

## Sir Charles Bell and the Anatomy of Expression

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### Résumé de l'article

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# Sir Charles Bell and the Anatomy of Expression

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## Résumé

Sir Charles Bell (1774–1842) était un brillant anatomiste et neurologue qui possédait un intérêt marqué pour la théorie de l'art de son époque. Ses recherches, publiées dans *The Anatomy and Philosophy of Expression as Connected with the Fine Arts*, ont d'ailleurs grandement influencé la théorie de l'art puisqu'il démontrait que le mariage de l'art et de la science était, après tout, possible. Cet ouvrage, pourtant très bien reçu à l'époque, a pour ainsi dire disparu de la scène contemporaine de l'histoire de l'art. Il visait à mettre les recherches de son auteur en matière d'anatomie et de neurologie au service des artistes qui essayaient de représenter de manière naturaliste l'expressivité du corps. Selon Bell, le corps possède un langage tangible qui traduit les émotions et dont les signes, associés aux états psychologiques, sont facilement interprétables une fois une profonde connaissance de l'anatomie acquise. Il y éduque les artistes sur les fonctions des systèmes anatomiques, sur les limites qu'elles imposent sur la représentation du corps ainsi que sur les rudiments du langage des émotions.

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*The Anatomy and Philosophy of Expression as Connected with the Fine Arts* by Sir Charles Bell (1774–1842) is a noteworthy example of how science and art have interacted in the pursuit of a common end.<sup>1</sup> In this case the end was to determine how bodily systems served as the basis for the expression of emotion. The hope was that once this was known a language of bodily expression could be articulated, and that this in turn would provide the foundation for a more realistic approach to the depiction of human beings. This paper is a discussion of Bell's account of the bodily basis of expression and an analysis of why the artistic project attached to it was doomed to failure.

Bell was born in Edinburgh and studied anatomy and medicine at the University of Edinburgh, which had a renowned medical school. He also gained a reputation as an exceptional medical illustrator and did most of the drawings for the engravings in his books. Bell was a groundbreaker in anatomy and neurology and made his name by differentiating between the motor and sensory functions of the nerves. He also established the paths of nerves in relation to particular regions of the brain and the functions they determined. It was for this work that he became Sir Charles Bell.

Bell published the first version of *The Anatomy and Philosophy of Expression* in 1806, before he completed the neurological studies that would make him famous. He tells us in the preface to the posthumously published third edition that it was his artistic interest in the depiction of expression that led him to his successes in anatomy and neurology.<sup>2</sup> After a lifetime devoted to those subjects he made a final revision of the book in the light of his discoveries. This revised third edition was delayed, however, because Bell decided that he needed to take an extended journey to Italy to see first-hand, and to test his artistic judgment against, the canonical works of art that provided the points of reference for his discussion. Ill health further delayed the revision, and in the end Bell died before he could see the work through to printing. This was done in 1844 by his brother George, who was a professor of law at the University of Edinburgh. It is this revised third edition that I shall be discussing.

Bell remains a familiar historical figure through the discoveries and disorders that bear his name—Bell's Palsy, for example.<sup>3</sup> *The Anatomy and Philosophy of Expression*, though, has suffered a reversal of fortune and fallen into obscurity. In its time it was considered an important work. Bell, who had received better than a gentleman's education in art, was well thought of by the art establishment of Georgian London. John Flaxman, who was a friend of Bell's, thought very highly of *The Anatomy and the Philosophy of Expression*, and said that Bell had done more for the arts than anyone of the age.<sup>4</sup> Henry Fuseli, too, was most impressed, and in gratitude offered Bell some engravings.<sup>5</sup> Charles Darwin also had high praise for Bell's achievement and said that it shaped the development of his book *The Expression of the Emotions in Man and Animals*. Indeed, many of Bell's contemporaries believed it was this book that would carry his name into the future. *The Anatomy and Philosophy of Expression* was appealing because it was written by a first-rate anatomist at the summit of his profession, and this for artists guaranteed naturalistic accuracy; however, Bell also provided a new physiognomic analysis of beauty that was beholden to neoclassical ideals, and this guaranteed a naturalism without blemishes. Accordingly, his analysis was able to offer direction to artists as varied as Flaxman and Fuseli. The success of the first edition almost earned him the position of professor of anatomy at the Royal Academy. Flaxman and Fuseli thought he was the ideal candidate and lobbied for his appointment. Fortunately for the history of medicine, the position was given to a historically less consequential figure, Anthony Carlisle, who had better connections.

There is much to be said about Bell's book and its relation to its age. I will confine my discussion to a few central issues that distinguish Bell's account of depiction. Let me begin by outlining the central project of the work.

Its most general purpose is an old and familiar one: to provide artists with the knowledge they need to accurately represent the human body. What is different about Bell's book is the knowledge that he hopes to convey and the consequences he be-

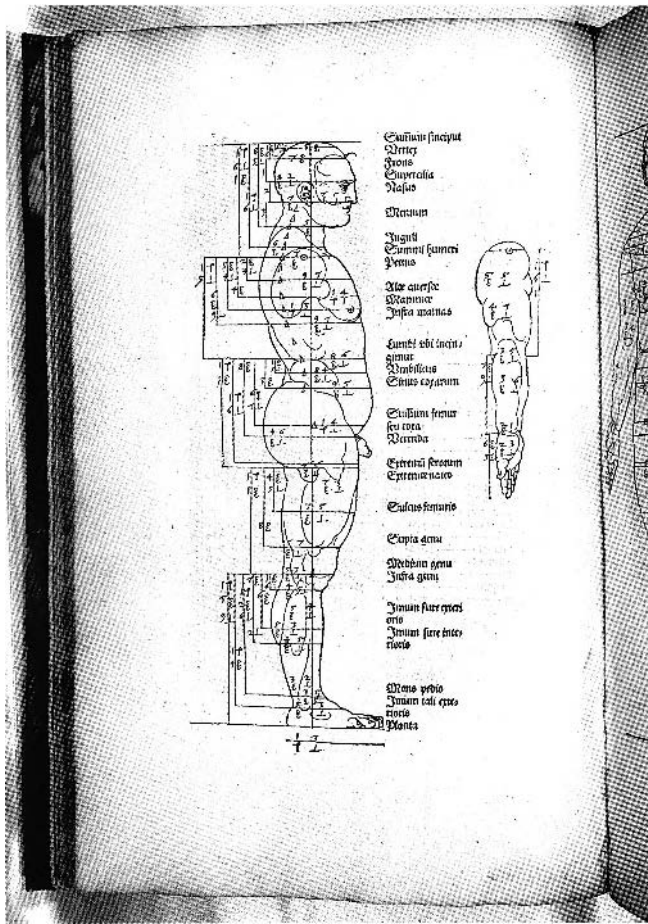


Figure 1. Albrecht Dürer, *Vier Bücher von menschlichen Proportion*, man of medium build in side elevation, from *Nürnbergae: in aedib. Viduae durerianae*, 1532 (Photo: The Osler Library of the History of Medicine, McGill University).

lieves follow from it. Let us not forget that this would have been cutting-edge science, delivered by a stellar practitioner and theorist. As Bell's long-time assistant Alexander Shaw tells us, "When Sir Charles Bell entered upon his researches into the subject, he found it involved in so much confusion, and surrounded by so many difficulties apparently insurmountable, that physiologists had almost ceased to prosecute it."<sup>6</sup> What Bell contributed was not merely new medical knowledge; it was knowledge that reconceived how the body functioned. And in an era when naturalism provided the common centre for art, it was knowledge that not only advanced the artist's understanding of what was to be represented, but also set new limits for representation.

One cannot discuss Bell's approach to the representation of the body without passing through his aesthetics, which not surprisingly also influenced his understanding of medical illustration. In the Western tradition, theories of beauty have typi-

cally been tied to canons of proportions and the delineation of form. But according to Bell, proportions and form alone are not sufficient to determine beauty, and as a kind of shorthand proof he refers us to Albrecht Dürer's *Four Books of Human Proportion* (fig. 1). What is so striking—almost perplexing—about Dürer's studies is the vastness of their range and the precision of their execution, as though they were a prolegomena to some future science, which in fact they were: to anthropometry. These studies, however, were not enough to reveal the secret of beauty, as Dürer himself admitted with resignation: "What Beauty is I know not, though it dependeth on many things."<sup>7</sup> Proportion is certainly one of those things, as is the apparent capacity for expression that is embodied in a finely proportioned face. But, Bell argues, equally important is an understanding of the mechanisms that move that finely proportioned face (fig. 2):

Avoiding a mere distinction in words, let us consider first, why a certain proportion and form of face is beautiful, and conveys the notion of capacity of expression; and, secondly, the movements or the actual expression of emotion. I believe that it is the confusion between the capacity of expression, and the actual indication of thought, which is the cause of the extraordinary difficulty in which the subject [of beauty] is involved, and which has made it be called a mystery.<sup>8</sup>

This, he tells us, is what his predecessors in art theory had overlooked. The impassive yet potentially expressive face of a classically proportioned statue may be beautiful, but what the artist needs to know in order to make convincing and compelling expressive faces are the possibilities that are given by the physical structures underlying those faces. This is the better part of what Bell's book is about.

Bell's discoveries in neurology and anatomy put him in a position to tell artists new and important things that, if naturalism were their goal, would change forever their approach to the representation of human and other animals. The most general lesson that Bell wanted to convey was that one cannot represent the expressive body in any way one wants—and here we are not just talking about how far limbs can move and heads turn. There are constraints imposed by the systems of the body, particularly by the respiratory and circulatory systems, that govern the possibilities of expression (fig. 3):

[Uprturned eyes] address us in a language intelligible to all mankind.... The humble posture and raised eyes are natural, whether in the darkened chamber, or under the open vault of heaven.... The action is not a voluntary one; it is irresistible. Hence, in reverence, in devotion, in agony of mind, in all sentiments of piety, in bodily pain with fear of death, the eyes assume that position.<sup>9</sup>

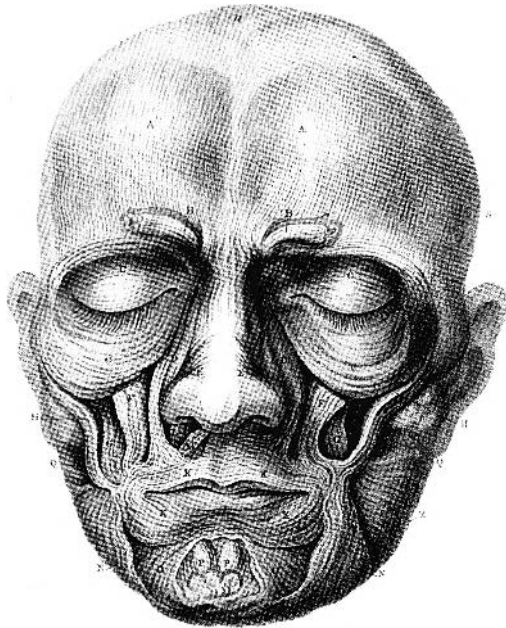


Figure 2. Sir Charles Bell, *The Anatomy and Philosophy of Expression as Connected with the Fine Arts*, muscles of the face (London: J. Murray, 1844), Plate II (Photo: The Osler Library of the History of Medicine, McGill University).

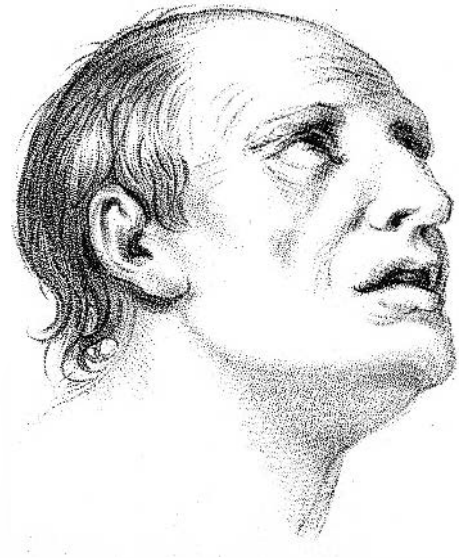


Figure 3. Sir Charles Bell, *The Anatomy and Philosophy of Expression as Connected with the Fine Arts*, upturned eyes (London: J. Murray, 1844), p. 104 (Photo: The Osler Library of the History of Medicine, McGill University).

Bell then goes on to explain for the artist the arrangement of the muscles around the eyes, the stimuli that influence them, and the involuntary nature of their upward movement.

As one would expect, Bell's discussion of the anatomical structures that govern expression leads to interesting evaluations of well-known works of art. Consider his assessment of the writer Payne Knight's claim that, because of his dignity and character, Laocoön did not "roar like a bull" in his struggle with the serpent, as Virgil said he had:

The writer has had the impression, which all who look on the statue must have, that Laocoon suffers in silence, that there is no outcry. [But that is to misunderstand the artist's intentions, whose design] was to show the corporeal exertion, the attitude and struggles of the body and of the arms. The throat is inflated, the chest straining, to give power to the muscles of the arms, while the slightly parted lips shew [sic] that no breath escapes; or at most, a low and hollow groan. He could not roar like a bull—he had not the power to push his breath out in the very moment of the great exertion of his arms to untwist the serpent which is coiled around him.... The instant the chest is depressed to vocifer-

ate or bellow, the muscles arising from the ribs and inserted into the arm bones must be relaxed, and the exertion of the arms feeble. Again, in speaking or exclaiming, a consent runs through all the respiratory muscles; those of the mouth and throat combine with those which move the chest. Had the sculptor represented Laocoon as if the sound flowed from his open mouth, there would have been inconsistency with the elevated condition of his breast.<sup>10</sup>

In the history of Western art there are many careful and attentive works that appear to reveal an understanding of how the body functions: the *Dying Gaul* from Pergamon, for example. There are as well many famous ones, in Bell's judgment, that are weakened because of anatomical ignorance. Consider his evaluation of Bernini's *David* at the Galleria Borghese:

The artist has meant by the biting of the lip to convey the idea of resolution and energy. But that is an action intended to restrain expression, to suppress an angry emotion which is rising in the breast; and if it be permitted, even in caricature, it must be as a sign of some trifling inconvenience, never of heroism. It is not suitable to the vigorous tone which should

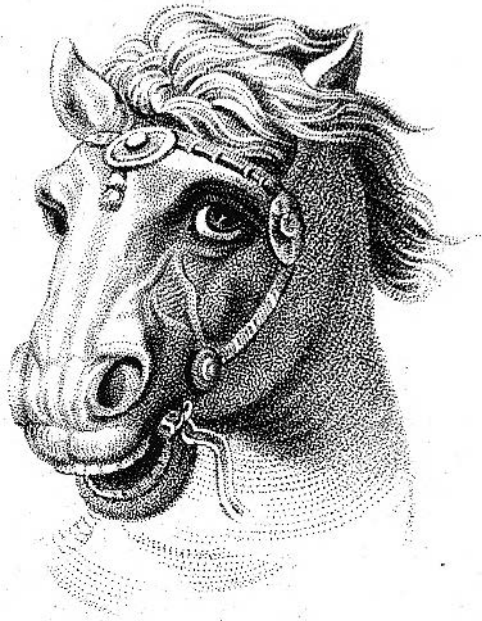


Figure 4. Sir Charles Bell, *The Anatomy and Philosophy of Expression as Connected with the Fine Arts*, Giulio Romano, horse (London: J. Murray, 1844), p. 126 (Photo: The Osler Library of the History of Medicine, McGill University).

pervade the whole frame. That vigour cannot be otherwise represented, than by the excitement of the breast, lips, and nostrils, while the posture and the eyes give it a direction and meaning.<sup>11</sup>

Bernini seems ignorant of how the body reacts in this type of situation, and the work is less convincing because of it, or so Bell believes. He provides many other examples of anatomical falseness weakening the power of works of art, and often his discussion is on a level that draws on his discoveries in neurology. His concern is not simply that artists learn their anatomy but that they get a better understanding of the relations of fittingness or appropriateness to function that characterize the body's parts. Only when these are understood is it possible to control expressiveness and reveal beauty in an animated figure.

That judgments of beauty cannot be separated from judgments about fittingness and function is not a new idea, and goes back at least to Book X of Plato's *Republic*. Dürer, to return to him, included it in his list of things that beauty "dependeth upon," though he had little to say about how and why that might be. Not surprisingly, Bell had quite a bit to say about how and why it might be.

For another illustration let us take a non-human animal, a horse by Giulio Romano (fig. 4). There is a fairly long list of things physiologically amiss with this horse. It is not clear how its expression is to be read, and that in good part is because it has ceased to be a horse. Let us restrict our attention to just the mouth. Here is what Bell has to say:

In the utmost excitement, animals of this class do not open the mouth; they cannot breath through the mouth,—a valve in the throat prevents it,—so that animation is exhibited only in the nostril and the eye. The open mouth is from the checking of the bit, [something you do not see when] the horse is untrammelled and free.<sup>12</sup>

Horses open their mouths for a limited number of reasons. They do not run with their mouths open, as is sometimes represented; they certainly do not open their mouths to smile, because they lack the facial muscles that would allow them to smile (fig. 5). Anthropomorphized horses like Giulio Romano's fail because they ignore the physiological structure of a horse's head, and the functions of its parts. They can never be striking and beautiful *animals*, like the ones on the Parthenon Frieze by which Bell was so impressed, because they are human beings in costume.

When Bell turns to beauty, fittingness, and function in human beings the results are less impressive, but only because his usual intellectual inventiveness is marred by unfortunate racial assumptions. The result is a remarkable example of how normative judgments can be made to work in collusion with scientific research. Human beings, it turns out, have refined sensibility and intelligence as their ultimate defining characteristics, as their highest functions, and these have shaped the development of the organs of sense. Thus the functions of the individual organs are related to realizing these higher characteristics; for instance, the proper function of the human mouth is eloquence. A beautiful mouth, then, would be one that betrays the capacity for eloquence. In general, the beauty of human features depends upon their distance from animal features. As one might suspect, some human beings are further removed from animal appearance than others, and it comes as no great surprise that Caucasians are the most remote from animals, and that all other peoples can be ranked quite neatly on a descending scale. Such Eurocentric bigotry is nothing new and there is nothing especially striking about Bell's version of it, except in its novel theoretical foundation.

What is theoretically interesting in Bell's account of beauty is his attempt to give it an empirical basis.<sup>13</sup> Although his aesthetics are classical, he parts company with the neoclassical doctrines of his era by grounding his account of human beauty on function and distance from animal physiognomy and animal need. The concept of ideal beauty, as it survives in Bell's aesthet-

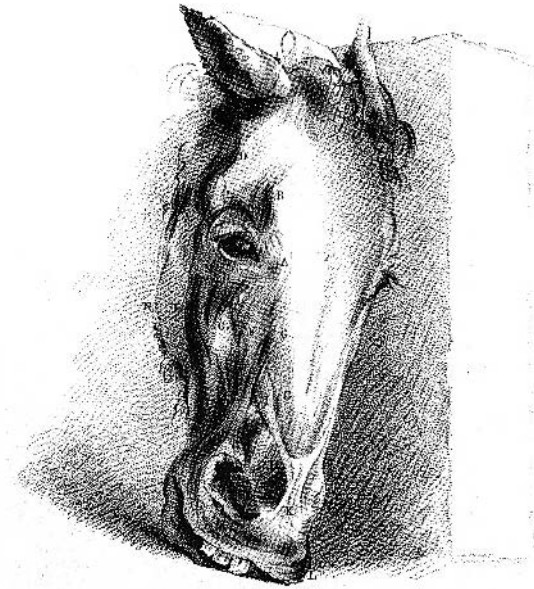


Figure 5. Sir Charles Bell. *The Anatomy and Philosophy of Expression as Connected with the Fine Arts*, muscles of a horse's head (London: J. Murray, 1844), p. 128 (Photo: The Osler Library of the History of Medicine, McGill University).

ics, is also given an empirical basis, as we see in this passage about Raphael and ideals:

We are informed that Raphael, in painting, found no beauty deserving to be his model; he is reported to have said, that there is nothing so rare as perfect beauty in women; and that he substituted for nature a certain idea inspired by his own fancy. This is a mistake: painters have nothing in their heads but what has been put there. There is no power in us “to disengage ourselves from material things, and to rise into a sphere of intellectual ideas,” and least of all in what regards man.<sup>14</sup>

One could not have a clearer anti-Platonic analysis of the notion of ideal beauty, in complete harmony with the empiricist epistemology that framed Bell's scientific culture, a kind of Lockean version of the old Zeuxis story.<sup>15</sup>

For the artists for whom Bell was writing, the lesson to be learned from his analysis was unmistakable: if you want your depictions to be beautiful and expressively convincing you had better read this book very carefully and start attending those new lectures on anatomy at the Royal Academy.<sup>16</sup> Bell's book presents a vision of what I will call “Deep Realism”—the dream of discovering psycho-physical scientific laws that link the mental and the physical and govern human expression. Behind this

dream is another big issue, another old question, about the rank and status of the visual artist.

If artists want to lay claim to the same rank as poets and historians as astute observers of human character, then they are going to have to be able to compete with them in representational power: “Till he has acquired a poet's eye for nature, and can seize with intuitive quickness the appearances of passion, and the effects produced upon the body by the operations of the mind, he has not raised himself above the mechanism of his art, nor does he rank with the poet or historian.”<sup>17</sup>

The representational drawback for the painters of Bell's era was that they were restricted temporally to a frozen instant, trapped in a two-dimensional illusion of three-dimensional space. Poets and other writers could go on at great length describing the psychological intricacies of the scenes they portrayed, intricacies that the painters could not even imagine rivalling—until now. Bell's work seemed to herald the beginning of a glorious new era for painters. The book outlined a basic structure of psycho-physical laws that would be open, like all new bodies of scientific knowledge, to continual refinement. Indeterminacy and ambiguity had always been the enemy of artistic depiction: there was no sure method for representing a human being that would guarantee that the complex psychological state the artist wanted to reveal to the viewer would be conveyed. But now the dream of Deep Realism foretold a time when the psycho-physical laws of human expression would be as precise as the calculations of physics, and painters would have no trouble rivalling poets.

There is a fatal flaw, though, at the heart of this dream—this persistent delusion that has haunted the history of Western art and continues today in the fantasies of virtual reality, propped up by the optimism of technological progress. The delusion is that the depiction of surface anatomy is in itself sufficient for the representation of emotion. Bell was living in an optimistic time in which great advancements were being made in the natural sciences and medicine. With important discoveries commanding one's attention at an accelerating rate, it seemed reasonable to hope that before long the laws that govern the operations of the body would become transparent and could be presented with mathematical exactness. The new discipline of neurology, linked with precision to the triumphant psychology of British empiricism, would join the heady victory parade being led by Newtonian mechanics.

As we know, the astounding growth of scientific knowledge in the two centuries since Bell's book was first published did not result in the dream of Deep Realism being fulfilled. There are a number of reasons why this was the case. We now recognize that some aspects of expression are culturally determined and will confuse or confound any attempt to formulate laws that link psychological states to bodily expressions. Furthermore, as mod-



Figure 6. Sir Charles Bell, *The Anatomy and Philosophy of Expression as Connected with the Fine Arts*, peevishness (London: J. Murray, 1844), p. 173 (Photo: The Osler Library of the History of Medicine, McGill University).

ern semiotics tells us, within any given cultural community there are codes for the creation and comprehension of behaviour that have nothing to do with anatomy. But it seems to me that such points do not direct us to the fundamental problem with Bell's vision, which is more philosophical than empirical. The problem does not go away if we generate more natural or social-scientific information, have better theories of how the body functions, or know more about communities and their codes.

The obstacle to the clear and unambiguous representation of emotional states is conceptual, not empirical, and coming up with increasingly refined observations linking physiognomy and psychology will not help. What will help is a better understanding of what beliefs the person to be represented holds. The difference between anger and indignation, for example, is not a matter of facial expression or bodily configuration, nor is it a matter of what the person feels: pounding heart, churning stomach, the sensation of being flushed, and so forth. These can be present in exactly the same way in both emotions. What differentiates the two states is the belief the person holds: what philosophers would call the intentional object of the psychological state.<sup>18</sup> One can be angry about anything. Not so for indignation. Indignation has to have at its centre, so to speak, a belief that one has been wronged, that an agreement, implicit

or explicit, has been breached. I take my car in for a tune-up. I ask the garage to change the spark plugs and points; they do not, but charge me for them anyway. I get home, look under the hood, see that I have been swindled, and become indignant. Anger involves no such evaluation: I can become angry with or about anything when clearly no one is to blame, when—for example—it is too cold for my car to start and I miss an important engagement. Looking for the defining characteristics of emotion in the anatomy of the face is not looking deep enough, or, more accurately, is looking in the wrong place.

Bell's image of peevishness makes this point clearly (fig. 6). If one asked a roomful of people what emotion this represents, how many different answers would one receive? Peevishness is a complex structure of evaluative beliefs and dispositions to behave, and that cannot be revealed in single facial expression. In a way Bell was aware of this, as the following passage betrays:

Horror differs from both fear and terror, although more nearly allied to the last than to the first. It is superior to both in this, that it is less imbued with personal alarm. It is more full of sympathy with the sufferings of others, than engaged with our own. We are struck with horror even at the spectacle of artificial distress, but it is peculiarly excited by the real danger or pain of another.<sup>19</sup>

In other words, what distinguishes horror from fear and terror are the beliefs that you have about what is taking place, and your evaluation of it (fig. 7). How could one determine from mere appearance that this is an image of fear, as Bell says it is, and not of horror or terror?

Bell's implicit recognition that there is more to the question than physiology does not, nevertheless, undermine his faith in the quest for the psycho-physical laws of Deep Realism. In the grip of a new and promising scientific discipline, he believes that it is just a matter of time before its gaps are filled, its generalizations made more specific, and the dream of empirical determinism realized. Our attachment to this desire remains today, and not just in the fantasies of virtual reality. While I was composing this paper I came by chance across two contemporary manifestations of it on two reputable websites. The first was on the Wellcome Trust website and concerned a recent study about how we make judgments regarding the sadness of others by attending to the size of their pupils.<sup>20</sup> The second appeared in the arts section of the CBC website and was about an interactive work of art, created by John Collomosse of the University of Bath in England, in which a represented face changes its emotional expression to accord with that found in the face of the viewer.<sup>21</sup> The determination of the viewer's emotional state is arrived at by software programming that analyses the shapes and positions of various facial features. The considerations that



Figure 7. Sir Charles Bell, *The Anatomy and Philosophy of Expression as Connected with the Fine Arts*, fear (London: J. Murray, 1844), page 169 (Photo: The Osler Library of the History of Medicine, McGill University).

are brought to mapping these features are no more complicated than the ones that Bell would have offered. Similarly, the psychological study reported by the Wellcome Trust, although buttressed by the technology and vocabulary of contemporary cognitive science, did not offer much more than Bell would have been able to provide. If I am right, if we seem not to have advanced much beyond Bell's reflections, that is because the problem is still seen primarily as one of physiological mapping. The obstacle to advancement, though, is not better science and more computing power, but old philosophical questions about being human and the nature of consciousness with which we are still trying to come to terms. It is the importance of these questions, and our desire for a transparent self and transparent others, that underlies our attachment to the dream of Deep Realism.

#### Acknowledgements

I would like to thank Pamela Miller, Christopher Lyons, Lily Szczygiel, and Diane Philip of the Osler Library of the History of Medicine of McGill University for their good will, patience, and generosity. I have benefited greatly from their expertise and knowledge of their library's impressive collections.

#### Notes

- 1 Sir Charles Bell, *The Anatomy and Philosophy of Expression as Connected with the Fine Arts*, 3rd ed. (London, 1844).
- 2 Bell, *The Anatomy and Philosophy of Expression*, v.
- 3 Bell's palsy is a form of temporary facial paralysis resulting from damage or trauma to one of the two facial nerves.
- 4 Gordon Gordon-Taylor and E.W. Walls, *Sir Charles Bell: His Life and Times* (Edinburgh, 1958), 22. John Flaxman (1755–1826) was an English sculptor and draughtsman. His style was based on a linear language of ideal forms, a kind of purified neoclassicism. In 1810 he became professor of sculpture at the Royal Academy.
- 5 Henry Fuseli (1741–1825) was a Swiss-born, English Romantic painter and art critic. He became professor of painting at the Royal Academy in 1799.
- 6 Sir Charles Bell, *Engravings of the Arteries*, Appendix by Alexander Shaw (London, 1811), 232.
- 7 Albrecht Dürer, *The Writings of Albrecht Dürer*, trans. and ed. William Martin Conway (New York, 1958), 179.
- 8 Bell, *The Anatomy and Philosophy of Expression*, 19–20.
- 9 Bell, *The Anatomy and Philosophy of Expression*, 102.
- 10 Bell, *The Anatomy and Philosophy of Expression*, 192–93.
- 11 Bell, *The Anatomy and Philosophy of Expression*, 194.
- 12 Bell, *The Anatomy and Philosophy of Expression*, 126–27.
- 13 Bell's racist account of beauty does condition what he considers empirically relevant, but this is not an issue that I am going to pursue, as it does not affect the course of my argument. For a further discussion of this matter, see Paul Youngquist, "In the Face of Beauty: Camper, Bell, Reynolds, Blake," *Word & Image* 16, 4 (October–December 2000): 319–34.
- 14 Bell, *The Anatomy and Philosophy of Expression*, 23.
- 15 Bell was not strictly speaking a follower of John Locke. His philosophical mentor was the Scottish philosopher Dugald Stewart, who attempted to ground the epistemology of British empiricism in a type of faculty psychology that mitigated its more radical doctrines, as advanced for example by his countryman David Hume.
- 16 For art historians the most influential book on the depiction of expression in the era before Bell was Charles I.e Brun's *Conférence sur l'expression générale et particulière* (1668). There are many important differences that distinguish the two approaches. The most evident difference is that I.e Brun's work does not have the complex anatomical armature that supports Bell's. The second is that Le Brun's philosophical and scientific foundations are derived entirely from Descartes, especially his *Les Passions de l'âme* (1649), whereas Bell's are indebted to British empiricism. Each man triangulates the art-philosophy-science triad in a unique way. It would be an interesting cross-cultural study to set out and compare their conceptions of these relations.
- 17 Bell, *The Anatomy and Philosophy of Expression*, 3.
- 18 The characteristic feature of mental states is that they invariably represent or are about something beyond themselves and that something, the intentional object, makes the mental state what it is.
- 19 Bell, *The Anatomy and Philosophy of Expression*, 169.
- 20 [www.wellcome.ac.uk/doc%5Fwtx031800.html](http://www.wellcome.ac.uk/doc%5Fwtx031800.html) (accessed 3 September 2006). The Wellcome Trust is the world's largest medical research charity funding research into human and animal health.
- 21 "Electronic art changes with viewer's mood," [CBCnews.ca:www.cbc.ca/story/arts/national/2006/08/03/art-mood.html](http://CBCnews.ca/www.cbc.ca/story/arts/national/2006/08/03/art-mood.html) (accessed 3 September 2006).