Chapter 15

Hands On

Neil Forsyth

Pope Francis told an interviewer in August 2013 that he never used to know Rome well, apart from St Peter's.

> 'When I had to come to Rome, I always stayed in [the neighborhood of] Via della Scrofa. From there I often visited the Church of St. Louis of France, and I went there to contemplate the painting of *The Calling of St. Matthew*, by Caravaggio … That finger of Jesus, pointing at Matthew. That's me. I feel like him. Like Matthew'. Here the pope becomes determined, as if he had finally found the image he was looking for: 'It is the gesture of Matthew that strikes me: he holds on to his money as if to say, "No, not me! No, this money is mine". Here, this is me, a sinner on whom the Lord has turned his gaze. And this is what I said when they asked me if I would accept my election as pontiff'. Then the pope whispers in Latin: 'I am a sinner, but I trust in the infinite mercy and patience of our Lord Jesus Christ, and I accept in a spirit of penance'.
>
> (Spadaro 2013)

This feeling of identification ('That's me') is something we must all have experienced, and recent advances in neuroscience, still controversial, especially the discovery of mirror neurones, may help us understand what is going on (Vessel, Starr, and Rubin 2013).

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Mirror neurones

Mirror neurones are nerve cells in our brains that vibrate however minutely when stimulated by what others do. What we sometimes call by the vague term 'empathy' can be located in specific areas of the brain.[1] Seeing someone else in pain or joy can produce the same brain and body reaction as if we ourselves were experiencing the emotion. This has come to be called 'simulation'. We learn to smile when mother smiles: we even smile inwardly – the phrase has real meaning. Cognitive sciences have been demonstrating through many and various experiments that we are impelled to move our own bodies, however slightly, by the movements of others, and – this is what is most remarkable – not only by seeing movements in others but even by looking at pictures or reading about them. The way we understand an action is by simulating it in our own neuronal system. Mirror neurones make our brains, our embodied minds (Gibbs 2005), act as if we ourselves are experiencing whatever that other person is experiencing.

Mirror neurones were first discovered in monkeys through research in Parma published in 1999, and this initially led to a great deal of amused contempt for the idea that they might explain human behaviour. But it has since been shown that the monkey and human mirror neurone systems differ in at least one critical respect: for a monkey a grasping hand has to be directed at an object for the neurones to fire, but the human system responds to representations.

> The human mirror system responds to empty-handed gestures, that is, to movements made in the air, simulating actions made on an object but without having the object present.
>
> (Cartmill, Beilock, and Goldin-Meadow 2011)

These controversial ideas have now been extended to theories of reading, and indeed they have revised our thinking about how the body works, the hand in particular. The development of the hand, along with language, differentiates humans from other primates, and indeed neurological research suggests language and the hand are linked both historically and somatically. The mirror neurone system is strongly activated during imitation, what the Pope was apparently doing when he saw himself in St Matthew's pointing hand, and it also 'plays an important role in speech comprehension' (Steele, Ferrari, and Fogassi 2011).

Caravaggio

In Caravaggio's *The Calling of St Matthew* (Figure 15.1), light falls sharply across the painting, perhaps from an opened door through which Peter and Christ have just entered. What we notice are the three hands. Jesus is pointing directly at Matthew, and the hand of Peter, less insistently, does too, almost as if encouraging the light to fall on the disciple's face, while the hand of Matthew himself picks up the movement. But there is an ambiguity. Is Matthew pointing at himself and saying 'what, me? Surely not me?' (as the Pope seems to have assumed) or is he pointing beyond himself to the figure in dark shadow who is still doing the counting (Matthew was Levi the 'taxgatherer') and saying, 'no, you want him, he'd do a better job'. Ambiguity of this kind takes us squarely into the

Fig. 15.1 Caravaggio: *The Calling of Saint Matthew*. Source: Rome: Church of San Luigi dei Francesi. Photo © Scala, Florence.

world of subjective interpretation and thus well beyond the realm of what mirror neurones respond to, or can tell us (Tallis 2011). But the ambiguity does not invalidate the science: it merely indicates its limits.

Another painting from a slightly later period, *The Raising of Lazarus* in Messina (restored 2012, Singer) also has ambiguous hands. The corpse of Lazarus recalls the fascination with the body in contemporary anatomy texts, and indeed legend has it that the body was that of a criminal dug up in the way that bodies were made available for dissection. Caravaggio is brilliant at capturing a moment of time. But what is happening at this exact moment? What do the hands signify? The left one is open and languid, as if still dead, almost touching the skull beneath, and the right hand, the one that is raised, what is it saying? The body of Lazarus is still in the throes of rigor mortis, but his hand, facing and recognizing the miracle-working hand of Christ, is alive. Alive, yes, but is it not perhaps saying, 'Stop, I do not want to come back to life. Leave me alone!'

There is little ambiguity, however, in the remarkable painting in London's National Gallery, *Boy Bitten by a Lizard* (Figure 15.2). A similar sense of pain can be seen and felt in the way Caravaggio treats the hands in *The Beheading of Holofernes*. In that painting what matters is not so much the hands of Judith, barely visible, as the hands of the dying Holofernes, captured in the extreme moment of agony. Caravaggio's Goliath died in the same way, his hand still clenched a few seconds after David has cut off his head. We might usefully contrast Caravaggio's Judith with a version by a woman painter, in fact a disciple of his, Artemisia Gentileschi. In this instance the strong hands of the woman get the emphasis.

It is not only pain that Caravaggio evokes through his representation of hands, as the hands of his Christ demonstrate. One would expect hands to be the central motif in an Ecce Homo painting. The story requires hands pointing to the Christ as Pilate says the famous words. Caravaggio's are indeed expressive (Figure 15.3). But look at the contrast within the painting made by Christ's hands, how coolly accepting they are, holding the parody of a sceptre but turned inward and reinforcing the inward expression on the face.

Pointing hands

The theory of mirror neurones may be very flawed or crude, and it obviously cannot fully account for our experience of Caravaggio's hands. We may best see the theory as the latest effort in a long tradition

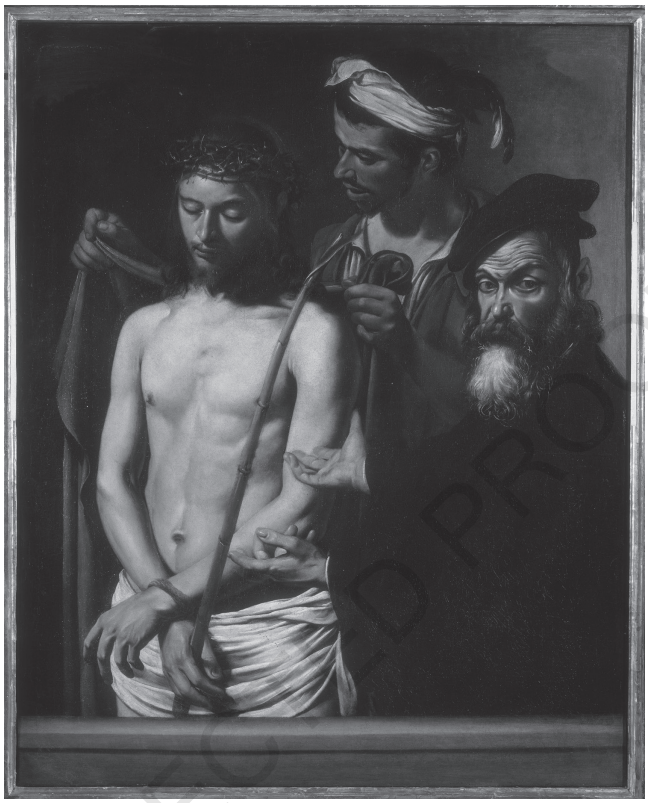

Fig. 15.2 Caravaggio: *Ecce Homo*. Source: Genoa: Palazzo Bianco. Photo © Scala, Florence.

of putting the representation of hands at the centre of human experience, even of linking them to language. In one of the eclogues in Book 1 of Sidney's *The Countess of Pembroke's Arcadia*, an allegory tells how the animals demand a king, and in spite of the owl's warning, Jove reluctantly agrees to the making of man. He gives out some of his heavenly fire for man's spirit, the earth provides clay, and the animals their own specialties – lion heart, the nightingale singing voice, the elephant perfect memory, the parrot a ready tongue, the crocodile 'tears, which might be falsely spilde', and finally the ape gives 'the instrument of instruments, the hand'. This phrase is commonplace in the period: it derives from Galen. In the first part of his enormously influential treatise on *The Usefulness of Parts of the Body* (*De Usu Partium Corporis*), Galen had discussed the hand and claimed that Aristotle

Fig. 15.3 Caravaggio: *Boy Bitten By a Lizard*. Source: National Gallery. © Bridgeman Art Library.

called it 'the instrument of instruments'.[2] All animals have their peculiar skills, but naked man, to compensate for his weakness, has been given the hand. Galen's English translator has suggested that the phrase is ambiguous: it can mean that the hand is the supreme tool, and that it is the tool that uses tools (Galen 1968, 1:71, 78). John Banister's *The Historie of Man* (1578) adds Vesalius to the company of those who say the hand is indeed 'the organ of organs' (Goldberg 1990, 85, 325).

Elsewhere in the *Arcadia*, this insistence on the power of the hand gets a further twist. The hand *in* the story becomes briefly the hand pointing *to* the story: in one episode,

> *Zelmane* that saw in [Dorus the lovesick shepherd] the glasse of her owne miserie, taking the hande of *Philoclea*, and with burning kisses setting it close to her lips (as if it should stande there like a hand in the margine of a Booke, to note some saying worthy to be marked) began to speake these wordes. O Loue, since thou art so changeable in mens estates, how art thou so consta[n]t in their torments?
>
> (Sidney 1590, 1:19, sig. M1v)

Reflexivity of this kind is the product of a highly self-conscious writing and reading practice. It is obviously important that of all the body's organs it is the hand, the climax of the series in Sidney's allegory, which is so marked.

Indeed Renaissance people seem to have read with their hands. Book margins of the period are littered, as William Sherman has shown,

> with severed hands … that have an uncanny power to conjure up the bodies of dead writers and readers. Some of these hands are printed and some are handwritten … , and others capture the sinews, joints, and even nails with a precision that rivals the most artful anatomical study.
>
> (2008, 29)

The hands with which Renaissance readers annotate their texts are various and often distinctive. John Dee 'drew neat hands, with gently arching index fingers leaning toward the text from almost perfectly circular sleeve ends …'. On one page 'four different pointing hands (with sleeves of various fashions) highlight Dee's extensions' of a cabalistic analysis in Johannes Pantheus's alchemical *Voarchadumia*. Bernardo Bembo, father of Cardinal Pietro, compiled a commonplace book now in the British Library in which he uses careful shading and sharp angles to position the hands in dramatic acts of pointing. Better-known humanists tended to use simpler hands: Petrarch's 'have long index fingers, generally with the nail marked, a cuff is indicated by two parallel lines, and although no thumb is shown there are often five fingers, which makes the hand look very odd', whereas Boccaccio too has elegantly drawn pointing hands, also 'with long index finger and sometimes a buttoned sleeve' (Sherman 2008, 36). There are many symbols written in the margins of Renaissance books, but these hands are the clearest. They serve various functions: to highlight passages added to a new edition, to signal an authorial annotation in a manuscript, or even in the Great Bible of 1539: there the controversial

annotations themselves were removed at a late stage of printing, but the little hand signs stayed in the text. Erasmus in *De Ratione Studii* advocated the following as a way of learning to pay attention:

> you will, as you read the authors, methodically observe occurrences of striking words, archaic or novel diction, cleverly contrived or well adapted arguments, brilliant flashes of style, adages, examples, and pithy remarks worth memorizing. Such passages should be marked by the appropriate little sign.
>
> (Sherman 2008, 27–29)

Several such symbols could be used, asterisks, triangles, a kind of V for Venus, but the most ubiquitous is the pointing hand.

These manicules, as Sherman calls them, seem to be part of a larger interest in systems of meaning. They indicate, for one thing, that in the sixteenth and seventeenth centuries, to grasp someone's meaning (as we say) by reading was no less a manual art than writing or printing. Awareness of the instrumental power of the hand is clear in two books published in 1644 by an English physician, John Bulwer, about hand gestures, *Chirologia* and *Chironomia*. Bulwer draws many diagrams of various gestures of fingers or hands, called 'chirograms'. The scope of Bulwer's books can be glimpsed in some dedicatory verses at the front: 'The tongue and heart the intention oft divide, / The hand and meaning ever are allied', which is to say that the tongue may deceive, it may distort what is in the heart, but hand gestures tell the truth (Bulwer 1974, 9).

This truth-telling function surely helps to account for the central importance of the hand in so many Renaissance paintings. Though artists consciously use their own complex languages, in another sense their work aspires to direct representation beyond words. Caravaggio in particular, who is depicted in the historiography of art as the founder of stylistic naturalism, quickly learned to eschew idealized beauty in favour of a realistic presentation of his subjects. As Gordon Campbell notes in his remarkable *Dictionary of the Renaissance* (2003), Caravaggio's St Matthew is the earliest disciple to be shown with dirty feet. It is a shame the painting was destroyed by bombing in Berlin during the Second World War (though black-and-white photos survive), since it has as a central motif the young angel's hand helping the aged disciple's to write, as if for the first time, and even to read. Indeed Renaissance guides to writing often follow Quintilian in recommending exactly that procedure:

> The pupil, by feeling the movement of the master's hand, comes to appreciate more readily the details, the subtle points, and the essential shape that this letter, which he is trying to learn, should have.
>
> (Goldberg 1990, 91)

And as in Caravaggio's *Boy Bitten by a Lizard*, the lost St Matthew probably had dirty fingernails as well as feet.

The reading hand

Bulwer's elaborate diagrams and explanations not only show that reading in the Renaissance was seen as an embodied practice, and self-consciously so, but they were also an early effort to establish a sign language for the hand that would be independent of any particular spoken or written language. He soon wrote a book called *Philocophos: The Deaf and Dumb Man's Friend* (1648), which was the first treatise in English on the education of the deaf. Bulwer's work, fascinating in itself, may also be understood against the background of the seventeenth-century search for the language of Adam, that is, the universal language spoken before the Tower of Babel broke it up. In one sense this was a quest for language beyond language. Deaf signing has now grown into a separate system beyond dependence on any one language. It involves more intense and sensitive use of the hand than hearing people are normally conscious of. The new practice of reading on screen with an iPad is perhaps restoring something of this intricate relationship of reading and the hand.

In his *Philosophical Investigations*, Wittgenstein opens with a long meditation on Augustine's description in the *Confessions* of how he came into language:

> When my elders named some object, and so moved towards something, I saw this and I grasped that the thing was called by the sound they uttered when they meant to point it out. Their intention was shown by their bodily movements, as it were the natural language of all people.
>
> (Wittgenstein 1958, 2)

On this basis Wittgenstein developed the notion of 'ostensive teaching' as one of the primary vehicles for the language games by which we learn the relation of words and the world. We learn to read by sensing the intention of the teacher's hand and having that intention made into the sound of a word (Sherman 2008, 50). Most of us have forgotten

how often in our early lives we would tire our parents' patience by endlessly pointing to things and asking 'whassat?' We have probably also forgotten that when we first learned to read, we traced the words, even the letters, on the page or slate with our fingers, usually the first or index finger. But that connection to the page as a corporal experience may not have been entirely forgotten by our bodies. The relationship of reading and hand movement is likely to be especially important when the text we are reading, as in the self-conscious case of Sidney's *Arcadia*, itself represents a hand or hands.

Anatomy

The Frontispiece of Vesalius's treatise *De Humani Corporis Fabrica* of 1543, for example, shows the great anatomist, the man who radically changed the way human beings look at and feel the body, standing beside a gigantic cadaver and looking gravely at the viewer (Figure 15.4). Between his thumb and forefinger he is holding a tendon of the flexor muscles of the cadaver's hand. In the prefatory letter to Charles V on the previous page Vesalius argues for what the frontispiece shows – the acceptance of hands-on surgery. He contrasts it with a distaste for manual labour that goes back to antiquity. Our word *surgery* indeed derives from the Greek *cheirourgia*, working by hand (*cheir*), which Vesalius Latinizes simply as *manus opera*.[3] The letter shows how proud he was that, as an undergraduate in Paris, he had waved aside the ignorant barbers who normally carried out the actual dissection under instruction from the professor and 'tried to demonstrate the muscles of the hand', something that had not been done before. It is perhaps less obvious that Vesalius is making a complicated statement about his great predecessor, Galen, who had considered the hand one of nature's masterpieces and unique to human anatomy. Though he defends Galen against the ignorance of medieval surgeons, Vesalius points out that Galen never practised dissection himself, and knew about the peculiarities of the hand only because it is so obviously different (like the knee) from the Barbary macaques that he did cut up.

The Vesalius frontispiece links the two hands, living and dead, but at the same time makes a striking contrast between them, both visually and emblematically. The portrait is apparently the only one that Vesalius himself authorized. Commentators notice that his head is unusually large for so small a body, and it is possible that Vesalius is calling attention to a common type of dwarfism (hypochondroplasia)

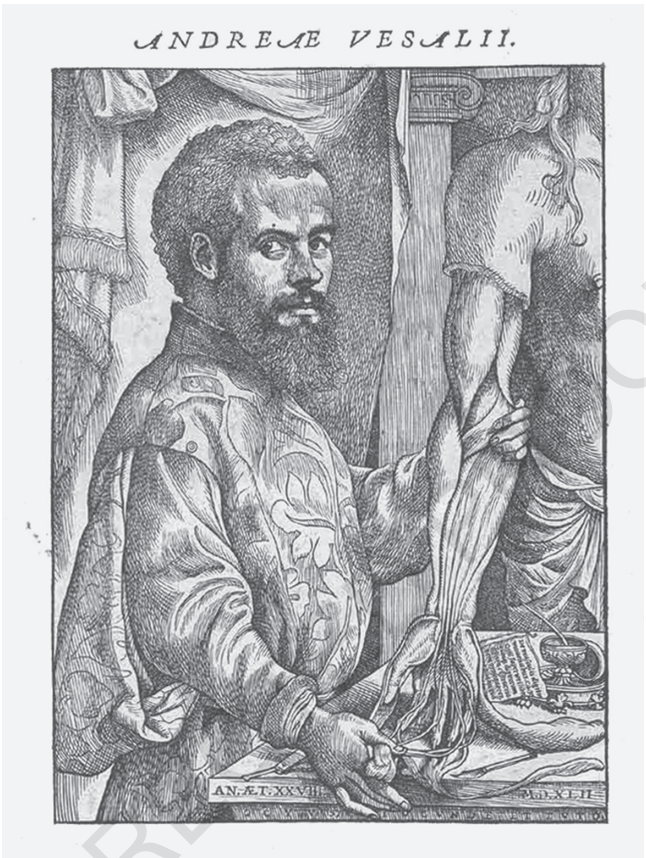

Fig. 15.4 Vesalius: Portrait, p. xii of *De Corporis Humanis Fabrica* (1543). Source: Courtesy of the National Library of Medicine.

in his personal anatomy. This would explain why the corpse he is dissecting stands so tall. The dead hand is very long compared to the short hand with which it is entwined. Yet it is the powerful, living hand of Vesalius that the insistent gaze of the frontispiece wants us to notice. The two hands are also related emblematically since, as he says in that revealing prefatory letter:

> it was my thought that this branch of natural philosophy should be recalled from the dead so that even if we treated it less perfectly than the ancient professors of anatomy, it should be good enough that no one would ever be ashamed to declare that our science of anatomy could be

> compared with the ancient one; and that in this present era nothing so fallen to ruin had been so soon restored to health as Anatomy.
>
> (Vesalius, 3r; Rowe 1999, 42)

So the dead hand represents the ancient art of anatomy, yet at the same time it is also, and very obviously, the hand of a corpse in the process of being dissected by that of the very much alive anatomist.

Two further details in the portrait reinforce this double meaning. One is the scalpel that sits quietly on the table as if it has just been laid aside to allow the demonstrator to pick up and show the tendon. The other is the book, or rather a scrap of writing, which begins *de musculis digitos moventibus*, 'on the muscles that move the fingers'. This text has not been identified, but a likely explanation is that it represents a lost commentary by Vesalius himself on the opening section of Galen's *De Usu Partium*, since that book, unusually for anatomy texts, begins with the hand. If so, then the anatomist is not at the moment reading it or following its instructions. Thus these two details from the portrait page bring into emblematic opposition the authority of tradition and practical experience, the two aspects of medical science Vesalius contrasts throughout the work. What is important about this hand is that it can wield the scalpel, not so much that it can write the definitive text, and turn its pages.

Anatomy as a scientific discipline is instituted by the hand: the master is present in his art. That sense of the master's presence is what this formal genre of the *demonstratio* aims at. 'Presence' is a mysterious quality (the term is common in analysis of stage-acting) that allows the pupil, or the reader of the book, not only to feel the master's power but to read his intention. Illustrations of dissection may work on both levels, physical and psychological, trying to overcome what was widely seen as a key problem in artistic representation, the difficulty of showing intention. Leonardo had commented on this:

> The good painter has to paint two principal things, that is to say man and the intention of his mind. The first is easy and the second difficult, because the latter has to be represented through gestures and movements of the limbs.
>
> (Rowe 1997, 302)

Pictures in anatomy books share many techniques with painting, as the extended discussion devoted to Rembrandt's *Anatomy Lesson of Dr Tulp* (1632) has shown. One critic argued that Tulp had asked to be represented as a kind of Vesalius *redivivus* (Heckscher 1958, 115), and

another thinks that the curled left hand of the anatomist is representing what the forceps are doing to the corpse with his right. Both make clear how throughout the early modern period, the beauty and subtlety of the hand were renowned and could lead to a greater knowledge of God. The hand is a monument to God's wisdom and allows humans to create civilization (Shupbach 1982, 49). A work like Helkiah Crooke's *Microcosmographia: A Description of the Body of Man* (1615), when it gets to a witty, pun-filled discussion of the hand, explores the links between purpose, function, and beauty, all of which flow from 'God's handy work':

> Seeing therefore that the proper action of the Hand is Apprehension, and Apprehension a Motion depending upon our will, it was also necessary that the hand should have muscles which are the instruments of voluntary motions whereby it might be moved altogether and every finger apart [i.e., separately].
>
> (Rowe 1997, 299)

What Crooke is trying to articulate here is the mysterious sense that our brain ('our will') intends to activate the hand, and that illustrations in books such as his show that intention. As in Wittgenstein's theory of ostensive teaching, the pupil quickly learns to follow what the hand indicates. Prehension leads to apprehension and thence to comprehension (Goldberg 1990, 92; Tallis 2003, 329).

Recent advances in the fast-growing field of motor cognition have helped us to understand the ways in which we recognize and respond to intentions through gestures. It seems that we comprehend the intentions of another's action with the same primary neural structures that are needed to execute the action ourselves.[4] This kind of simulation is always happening when we observe the actions of another, but it also works when we see a represented action like those in Vesalius's book. This new research has many implications, but in the case of the anatomist's *demonstratio* it means that the readers of the book are likely to respond to the active hand of the professor by activating their own motor and pre-motor cortex, and so their own hands. This would help us see why the flexor-muscle dissection, as in both Vesalius and Rembrandt, becomes a coherent emblem motif in several different contexts throughout the sixteenth and seventeenth centuries. For the anatomist, simulation of this kind will be especially useful, since it accounts for and encourages the process of teaching and learning that is at stake. Didactic interests predominate in such illustrations, yet they are striking precisely for the intentional force of the implied invitation.

As Katherine Rowe puts it, 'when such figures gesture, the faculty of agency (understood as the animation of the muscles by the motions of the soul) is displayed as an essential feature of the hand, a structural quality like shape and position of the muscles' (1997, 299–302).

Claude Verdan

In Lausanne, there is a foundation honouring the work and memory of the surgeon Dr Claude Verdan (1909–2006), who was a specialist in the reconstruction of damaged hands, and also a keen amateur sculptor. A splendid illustrated book, *La Main, Cet Univers* (1994), commemorates his work (Figure 15.5).[5] The hand is, he says, a cerebral organ. 'Our cerebral cortex', he shows, 'is composed of well-defined areas that correspond to the peripheral elements of our body' (Verdan 1994, 17). By far the largest of these areas is occupied with the operation of the hand. The book contains a sketch of this part of the brain showing the separate areas for each finger and part of the hand. There is a special pathway in the nervous system, a direct corticospinal tract, that allows individual fingers to be controlled. At some point in our evolution, this was linked to a massive expansion of the brain (Tallis 2003, 277).

Verdan shows that each finger is represented by a certain number of neurones: indeed we possess in our brain a 'double' of our hands such that people who have a hand amputated still feel its presence (1994, 16). Long after he lost his right arm in battle, Admiral Nelson had the sensation that his non-existent fingers were digging into his non-existent palm. This led him to believe in the soul and the afterlife. If an arm can survive an amputation, he thought, then an entire person can survive annihilation of the physical body. Nelson's neural connections were trying to make sense of the pain of the injury, but the wiring had gone wrong. 'The brain may remap itself in peculiar ways, altering the neural circuitry laid down in the womb. Sometimes a slight error is made in the remapping' (Thompson 2011, 39). Descartes was also influenced by the phantom limb phenomenon in his identification of the pineal gland as the seat of the soul (Sawday 1995, 156). Phantom hands are felt most strongly of all the limbs because such a large area of the brain is devoted to hand movement.

The reference to Nelson is common in the scientific literature: Oliver Sacks repeats it in his new book *Hallucinations*, as Greenberg shows in his review:

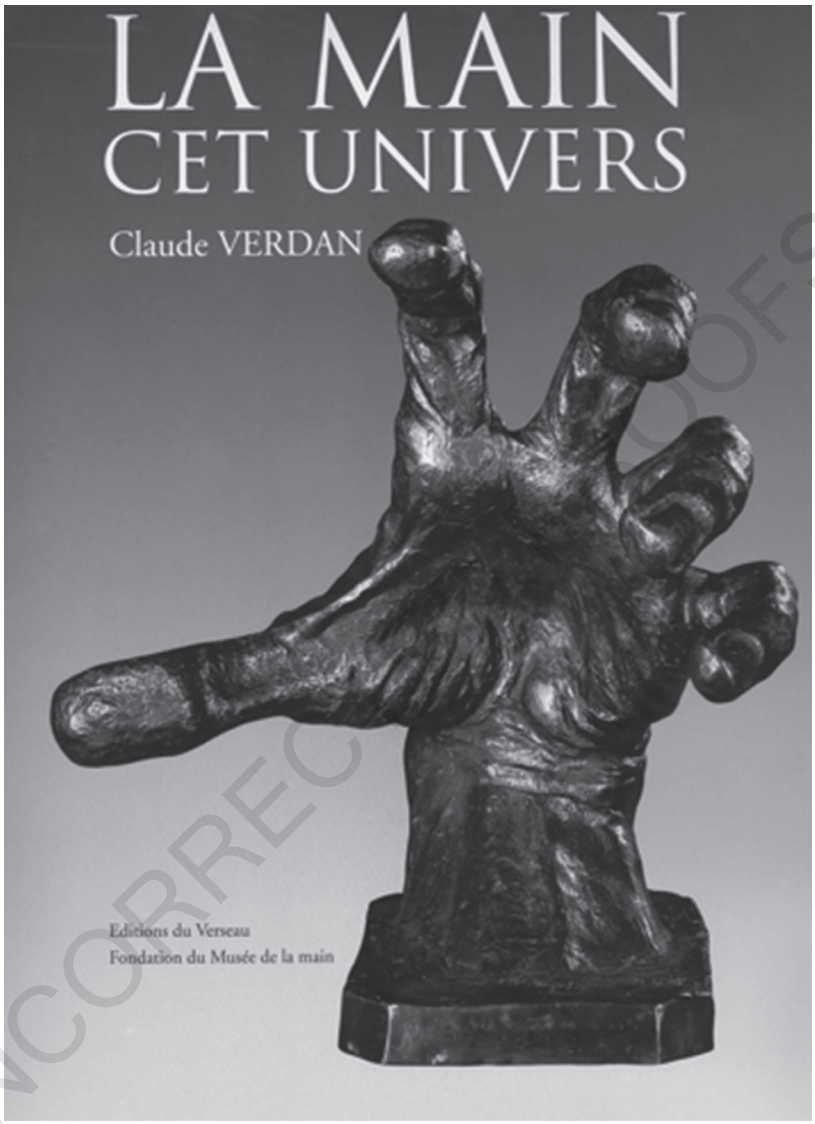

Fig. 15.5 Claude Verdan: *La Main, Cet Univers*. Source: Editions de Verseau: 1994.

Technically, the phantom is a hallucination because it involves the perception of something that has no material existence in the outside world. But in an important way, phantom limbs seem not to be a disorder but rather a natural neurological response to a severance and

> incompleteness that the body cannot accept as final or even real. Sacks points out that 'the feeling of a limb as a sensory and motor part of oneself seems to be innate, built-in, hardwired' – what Ahab, in *Moby Dick*, referring to his phantom leg, calls 'tingling Life'. This is given credence by the case of a girl born without forearms who nevertheless was able to 'move' her phantom hands. As a schoolgirl she would do simple arithmetic by counting with her nonexistent fingers. Over time, a phantom limb may shrink into a painfully paralyzed position. The phantom arm may disappear, while the hand remains, sprouting deformedly from the shoulder, gnarled and digging into its phantom palm with its phantom nails. In these cases the brain has abandoned the limb, because of the absence of visual confirmation of its existence. A simple and ingenious remedy to this is to 'show' the person the missing arm, through an optical illusion of mirrors, looking normal and attached to the hand. Upon taking in this sight, the brain will plug the hand back in and the phantom sensation will become whole and normal again.
>
> (Greenberg 2013, 43)

John Donne

Such phenomena allow us to take a quasi-scientific approach to the representation of the hand, not only in painting but even in poetry. John Donne evokes the presence of his own hands (or the speaker's) in that pleasantly erotic poem we know as Elegy 19, 'To His Mistress Going to Bed'. At one point, half imperative, half begging, he asks his mistress for permission to let him move his hands across her body. 'License my roving hands, and let them go / Before, behind, between, above, below'. Donne immediately follows with a line of awed exclamation: 'O my America, my new found land …'.

In an essay for the *Times Literary Supplement* of 22 September 2006, the critic and novelist Antonia Byatt used this poem as an example of how cognitive science works. She wrote that she had just discovered the theory of mirror neurones and explained that 'We have neurones that feel in the mind what we see others feel with their fingers or tongues' (Byatt 2006, 250). The mirror neurones that respond to 'Before, behind, between, above, below' activate locations on the body of both writer and reader. Donne's adverbs are the more powerful because they activate brief firings in the mind of its deep habit of imagining motion in the body, and linking these images via memory to other emotions, to form concepts and map them with grammar.

Donne excited her as a young woman, and now she knew why. It was all in the neurones**.** The poem excites, encourages, impels the

hand to move to those adverbial areas ('Before …' etc.) and then to discover itself there – which is what the poem actually says when the hand gets to its target. 'Oh my America! My new found land! … There where my hand is set, my seal shall be' – with its characteristic pun on the legal seal and a penis.[6] This way of reading Donne would not do, however, for Raymond Tallis. He replied to Byatt in the *TLS* of 9 April 2008 writing as a neurosurgeon who had just published a paper on mirror neurones. The literary critic as neuroscience groupie, Tallis complained, was part of a growing trend. These minute reactions within the brain are barely decipherable, and appreciation of poetry has more to do with rhythm and rhyme than with neurones. It is the grossest reductionism to argue for the impact of poetry on us via science.

Tallis had a point: one does need to be careful as one crosses disciplinary boundaries. Critics and scientists do have different vocabularies and we risk misunderstanding each other.[7] But what was most revealing was how he continued. We are not much like the monkeys in whose brains these mirror neurones were first discovered by that team at the University of Parma. Indeed:

> We are different from animals in every waking moment of our lives … But if we deny this difference (invoking chimps etc.) even in the case of creativity – and the appreciation of works of art – then no distance remains. That is why one would expect critics to be on the side of the poets, with their sense of this complexity, rather than siding with the *terribles simplificateurs* of scientism. A. S. Byatt's neural approach to literary criticism is not only unhelpful but actually undermines the calling of a humanist intellectual, for whom literary art is an extreme expression of our distinctively human freedom, of our liberation from our organic, indeed material, state.
>
> (Tallis 2008)

In these last words Tallis was alluding to George Steiner's *After Babel* (1975), as he had in his earlier book, *The Hand* (2003). There, however, he had admitted that it was 'something of an exaggeration' to say that 'humankind', or some of it, has 'spoken itself free of organic constraint' (7). Yet in this ringing appeal to the calling of a humanist intellectual, Tallis writes as if there is a war on and we need to take sides. Indeed he often writes that way. Tallis cooled off a little as the essay went on:

> At any rate, attempting to find an explanation of a sophisticated twentieth-century reader's response to a sophisticated seventeenth-century

> poet in brain activity that is shared between humans and animals, and has been around for many millions of years, rather than in communities of minds that are unique to humans, seems perverse.
>
> (Tallis 2008)

As in other cases, the brilliant polymath Tallis was worth attending to, but here he missed the point. No one, certainly not Byatt, was proposing to dispense with literary analysis in order to examine the reading brain. She is interested in the sensations provoked by reading, in creativity and where it comes from, not in denying our difference from monkeys. Tallis was upset, I suspect, because of what he saw as a serious boundary violation. Neuroscience was his turf, and he did not want it trampled on. Tallis himself does not hesitate to trample in the other direction, as he did with his elaborate and witty put-down of literary theorists, *Not Saussure*, or indeed in offering his own analysis of reasons why Donne's poem is fun (among others 'the image of the frantic hand of the poet wanting to possess all of his mistress's body at once, and itemizing the places he wants to visit' [Tallis 2008]). Second, he was furious because, like many of those who reacted so strongly against Darwin, the boundary between human and animal was crossed, or redrawn. He is intent on a philosophical and moral reading of aesthetics, and indeed sets himself up as a kind of moral policeman. And third, perhaps most important, Tallis had written a book, in fact a trilogy of books, about the importance of the hand in the development of humanity. And here came a neuro-groupie who had not even read his (very remarkable) books.

Tallis's underlying thesis is summed up by his fierce opposition to W.S. Gilbert's rhyme: 'Man, however well-behaved, / At best is only a monkey shaved' (2003, 274). He is also eloquent in attacking the popularity of Desmond Morris's *The Naked Ape* (1967). Tallis writes convincingly of the history of humanity as a:

> progressive spiralling interaction between hand and brain – and subsequently between hand, tool, and brain; hand, tool, culture/society and brain; and finally, hand, tool, culture/society, written and spoken language and brain – with relatively little impediment.
>
> (2003, 267)

Increased hand use and linguistic activity drive brain growth and this in turn leads to increased versatility and more complex linguistic behaviour. He notes the huge expansion of cortical representations of the relevant fingers in violinists or Braille readers. Important here is

the relative non-specialization of the hand, which thus becomes more and more the tool of tools. The indeterminacy of its use allows for all the many and various emotions associated with representations of the hand in art and literature.

Six years after the published tussle with A.S. Byatt, Tallis's attitude seems already outdated. Freeman Dyson's piece in the *New York Review of Books*[8] about progress in a parallel field would make a good rejoinder. Dyson discusses the work on the genome of David Haussler and his colleagues, published in the online edition of *Nature*, 16 August 2006:

> They discovered a small patch of DNA in the genome of vertebrates that has been strictly conserved in the genomes of chickens, mice, rats, and chimpanzees, but strongly modified in humans. The patch is called HAR1, short for Human Accelerated Region 1. It evolved hardly at all in three hundred million years from the common ancestor of chickens and mice to the common ancestor of chimpanzees and humans, and then evolved rapidly in six million years from the common ancestor of chimpanzees and humans to modern humans.
>
> (2009, 13)

Dyson claims that this discovery is an event of parallel importance to the discovery of the nucleus of the atom by Ernest Rutherford in 1909 or the discovery of the double helix in the nucleus of the cell by Francis Crick and James Watson in 1953. It 'opens the door to a new science, the study of human nature at the molecular level'. One crucial fact about HAR1 is that it is:

> active in the developing cortex of the embryo brain during the second trimester of the mother's pregnancy, the time when the detailed structure of the brain is organized. Haussler's team found another similar patch of DNA in the vertebrate genome which they call HAR2. It is active in the developing wrist of the human embryo hand. The brain and the hand are the two organs that most sharply differentiate humans from our vertebrate cousins.
>
> (Dyson 2009, 13)

A good deal of this more recent research concerns perception of hand actions. A conference (24 March 2012) entitled 'Being Human', sponsored by the University of California and reported in *Greater Good*, the UC Berkeley journal that publicizes science online (Marsh 2012), helps us to make a link with phantom limbs like Nelson's or the girl who counted on non-existent fingers. V.S. Ramachandran's presentation to the conference explained:

> that people with a phantom limb have a strong propensity to experience others' pain as their own … When most of us see someone get hurt, mirror neurones in our brains fire in such a way to suggest that we ourselves are experiencing their pain. But our skin knows better: It doesn't send any signal of being hurt (because it's not), and it serves to 'veto' the signal sent by the mirror neurons … But when people are missing a limb, there's no skin to veto the brain's signal and indicate that the pain's not real. So when people with a phantom limb observe someone else getting hurt (like by getting pricked in the finger), they feel and react as if they themselves have been hurt – they say 'ouch' and pull back their hand.
>
> (Marsh 2012)

A potential answer to the most serious point Tallis makes had already appeared in the 2008 issue of the *Annual Review of Psychology*. Lawrence Barsalou shows how 'the neurones that fire the simulation system are in humans closely integrated with the linguistic system … Non-human animals do indeed have roughly the same simulation system as humans but lack a linguistic system to control it' or indeed to activate it (2008, 622).[9] Thus reading the word for an action, whether of head, arm, or leg – or hand – may produce appropriate simulations. So does seeing the action represented.

Milton

For a more subtle representation of the sensuous hand in poetry, we may turn finally to *Paradise Lost*. The hands of Adam and Eve are mentioned at key moments in the poem. We first see them together hand in hand (4.321).[10] Then as they pass into the bower they are described as 'handed' (4.739). This word, according to the *OED*, occurs first in Milton in this sense (8). He used it in the preface to the first divorce tract, and now here in the great poem. In the bower Adam and Eve sleep naked of course and they make love. We may be less accustomed to thinking of the erotic qualities of this poem than in the case of Donne. And yet Milton was a younger contemporary of Donne's after all, and may even have heard him preach in St Paul's, since the cathedral was just round the corner from his house. He was certainly not immune to Donne's influence. When Milton composed *Paradise Lost* he was blind, and presumably his other senses were all the more active (Davies 1991, 129). So it is plausible to insist upon the sensuality of these passages, their tactile qualities, and the ways in which readers are invited to feel them.

In Book 5, for example, Adam is surprised to find Eve still asleep. In fact we soon learn she has been having the dream that Satan instilled in her mind. But Adam does not know that, as he goes to wake her. All he sees are her tresses discomposed and glowing cheek. 'Her hand soft touching, [he] whispered thus. Awake / My fairest, my espoused, my latest found' (5.17–18) and so goes into a speech which echoes a famous passage in the Song of Songs: 2:10–13:

> Rise up, my love, my fair one, and come away. For, lo, the winter is past, the rain is over and gone; The flowers appear on the earth; the time of the singing of birds is come, and the voice of the turtle is heard in the land. The fig tree putteth forth her green figs, and the vines with the tender grapes give a good smell. Arise my love, my fair one, and come away.

The reminiscence is obviously intended, but Milton has added the hands, Adam 'soft touching' Eve's. How are we to parse these words? Is Eve's hand soft (an adjective) or is the touching soft (adverb)? Perhaps the adverb predominates, but then it makes Adam's hand soft too, by implication. The grammar involves the reader in the experience.

This subtle moment is echoed later, at the separation. The moment is even more poignant because of how we feel it ourselves. 'Thus saying, from her husband's hand her hand / Soft she withdrew, and like a wood-nymph light' (9.385–86) goes off to her doom and ours. The word 'soft' appears again, not only at the beginning of the line where it gets emphasis, but in the same ambiguous grammar. She withdrew it softly (adverb) or the hand itself felt soft to Adam as she withdrew it. Either way, or both, the reader cannot but feel the movement, however slightly, in the hand. Nonetheless, in his magisterial edition of the epic, Alastair Fowler notes against this view (which was first explored by Christopher Ricks) that 'a monosyllabic adjective seldom follows a monosyllabic noun in English poetry' (1998, 491). Fowler is a very fine critic and editor. But surely, his 'seldom' makes it all the more likely that Milton *would* use such an expressive monosyllable at this important moment of world history.

In *Paradise Lost* there are several pairs of scenes which the reader is invited to compare and distinguish. One of the most interesting is the two versions of the first encounter between Adam and Eve. As Adam tells the story to Raphael, Eve first turns away when she sees him as if, in her 'innocence and virgin modesty', she 'would be wooed and not unsought be won'. Adam follows her, and convinces her by 'pleaded

reason' that she should come with him (8.500–10). Eve's version is rather different. For one thing she has more sensual detail. As she tells it, she at first inclines toward her own reflection in the lake until a voice (we learn later it is God's) warns her that the shape she sees is just herself. She is invisibly led toward Adam but finds him 'less fair, / Less winning soft, less amiably mild, / Than that same watery image; back I turned, / Thou following cried'st aloud, Return fair Eve' (4.478–81). Adam explains (she says) that she is taken from 'His flesh, his bone', that she is even part of his soul, his other half. 'Part of my soul I seek thee, and thee claim / My other half: with that thy gentle hand / Seized mine, I yielded, and from that time see / How beauty is excelled by manly grace / And wisdom, which alone is truly fair' (487–91). The mingling of second person pronouns here takes the reader a second to sort out: she is first quoting what Adam said before telling him what he did: 'thy gentle hand / Seized mine'. Words of 'pleaded reason' figure in both versions of the story, but the softness of the watery image, and the hands, figure only in Eve's. She immediately yields to this seizing, and clearly the word 'gentle' (slightly different from 'soft') is there to explain why. She is talking to Adam after all, so would not say his hand was rough or hard. Indeed after that word 'gentle', the sudden 'Seized' following the enjambment comes almost as a physical surprise to the reader. Milton lets the discrepancy between the two testimonies remain, inviting the comparison. Adam seems to misunderstand Eve's turn away from him: she turned, she says, to go back to the lake; she turned, Adam says (protecting his male ego before the angel – he has previously heard Eve's version) in order to provoke my wooing. In the comparable moment after the Fall, as the narrator tells it, almost calling attention to the shift from prelapsarian language, no adjective like 'gentle' prepares the action at all: 'Her hand he seized, and to a shady bank, / Thick overhead with verdant roof embowered / He led her nothing loth' (9.1037–39).

We might contrast these gentle and vulnerably soft, human hands with those of the supernatural characters. There we have, of course, God's creative hands as he fashions Eve in Adam's trance-like vision. The scene itself is physically sensual, more so than in Genesis, with its wound in Adam's side, its rib and cordial spirits and blood (8.464). Milton's God has 'forming hands' like an artist and they 'fashion'. Apart from that brief moment the poem's supernatural hands are highly conventional: we have just the standard biblical phrase whereby Christ sits at God's right hand mentioned more than once in the poem, and the parody of it whereby Sin claims to sit at Satan's 'right hand

voluptuous' (2.869). Satan claims at the moment of his rebellion, that 'Our puissance is our own, our own right hand / Shall teach us highest deeds, by proof to try who is our equal …' (5.864–66). During the war these right hands deliver blows with swords and even gunpowder, Victory sits at Christ's right hand, and so forth, but with nothing of the sensuousness that attaches to the human hands. Even in the moment when Satan first catches sight of Adam and Eve, immediately admits to himself he could love them, 'such grace / The hand that formed them on their shape hath poured' (4. 364–65), there is nothing especially sensuous about the hand itself. God takes Adam by the hand when he comes to him in a dream soon after his birth and leads him to his garden, gliding as in air, but Adam does not comment on the feel of the hand, or even whether it was a hand that took his (8.300).

This contrasts with the moment when Adam meets Eve returning from the tree, hears her story and 'all his joints relaxed; / From his slack hand the garland wreathed for Eve / Down dropped, and all the faded roses shed' (9.891–93). The cataclysm horrifies Adam, and his body momentarily loses its inherent shape. The moment enacts the Fall physically. The delicate placement of the key words within the pentameters, the shift from 'relaxed' to 'slack hand' to 'Down dropped', encourages the reader's body to experience what Adam feels. This is a superb example of what Guillemette Bolens calls 'embodied cognition and sensorimotor sensibility' (2012, 33). The sequence of hand images concludes with the memorable lines that also conclude the poem: led first by an angel, the hands are joined again, and then 'They hand in hand with wandering steps and slow / Through Eden took their solitarie way'.

There is perhaps one moment when Satan's hands appear sensuous, but in an oddly negative way – the great moment when he returns to hell in triumph, makes an elaborate speech about his great deeds, and, expecting applause, finds it all turn to hiss, as he and then all the devils are turned into serpents. He wonders at the hiss, which he hears as the 'sound of public scorn', but 'not long / Had leisure, wondering at himself now more; / His visage drawn he felt to sharp and spare, / His arms clung to his ribs, his legs entwining / Each other, till supplanted down he fell / A monstrous serpent on his belly prone / Reluctant but in vain' (10.509–15). This is the final physical fall in the poem, one that picks up and subsumes all the others, both literal and metaphysical. Satan falls, as the physically and kinaesthetically attuned reader will feel, because he cannot, now that his arms are clinging to his ribs, put out hands to save himself.

It's alive!

Even without the underpinning given by recent neurological theory, the importance of our hands has often, as we have seen, been regarded as central to the experience of being human. The hands are a basic indicator of life itself in the 1931 film *Frankenstein*: at the key moment, memorably picked up by the trailer available on YouTube, a close-up on Boris Karloff's hand as he starts to raise it from the operating table leads Colin Clive to whisper 'It's moving' and then to make the famous cry 'It's alive! It's alive!' Several other creepy movies of the period also have a focus on the hand, like *Mad Love* (1935) with Clive (again) and Peter Lorre, a remake of *Orlacs Hände*, a 1924 silent film directed by Robert Wiene, in which a pianist damages his hands but has a transplant operation that gives him a new pair. Unfortunately, the hands previously belonged to a criminal, and he finds the hands starting to take over his life and he cannot stop himself from committing murder.[11] We thus come full circle from the power and beauty of the painter's and poet's hand, his own or those he imagines, to a splendid parody of the importance of the hand in our anatomy. All representations of hands gathered in this chapter are on one level, conscious or unconscious, and in different degrees, also those of the sculptor, the painter, the anatomist, or the poet. They all represent moments of extreme sensuousness and they are also appeals to communication, like that of Vesalius. Feel what I feel.

Notes

1 Damage to 'the right somatosensory cortices, namely in the insula, S11 and S1 regions of the right cerebral hemisphere' means that 'it is not possible for the brain to simulate other body states' (Damasio 2004, 115–18, 312). The redoubtable Raymond Tallis, himself a retired neurosurgeon, has called this wave of interest 'neuromania' (2011).

2 Aristotle, arguing against Anaxagoras, actually calls the hand 'an instrument that represents many instruments' (*De Partibus Animalium* 4.10.687a; 1937). Cf. *De Anima* 3.8.432a (1957).

3 A new edition of Vesalius's *De Humani Corporis Fabrica* is being prepared for the centenary in 2014 and is described at http://www.vesaliusfabrica.com/ (accessed on 24 January 2015). It includes Nutton's translations of Vesalius's recently discovered annotations in view of a third never-to-be-published edition.

4 A good summary of recent research is Bolens (2012, 11–16). Her analysis of the painting by Chardin, *L'Enfant au Toton* (*Boy with a Top*) (1741),

shows brilliantly how the viewer's own embodied memory of spinning a top is activated by the delicate relation between the boy's thumb and forefinger. The viewer infers that 'the child anticipates that the top will slow down and fall: his hand is poised to repeat the action and renew the top's spin' (4).

5 Verdan especially admired Rodin, but he also points to the desperate hands in Picasso's *Guernica*. The cover of the book represents Rodin's own hand sculpted by a disciple, Vladimir Kouritsin. For Rodin's *Clenched Hand* in Paris, see Hart (2014).

6 See Winkleman (2013), which applies findings from neurolinguistics and presents Donne as a test case for the cognitive interpretation of verse.

7 A fascinating application of neuronal research to the experience of reading even the most complicated texts (George Eliot, Dostoevsky) is Wolf (2008, e.g., 161).

8 Similar ideas were referred to as early as 1991 in a book inspired both by the French philosopher Merleau-Ponty and by Tibetan Buddhism (Varela, Thompson, and Rosch, 1991). Those who, like Tallis or McGinn (2011), argue that the 'mind-body problem' has not been addressed might like to rethink the issues from this combined point of view. For a scathing review of *Michelangelo's Finger*, Tallis's 2010 book about pointing, see McGilchrist (2010).

9 Discussion in the scientific literature comparing humans and non-humans is hard to keep up with. See Cartmill, Beilock, and Goldin-Meadow (2011), where the relationship between action, gesture, and thought in both humans and non-human primates and its role in the evolution of language is discussed. Differences in the mirror neurone system may explain why non-human primates lack representational gestures. The authors argue that 'gesture played an important role in the transition to symbolic thought and language in human evolution, following a cognitive leap that allowed gesture to incorporate representational elements' (201).

10 All quotations of *Paradise Lost* are from Fowler (1998).

11 The famous scenes in which Peter Sellers tries to control the mechanical hand of Dr Strangelove that involuntarily makes Nazi salutes and threatens homicide are probably an allusion to those horror hands from 1930s movies.

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