 1906 (1568), IV, 23-24.

[76] For the documentation of this work, and the deliberate way in which Huygens revealed it in his home to frighten spectators, see now Peter C. Sutton et al., *The Age of Rubens*, Boston 1993, 245-247, and now the excellent discussion by one of the very contemporary art historians to have begun to take the findings of the new neurosciences into serious consideration, Ulrich Heinen, *Emotionales Bild-Erleben in der Frühen Neuzeit*, in: *Anthropologie der Literatur. Poetogene Strukturen und ästhetisch-soziale Handlungsfelder*, hg. von Rüdiger Zymner/Manfred Engel, Paderborn 2003, 356-383, 359-362, with full literature in his note 9, 359-360.

[77] LeDoux 1996 [note 73], 163-165, 169; cf. now also R. J. Dolan/P. Vuilleumier, *Amygdala Automaticity in Emotional Processing*, in: *Annals of the New York Academy of Sciences* 985 (2003), 348-355 for a good account of amygdalic automaticity in the processing of emotions.

[78] The periacqueductal gray also seems to very involved in different kinds of fear reactions such as fight and flight. Damasio 2003 [note 36], 74.

[79] Cf. LeDoux 1996 [note 73], 166 and R. Adolphs, *Emotional Vision*, in: *Nature Neuroscience* 7/11 (2004), 1167-1170; cf. also D. G. Amaral/J. L. Price, *Amygdalo-cortical projections in the monkey (Macaca fascicularis)*, in: *Journal of Comparative Neurology* 230 (1984), 465-496.

[80] See, for example, B. Wicker et al., *Both of us disgusted in my insula: the common neural basis of seeing and feeling disgust*, in: *Neuron* 40/3 (2003), 655-64, and Gallese et al. 2004 [note 64], 396-403, 397-400, with a good summary of earlier literature. Carr et al. [note 52] make a strong claim for the role of the insula in the relay from action representation to emotion. Wright et al. 2005 insist on selective disgust processing at the insula (with the anterior insula responding to contamination and mutilation but not attacks, for example). The role of the basal ganglia in both fear and disgust reactions has also received some attention. For further important references to the role of the anterior insula and anterior cingulate in the perception and feeling of disgust, see also below [note 119].

[81] For example in Paul Ekman/Wallace V. Friesen, *Unmasking the Face. A Guide to Recognizing Emotions from Facial Clues*, Upper Saddle River, NJ 1975 as well as many of Ekman's other works [cf. note 8].

[82] The fundamental early article was N. Kanwisher et al., *The Fusiform Face Area: A Module in Human Extrastriate Cortex Specialized for Face Perception*, in: *Journal of Neuroscience* 17/11 (1997), 4302-4311, which duly records early work in the area of facial recognition as well. See also N. Kanwisher, *Domain specificity in face perception*, in: *Nature Neuroscience* 3 (2000), 759-763, and F. Tong et al., *Response Properties of the Human Fusiform Face Area*, in: *Cognitive Neuropsychology* 17/1 (2000), 257-280.

[83] Eg. Kanwisher et al. [note 82]; for opposing views, see, for the example the work of Isabel Gauthier, as in I. Gauthier/C. A. Nelson, *The development of face expertise*, in: *Current Opinion*

in Neurobiology 11 (2001), 219-224, where she questions whether indeed there are experience-independent precursors of face expertise; and expresses the concern that parallels between literature for infants and adults suggests that methodological issues need to be addressed before strong conclusions can be drawn regarding the origins of face recognition. Cf. also (inter alia) Gauthier et al., "Activation of the middle fusiform "face area" increases with expertise in recognizing novel objects", in: *Nature Neuroscience* 2 (1999), 569-573, and Gauthier et al., *Expertise for cars and birds recruits brain areas involved in face recognition*, in: *Nature Neuroscience* 3 (2000), 191-197, where the case is made that the role of the fusiform gyrus may be to distinguish a specific type of object from any general class of objects, not just faces. Nevertheless, the evidence now for the role of a specialized module in the brain for facial recognition - the facial fusiform gyrus seems overwhelming (cf. also Kanwisher 2000 [note 82] for responses to the Gauthier position).

[84] See Jennifer Montagu's definitive study of LeBrun, Montagu [note 7].

[85] For a remarkable and altogether pertinent exposition of the dangers and implications of taking physiognomics seriously, see Sauerländer adoption of Lichtenberg's astringent scepticism of Lavater, Sauerländer 1989 [note 9].

[86] P. E. Downing et al., *A Cortical Area Selective for Visual Processing of the Human Body*, in: *Science* 293 (2001), 2470-2243.

[87] Ibid., 2470 and [note 10].

[88] See R. Epstein/N. Kanwisher, *A cortical representation of the local visual environment*, in: *Nature* 392/6676 (1998), 598-601, and R. Epstein et al., *Viewpoint-specific scene representations in human parahippocampal cortex*, in: *Neuron* 37/5 (2003), 865-876.

[89] As Downing et al. have well put it. Downing [note 86], 2472.

[90] E. g. A. N. Meltzoff/ M. K. Moore, *Imitation of facial and manual gestures by human neonates*, in: *Science* 198 (1977), 75-78 and A. N. Meltzoff/ M. K. Moore, *Newborn infants imitate adult facial gestures*, in: *Child Development* 54 (1983), 702-709, as well as much subsequent work by them.

[91] D. I. Perrett et al., *Neurones responsive to faces in the temporal cortex: Studies of functional organization, sensitivity to identity and relation to perception*, in: *Human Neurobiology* 3 (1984), 197-208, D. I. Perrett et al., *Frameworks of analysis for the neural representation of animate objects and actions*, in: *Journal of Experimental Biology* 146 (1986), 87-113.

[92] Damasio 1994 [note 27], 132-146, 158-9, and Damasio 1999 [note 27], 279.

[93] Eg. Damasio 1994 [note 27], 173-177 on the somatic marker hypothesis. On the as-if body loop, see both 155-157 and 184, expanded in Damasio 1999 [note 27] 80 and 281-283 and Damasio 2003 [note 36], 115-116.

[94] Damasio 1994 [note 27], 184.

[95] Damasio 1999 [note 27], esp. 80 and 281-283.

[96] The critical parts of the brain involved in the mapping of the body state and ones sense of the body in space are above all the right somatosensory cortices, in particular the insula, and regions SII and SI of the cerebral hemisphere, in that order. This is where, as Damasio puts it, the brain accomplishes the highest level of integrated mapping of body states. Damasio 2003 [note 36], 116-117.

[97] See, for example, the useful discussions in Wicker et al 2003 [note 80], T. Singer et al., *Empathy for pain involves the affective but not sensory components of pain*, in: *Science* 303/5661 (2004), 1157-1162, Carr et al. [note 52], and Gallese et al. 2004 [note 64].

[98] The relevance, I think, of all this to the way in which we feel in our body the pain or the suffering or the pleasure of the figures in a picture, is clear. So too, I think, for the way in which we feel absorbed by the line, the impasto, and the texture, real or imagined, of a picture, and have according feelings of emotion as a result.

[99] At this point, the neurocognitive literature has grown to be substantial. In addition to the literature on mirror neurons by Rizzolatti, Gallese, Fogassi, Iacoboni and others cited in the following notes, see also the rich literature on action imitation and empathy, such as well exemplified by the work of Jean Decety and Julie Grèzes.

[100] G. Rizzolatti et al., *Functional organization of inferior area 6 in the macaque monkey: II. Area F5 and the control of distal movements*, in: *Experimental Brain Research* 111 (1988), 246-252. For an update, see L. Fogassi/V. Gallese, *The Neural Correlates of Action Understanding in non-human primates*, in: *Mirror Neutrons and the Evolution of Brain and Language*, ed. by. Maksim Stamenov/Vittorio Gallese, Amsterdam 2002, 13-31, and the very important article by

G. Rizzolatti et al., *Neurophysiological mechanisms underlying the understanding of action*, in: *Nature Neuroscience Reviews* 2 (2001), 661-670.
[101] V. Gallese et al., *Action recognition in the premotor cortex*, in: *Brain* 119 (1996), 593-609; G. Rizzolatti et al., *Premotor cortex and the recognition of motor actions*, in: *Cognitive Brain Research* 3 (1996), 131-141. On canonical neurons, see Rizzolatti et al 1988 [note 100], and A. Murata et al., *Object representation in the ventral premotor cortex (area f5) of the monkey*, in: *Journal of Neurophysiology* 78 (1997), 2226-2230.
[102] Fogassi/Gallese [note 100], 13-19; cf. also Gallese et al. 2004 [note 64], 396.
[103] Fogassi/Gallese [note 100], 19.
[104] G. Rizzolatti et al. *Neurophysiological mechanisms underlying the understanding of action*, in: *Nature Neuroscience Reviews* 2 (2001), 661-670. Cf. Gallese et al. 2004 [note 64], 397.
[105] For the activation of Broca's area in mirror neuron experiments, see Buccino et al., "Action observation activates premotor and parietal areas in a somatopic manner: an fMRI study", in: *European Journal of Neurosciences* 13 (2001), 400-404, and Iacoboni et al., *Cortical mechanisms of human imitation*, in: *Science* 286 (1999), 2526-2528. See also Leslie, Johnson-Frey and Grafton's summation of functional image studies indicating that "the inferior frontal cortex, including Broca's area, may be the key component of a human imitation system". Leslie et al., *Functional imaging of face and hand imitation: towards a motor theory of empathy*, in: *Neuroimage* 21 (2004), 601-607.
[106] Gallese et al. 2004 [note 64], 396.
[107] Ibid..
[108] Damasio 1994 [note 27], Gallese et al. 2004 [note 64], as well as V. Gallese et al., *The mirror matching system: A shared manifold for intersubjectivity*, in: *Behavioral and Brain Sciences* 25/1 (2002), 35-36.
[109] Buccino et al. [note 105].
[110] Fogassi/Gallese [note 100], 14-25.
[111] Gallese et al. 2004 [note 64], 397. Cf. also the important article by G. Rizzolatti et al., *The mirror system in humans*, in: Stamenov/Gallese [note 100].
[112] Ibid.. A particularly rich series of results about movement evoked potentials (MEP) has been obtained on the basis of examination by transcranial magnetic scanning (TMS) of motor and premotor cortex responses to movement in images. See now Battaglia et al., *Art, imagination and reality: the cortical motor networks*, *Neuroimage*, 2007 forthcoming which also contains a good survey of the relevant literature.
[113] F. Baldissera et al., *Modulation of spinal excitability during observation of hand actions in humans*, in: *European Journal of Neuroscience* 13 (2001), 190-194 as cited in Rizzolatti et al. 2002 [note 111], 41.
[114] In this view, we know that a picture of a dead Christ is only a picture, not a suffering body, and we suspend whatever emotional response we may be inclined to have to it. We instantly know it's a picture on display, a work of art, put up for esthetic consumption, and so we evaluate it only on this basis – or so the argument would run.
[115] See the justly famous article by O. von Simson, *Compassio and Co-redemptio in Rogier van der Weyden's*
Descent from the Cross, in: *Art Bulletin* 35 (1953), 9-16.
[116] For responses to distorted fingers as in the Isenheim altar, see S. Avikainen et al., *Enhanced Extrastriate Activation during Observation of Distorted Finger Postures*, in: *Journal of Cognitive Neuroscience* 15/5 (2003), 658-663.
[117] Keysers et al. [note 68], 335.
[118] Ibid., 335-336. In such cases the primary somatosensory cortex does not seem to be activated at all.
[119] Ibid., 336-338.
[120] Ibid., 340-341.
[121] Ibid., 341.
[122] Buccino et al. [note 105], Iacoboni et al. [note 105], Rizolatti et al. 2001 [note 104].
[123] J. L. Bradshaw/J. B. Mattingley, *Allodynia: a sensory analogue of motor mirror neurons in a hyperaesthetic patient reporting instantaneous discomfort to another's perceived sudden minor injury?*, in: *Journal of Neurology, Neurosurgery and Psychiatry* 70 (2001), 135-136.
[124] See also Oya et al. [note 68], 9511-9512 for amygdalic responses to images relating to human injury.

[125] For reactions of disgust and the role of the insula in such reactions to pictures of mutilation, see now Wright et al. [note 68]. They note that the anterior insual responds to contamination and mutilation but not attacks, while the ventral visual areas respond to attacks and mutilations more than to contamination. They argue for slective disgust processing in the insula, and that there are distinct neural reposnses to contamination versus mutilation.
[126] This particular notion offers another way of thinking about Constable's famous "Painting is a science…of which pictures are but the experiments", cited by Gombrich in an entirely different context (Ernst H. Gombrich, *Art and Illusion. A Study in the Psychology of Pictorial Representation*, ²New York 1965, 33).
[127] S. D. Preston/F. B. De Waal, *Empathy: its ultimate and proximate bases*, in: *Behavioral and Brain Sciences* 25/1 (2001), 1-20.
[128] Ibid..
[129] Cf. also the "motor theory of empathy" outlined by Leslie et al. [note 105].
[130] Singer et al. [note 97].
[131] Ibid..
[132] Ibid.., 1160. Cf. also D. H. Critchley et al., *Neural systems supporting interoceptive awareness*, in: *Nature Neuroscience* 7/2 (1996), 189-95.
[133] Cf. Singer et al. and Wright et al. [note 68].
[134] L. M. Philips et al., *A specific neural substrate for perceiving facial expressions of disgust*, in: *Nature* 389 (1997), 495-498; A. J. Calder et al., *Impaired recognition and experinece of disugst following brain injury*, in: *Nature Neuroscience* 3 (2000), 1077-1078; R. Adolphs et al., *Dissociable neural systems for recognizing emotions*, in: *Brain Cognition* 52 (2003), 61-69; P. Korla-Salmon et al., *An attention modulated response to disgust in human ventral anterior insula*, in: *Annals of Neurology* 53/4 (2003), 446-453, Wicker et al, 2003 [note 83].
[135] The literature is expanding by the day. See esp. Preston/De Waal [note 127], and, inter alia, P. L. Jackson et al., *How do we perceive the pain of others: A window into the neural processes involved in empathy*, in: *NeuroImage* 24 (2005), 771-779, Gallese et al. 2002 [note 108] (critiquing Preston and De Waal and insisting on the importance of the simulation mechanisms in the brain of the kind discussed in the present paper), as well as important forthcoming work by Stephanie Preston and Frans De Waal.
[136] See now, for example, Singer et al. [note 97], and Jackson et al. 2005 [note 135], with a full list of relevant literature there, 777-779.