

Neural Concept Formation and Art:
Dante, Michelangelo, Wagner

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INTRODUCTION

“Something, and indeed the ultimate thing, must be left over for the mind to do”

Arthur Schopenhauer (1859)

What is art? What constitutes great art? Why do we value art so much and why has it been such a conspicuous feature of all human societies? These questions have been discussed at length though without satisfactory resolution. This is not surprising. Such discussions are usually held without reference to the brain, through which all art is conceived, executed and appreciated. Art has a biological basis. It is a human activity and, like all human activities, including morality, law and religion, depends upon, and obeys, the laws of the brain. To understand the biological foundations of art, we must enquire into the biological foundations of knowledge, for art constitutes a form of knowledge, indeed is knowledge. We are still far from knowing the neural basis of the laws that dictate artistic creativity, achievement and appreciation, but spectacular advances in our knowledge of the visual brain allow us to make a beginning in trying to formulate neural laws of art and aesthetics, in short to study *neuroesthetics*. In this essay, I try to discuss the art of three Titanic figures in Western culture - Dante, Michelangelo and Wagner - in neurological terms. I try to show that we can trace the origins of their art to a fundamental characteristic of the brain, namely its capacity to form concepts. This capacity is itself the by-product of an essential characteristic of the brain. That characteristic is abstraction, and is imposed upon the brain by one of its chief functions, namely the acquisition of knowledge.

In all three examples that I use, the passion that governed the artists' work is romantic love, one of the most complex and overwhelming of all sentiments. It is in fact not so much love, but the ideal of love that each had created in their brains. None of the three found that ideal in real life, and each was impelled in a different way to create works of art in response to that gap. The ideal of love is of course not the only one that artists have tried to translate into their works. An artist may want to re-create simpler ideals, for example of natural scenery or even a straight line. But in every case, the motive force comes from the creation of ideals and concepts by the brain. I therefore begin by enquiring neurologically into the concept of ideals and their formation by the brain. That there are ideals, and that we have them, is a subject that has been discussed and debated by philosophers for over two millennia. They spoke in terms of the mind, not the brain¹. I will speak exclusively in terms of the brain, and begin by arguing that the formation of ideals is the necessary and unavoidable by-product of an efficient knowledge-acquiring system, which is what the brain is. But the imperative in terms of efficiency in acquiring knowledge also exacts a high toll, which can be alleviated through art. My approach is dictated by a truth that I believe to be axiomatic -- that all human activity is dictated by the organization and laws of the brain; that, therefore, there can be no real theory of art and aesthetics unless neurobiologically based, a belief I have developed at greater length elsewhere (Zeki, 1999a). This speculative essay is a contribution, however small, towards the neurobiology of aesthetics. Its main thrust is that a basically similar neural process governs the generation of all concepts, be they simple or lofty, and that art is a

¹ This is a correct general statement, but it is interesting to draw attention here to a remarkable passage from Plato's *Phaedo* (p.96, b, c) in which Socrates asks: "Is it with blood that we think, or with the air and fire that is in us? Or is it none of these, but the brain that supplies our sense of hearing, and sight and smell, and from these that memory and opinion arise, and from memory and opinion, when established, that knowledge comes?"

manifestation of that neural capacity, and reveals to us both the strengths and the weaknesses of the concept forming systems of the brain.

Abstraction as a Repetitively Applied Innate Cerebral 'Concept'

One of the primordial functions of the brain, then, is to obtain knowledge about the world. How it does that is a problem that, today, belongs firmly in the field of neuroscience in its broadest sense. But long before neuroscience existed as a discipline, the same problem exercised philosophers. Indeed, the problem of knowledge, of how we acquire it and how certain we can be of what we know, has been a cornerstone of philosophical debate ever since the time of Plato. For Plato and his successors in the Western philosophic tradition, the problem revolved critically around the doctrine that Plato ascribed to Heraclitus, which has therefore become known as the Heraclitan doctrine of flux. In general terms, this reflects the reality that things are never the same from moment to moment. The task for the brain thus becomes one of acquiring knowledge about the essential, permanent and constant properties of objects and situations, when the information reaching the brain is never the same from moment to moment and everything is in a continual state of flux. Nor is the importance of mutability restricted to Western culture. A cornerstone of Eastern cultures, for example, is the belief that nothing is permanent except change.

Plato himself believed in a world of Ideas that have an existence independent of man. He supposed that true knowledge can only be knowledge of those Ideas and that the only way of obtaining that knowledge was through a thought process, since Ideas were supra-sensible. There is little doubt that his Ideal Theory went through several stages (Frazer, 1930). These can be traced through the early Socratic discourses and especially *Thaetaetus* to the later Platonic dialogues, but this is not the place to trace

that development. Suffice it to say that it is arguable whether Plato was ever convinced that he should make Ideas of objects and things such as, for example, houses or horses or instruments. In Book X of *The Republic* (p 598, b, c) he used the example of a couch to question whether art could really give true knowledge, and to therefore express his contempt for it. Art, he thought, could only represent one particular facet of a particular object, not the universal, Ideal, object which alone could give knowledge about all objects of that category. Even in spite of this, he nevertheless acknowledged his own uncertainty about whether to make Ideas of things (as at p.130, b, c in *Parmenides*). What is certain is that his main pre-occupation was with the idealization of abstract notions such as justice, goodness and above all beauty and love (as at the close of *Cratylus* and especially in *Phaedo* and *The Symposium*). The thesis he entertained is that general notions such as beauty, love and goodness exist permanently and are not subject to the changes to which the sensible world is hostage. The neurobiologist would not share Plato's hesitation and would not wish to thus restrict himself. He would want to consider, instead, how the brain constructs abstract representations of particular things, as well as of more general notions such as the ones that pre-occupied Plato. Plato believed that there must be some kind of power in the mind which can compare the information provided by the different senses, and that notions such as 'smaller' and 'larger', or 'more beautiful' that enable comparisons must be innate, in order to supply the power for reasoning. Much later, Immanuel Kant (1781) proposed that we can never obtain knowledge about the 'thing-in-itself' (*das Ding an sich*), independently of our experience of it, which includes a thought process. But he supposed that the ingredients of knowledge were provided by the sensory input, read into thought processes of the brain that are governed by the two innate intuitions of time and space.

In seeking to understand our knowledge, it was therefore important to understand not only the formal contribution made by the mind (for us, the brain) but also the limitations imposed by it. I have argued that although time and space are critical 'intuitions' for obtaining knowledge, they cannot be applied in a uniform way in the acquisition of all knowledge, since the temporal and spatial requirements for constructing even two sub-modalities of vision, for example colour and motion, are significantly different (Zeki 1999b, 2001). But I believe that there is a formal contribution that is made repetitively by the brain, in every area of the cerebral cortex, and that contribution – abstraction - is not acquired through experience but is innate (Zeki 1999b, 2001). Thus contrary to the supposition of Plato, who believed that things are derived from abstractions, most today would probably agree that it is the other way round, and that sensory data are submitted to the innately acquired abstractive processes of the brain. By abstraction I here mean the process by which the particular is subordinated to the general, so that what is represented is applicable to many particulars. I would like to propose not only that all brain systems, however they differ in their functions, are engaged in abstraction and concept formation, because they are all somehow involved in the acquisition of knowledge, but also that a basically similar neural process governs the generation of different ideals by the brain. Art is basically a by-product of this abstracting, concept-forming, knowledge-acquiring system of the brain and can only be understood biologically in that context.

Functional specialization in the visual brain

That different areas of the brain undertake different tasks has been known for a long time, and it is common to speak of a functional localization in the cerebral cortex. More recently, it has been found that even the part of the brain devoted to a

single modality consists of many different areas. This has been most extensively studied in the visual brain, and the general picture of the organization of the visual brain that has emerged is worth alluding to briefly because it gives us insights into the following question: is there an operation that is performed in each one of the many cortical areas, regardless of what its specialization may be, and what can that operation be?

The most striking picture of the visual brain is one of functional specialization, in that different areas constituting it undertake different tasks (Zeki, 1978; Livingstone and Hubel, 1988; Zeki *et al.*, 1991). There are separate colour and visual motion centres (V4 complex and V5 complex, respectively). In addition, there are areas that are specialized for object recognition, face recognition, and the recognition of position in space. Of these, the most intensively studied are the V4 and V5 complexes, and I will therefore make larger use of them in illustrating the general point, that each one of these areas is capable of abstracting to a certain level of sophistication, in addition to the other functions in which it is specialized. The neurological processes underlying these abstractions are ones that occur automatically; we are not conscious of the processes but are only conscious of their results. If we say that each of the cortical areas is capable of abstractions in the domain in which it is specialized, we are naturally led to asking another question. Do the processes of abstraction that are integral to the physiology of an area result in a conscious correlate, a percept? Or is the processing spatially separate from the perception?

Processing sites in the visual brain are also perceptual sites

We have recently shown, using a visual stimulation paradigm, that the processing sites in the visual brain are also perceptual sites (Moutoussis and Zeki, 2002). The use of dichoptic visual stimulation allows us to arrange the sensory input into the visual brain in such a way that it is sometimes seen and sometimes not seen, even though the stimulus is identical in both situations. Thus, when an identical stimulus, such as a house or a face, is presented monocularly to each eye in turn, the presentation to one eye alternating with that to the other eye every 100 ms, the two images are fused into a single image and the subject can report consciously and correctly what the stimulus was. But if the same stimulus is presented to each eye in the same way but with opposite colour contrasts, the two colours cancel each other in the fusion and the stimulus is no longer perceived and cannot be recognized by the subject, even though the visual input to the brain through the eyes is the same as in the condition when the stimulus was correctly perceived. Brain imaging experiments show that the same stimulus specific areas are activated regardless of whether the stimulus is perceived or not. Thus when the stimulus is that of a face, the area in the brain specifically implicated in the perception of faces is specifically activated, regardless of whether the stimulus is perceived or not. A similar result obtains with stimuli depicting houses, which activate a different, specialized, part of the visual brain (see also Tovee 1998). This is not to deny that other cortical areas may also be involved in the abstractive process, especially where other, more abstract, notions such as beauty and justice, are involved. But the above demonstration, which I consider to be of some importance, shows that the cortical perceptual sites are not separate from the cortical processing sites. This, in turn, makes it credible to suppose that each cortical area has an abstractive machinery, a supposition that is much reinforced by the physiological examples given below. We are, in short, not aware of the abstractive process nor of

the processing in general, though we are aware of its results. There is, therefore, an unconscious 'mind' and a conscious 'mind'. This is of course not a novel idea. It can be traced back at least to Leibniz, who believed that we cannot be conscious of all the process of mind required to acquire knowledge about the world, and that we must therefore suppose that there is an unconscious mind. He wrote in *La Monadologie* (14), "The passing condition, which involves and represents a multiplicity in the unit [*unité*] or in the simple substance, is nothing but what is called *Perception*, which is to be distinguished from Apperception or Consciousness...In this matter the Cartesian view is extremely defective, for it treats as non-existent those perceptions of which we are not aware" (Leibnitz, 1714). Here, I am equating the unconscious 'mind' with the processing that occurs in an area, the processing that leads to a conscious awareness of the results of the operations that the unconscious 'mind' performs. Given the specializations in the visual brain and elsewhere, it is plausible that there are many unconscious 'minds' (neural processes) that process signals related to the attribute that they are specialized in, each one being centred on a different cortical area. The results of anatomical, physiological and clinical studies seem to point in this direction (Zeki and Bartels, 1999). Important in this regard is the result of recent psychophysical experiments which show that we do not become conscious of different visual attributes at the same time (Moutoussis and Zeki 1997a,b). Instead, we perceive colour, for example, some 80ms before we perceive motion, an enormously long time in neural terms. Since perceiving something means being conscious of it, it follows that we become conscious of different attributes at different times. Consciousness is therefore distributed in time. Since it is activity in geographically distinct locations that leads to the perception of different attributes, it follows that consciousness is also distributed in space.

Thus each of the parallel, specialized systems of the brain undertakes its own processing. But to what end? The acquisition of knowledge. And since abstraction is the necessary pre-requisite of any efficient knowledge-acquiring system, it follows that there are many abstractive systems, each one tied to activity in a particular cortical area. In a system such as the cerebral cortex, where there are multiple specializations, one can conjecture that each one of the specialized systems or sub-systems is capable of constructing, or at least contributing substantially to the construction of concepts and ideals, the final step in the process of abstraction. Abstraction, in addition to being a mandatory step in the efficient acquisition of knowledge, also frees the brain from enslavement to the particular, for example a particular point of view or a particular occasion or a particular object. Paradoxically this independence from particulars depends upon experience of many particulars. Through it the brain is no longer enslaved to the particular. Abstraction also frees the brain from total dependence upon the memory system, which can fail. If, for example, recognition of a car as a car depended upon a particular car, then the brain would need a fail-safe memory system, which it obviously does not possess. But abstraction and generalization, as a means to acquiring knowledge, are also testaments to the limitations of the brain. As Frazer has emphasized, “generalization, while the highest power of the human intellect and a mark of its strength, is no less a mark of its weakness. Generalization is but the compendious and imperfect way in which a finite mind grasps the infinity of particulars. A mind that could grasp at once all the particulars would not generalize...if there is a mind which grasps the totality of things, it...can have no need to have recourse to the summary which the limitation of our minds compels us to make use of” (Frazer 1930). There is also a price to be paid for this. Abstraction leads to an Idea or concept, but our experience remains that of

the particular, and the particular that we experience may not always satisfy the Idea formed in and by our brains. One way of obtaining that satisfaction is to ‘download’ the Idea formed in the brain, into a work of art. This is a theme I return to later in discussing the three artists I have selected for this essay.

In thus endowing individual cortical areas with the power of abstraction, I do not mean to imply that the individual areas do not interact with one another. As Plato saw (*Theaetatus* pp 185-186B), each sense (or each submodality of a sense, such as colour or visual motion) gives only the results of its own processings regarding the attribute it is specialized in. It does not process other senses, or other sub modalities. It cannot therefore view what other senses have processed in connection with what it has processed. There must therefore be some other power that unifies and binds what these different areas have processed, a problem that is currently under study. The point that I emphasize here, is that the unification and the binding come after the abstractive processes, which constitute the first step in the knowledge-acquiring system

Abstraction in the visual brain

How the brain abstracts is only partially known, for simpler constructs only. What is clear is that the neurological processes underlying these abstractions are ones that occur automatically; we are not usually conscious of the processes themselves but only of their results. What is also clear is that the capacity to abstract is not a characteristic of higher areas of the brain, or limited to them. It is characteristic even of early visual areas, as becomes evident when one considers the physiological properties of cells in the visual brain which are specialized for lines of specific orientation, or to detect motion in specific directions, or specific colours.

A cell in the primary visual cortex, area V1, that responds to a straight line of specific orientation is in fact abstracting, since it responds to a line of that orientation no matter what its contrast or colour may be (Hubel and Wiesel, 1962; Gouras and Kruger, 1979). These cells are very interesting to study in the laboratory. Once a cell that is responsive to the vertical orientation is isolated, one can establish quickly that it is responsive not only to a vertical line generated from luminance differences (for example, a white bar against a black background) but almost to any straight vertically orientated line or edge. If presented in the appropriate part of the field of view, one could elicit a vigorous response from such a cell by presenting a pencil or a ruler held vertically. The cell, in brief, abstracts for verticality, without being concerned about what is vertical. That the properties of such cells are largely innately determined implies that the abstractive process is also innate, even if the selective responses of such cells require visual nourishment during critical periods to maintain their selectivity and hence their abstractive powers as well (Hubel and Wiesel, 1977). Equally, a cell in V5 concerned with the direction of motion, is abstracting the motion and its direction since it is indifferent to the colour of the stimulus and usually to its form as well (Zeki, 1974; Maunsell and Van Essen, 1983; Albright, 1984). The V4 complex constructs colours in the abstract, in that it is not concerned with the objects that the colours vest. The latter seems to engage other cortical areas. (Zeki and Marini, 1998; Bartels and Zeki, 2000a). Another kind of abstraction is implicit in the behaviour of cells that are capable of responding in a view invariant manner to visual stimuli (Galletti *et al.*, 1993). These cells are located in the parietal cortex of the brain, and more specifically in area V6. Their properties are such that they are capable of signalling the position of an object with respect to ego-centric space, regardless of where we are looking.

It is worth emphasizing yet again that the neurological processes underlying these abstractions occur automatically; we are not conscious of them but only of their results. As an example, the construction of colour is a complicated process which must involve a comparison of the wavelength composition of the light reflected from the surface that we are looking at with the wavelength composition of the surrounds (Land, 1974; Land and MacCann, 1971). We know little about the detailed neural implementation that leads to the construction of colours, but we do know that it involves specialized pathways and areas and that, moreover, we are not conscious of these processes but of their end-results – colour – only. We know more about the wiring mechanisms that lead to the emergence of cells in the brain that signal lines of specific orientation (Hubel and Wiesel, 1962). But, once again, we are not aware of the processes themselves but only of their end results.

Perhaps even more interesting in this regard are recent experiments on object recognition. When monkeys are trained to look at particular views of ‘nonsense’ objects, which they have never seen before, most cells in the inferior temporal cortex (a visual centre in the brain) respond to only one of the views that the monkey has seen. But there is a minority of cells that responds in a view-invariant way (Logothetis *et al.*, 1995). By some neural mechanism about which we know little, a sort of idea of the object is built into the responses of single cells, such that their responses are no longer determined by a single view. The neural processes involved are almost certainly highly complex (Sheinberg and Logothetis, 2001), but we are not aware of them.

It is plausible to suppose that the result of this abstractive process is the creation of an ‘ideal’, in which all the sensory experiences have been combined synthetically to generate a construct which, though dependent upon many particulars in its

construction, is also independent of a given particular. For Plato, the Ideal meant the universal as opposed to the particular. The sense in which I use the term here is not vastly different, since the ideal does not represent a particular object, but is a construct of all objects of that category that the brain has experienced. From this, it follows that the ideal formed by a brain is dependent upon its neurological machinery (an innate mechanism) as well as the experience acquired by the individual. That neurological machinery, as well as the experience, varies between individuals. Hence the ideals formulated by one brain are not necessarily identical to those formulated by another, even if there is a common element underlying the formulation of ideals. Yet all brains have the common capacity of abstracting and forming ideals.

Can one generalize from these types of abstraction to love, a subject hardly touched upon in neurological studies? The answer must be speculative at present. Yet it is hard to believe that there isn't an abstractive process involved in love too. We do, after all, have special preferences in love, no doubt dictated by a variety of factors, and artists have tried to express their concepts of love in works of art. Moreover, recent imaging studies have shown that the sentiment of love associated with a face correlates with activity in restricted loci of the brain (Bartels and Zeki 2000b). Above all, artists have formed concepts and ideals of love, which they have translated into their art.

All ideals are brain constructs

I shall take what some may consider an extreme position, by supposing that the only 'ideals' that we have are those constructed by the brain. This is extreme because there are no doubt those who would disagree with the notion that, for example, natural numbers exist only by virtue of the organization of our brains. Roger Penrose is

among them. For him, the mathematical world is not a product of our thinking, and hence its laws do not depend upon the structure and functioning of the brain. The existence of that world “rests on the profound, timeless, and universal nature of these concepts, and on the fact that their laws are independent of those who discover them...The natural numbers were there before there were human beings, or indeed any other creatures here on earth, and they will remain after all life has perished” (Penrose, 1994). I have no way of refuting Penrose’s claim. Yet I wonder what the reaction would be to another, seemingly powerful, advance in mathematics, namely string theory which, put simply, is an attempt to quantize gravity. To do so, one needs to construct an abstract space with 26 dimensions, which can then be collapsed into 10, and subsequently into 4, giving the conventional space-time dimensions. As I understand it, there is no current scientific evidence for string theory or at any rate there was none when the theory was first developed. It is therefore a product of the human imagination, dependent upon brain organization. I wonder whether it would have been at all possible to develop string theory without the kind of brain organization that we have. Yet again, I am not in a position to provide a compelling justification for my view that even the mathematical straight line is a product of the human brain. Even allowing for this lapse, there nevertheless remains an important area -- for example, of object and shape recognition, of colour perception, of narrative recognition and much else besides -- which most would today acknowledge as being a property of the brain and dependent upon the laws of the brain.

Abstraction and its end process, the formation of ideals, are the necessary ingredients of an efficient knowledge- acquiring system, but there is a heavy price that is exacted in return. The experience that we have depends, by necessity, upon the experience of particulars. But the particular may not always satisfy the ‘ideal’

synthesized by the brain from many particulars. A refuge lies in recreating the brain's ideal in art and through art. I repeat again that abstraction and the construction of ideals is a process that is repetitively applied in the brain. This leads not only to the construction of the ideal straight line, but also the ideal house, the ideal representation of a scenery, and the ideal -- of love. Let us acknowledge that there are other dimensions to art. Dance and music are commonly collective artistic experiences that depend upon the interaction of many brains. That interaction can also be seen in the strong cultural influences in the creation and appreciation of works of art. The artist's concepts will also change as his work develops and as he *learns* more while creating. But the primordial source of art is the knowledge acquiring system of the brain, with all its splendours and shortcomings.

Brain concepts that are only realised in art

The three artists whom I use to illustrate my general point, in the chronological order of their lives, have much in common. All were men and each occupies a high position in Western civilisation. The culture of all three was deeply rooted in the Western, Christian tradition and each one had been deeply influenced by ancient Greek civilisation. The ideals formed by all three were therefore dictated by sensory input and inclination but also by the culture that they had imbibed. And all three had formed an ideal of love in their brains that they never seemed to have attained in life. All three temporarily saw death as a possible relief from the struggle for attaining it. Art was the refuge for all three. Let me emphasize that, in choosing romantic love, I am focusing on an overwhelmingly powerful passion in the service of which man has achieved a great deal but also destroyed much. I do not mean to imply that people have not found the perfect happiness in love. Many have, and yet many have not. My

purpose in concentrating on love is to show that concept formation by the brain is important even in so complex a sentiment.

Dante and Beatrice

My concern here is with Dante's relationship to Beatrice, the "lady" who inspired all his work. He met her when both were nine, and he was deeply infatuated by her for the rest of his life. She married a banker and died young. His love and desire for her was therefore forever to be frustrated, leading him into deep depression but at the same time unlocking his creative genius.

Dante was to marry later and raise a family. But his wife does not figure in any of his writings, and we can only presume that this was a marriage of convenience and convention, not of passion. In fact, there is only one other female figure that takes a prominent place in Dante's work -- Donna Gentile. She appears in the second half of the *Vita Nuova* as a real person, creating a tension in him between his love of Beatrice and her. But she remains an ambiguous figure. In the *Convivio*, written some ten years after the *Vita Nuova*, Dante equates her with Lady Philosophy, who instills in him the philosophical virtues of Wisdom, and consoles him for Beatrice's death. Her existence as a real person has been doubted (Donke, 1997).

Dante's work is written in the vernacular Italian. It displays deep knowledge of theology, astronomy and philosophy as known at the time. In steps through the *Vita Nuova*, the *Convivio* and the *Paradiso*, his unsatisfied and unfulfilled love for Beatrice is sublimated into love of philosophy and wisdom, which leads to Heaven. Beatrice herself is metamorphosed in the work, from a beautiful woman to Wisdom itself, and thus becomes the most precious of all beauties for Dante. It is she who leads him in steps to the highest reaches of Paradise, the Empyrean. In a sense,

therefore, his concept of love itself changes as we follow his writings through the three works, as indeed concepts generally do through the accretion of experience. There is a distinctly Platonic flavour to this metamorphosis. In both *Phaedo* and *The Symposium*, arguments are made in favour of love beginning as attraction and desire and metamorphosing gradually into the philosophical virtues of Wisdom, Truth and Universal Beauty. For Dante, this metamorphosis was probably much aided when the vernaculars, starting with Provençal, came to use the word *amor* and *amore* in both sexual and sacred senses, its previous use in the sacred sense having been frowned upon as being compromised by its use in the other sense. This dual use of the word “can be said to have facilitated Dante’s extraordinary enhancement of his angel-like lady, Beatrice, and his exaltation of her and his love for her” (Nelson, 1986).

Moreover, however individual Dante’s work is, it is nevertheless worth recalling that idealisation of a woman, usually someone other than a wife, was common in the culture to which Dante belonged (Petrie and Salmons, 1994). This emphasises the importance not only of the cultural context within which Dante worked, but of cultural contexts in general in the formulation of concepts. It also raises the question of why this kind of idealisation should have occurred so commonly in literature.

The metamorphosis starts in the *Vita Nuova*, where, interestingly from a neuroesthetic point of view, Dante begins by writing of the “glorious lady of my mind” [*“la gloriosa donna de la mia mente ”*], thus acknowledging that even though his love of her had been triggered by an encounter with a real person, she was very much a construction of his mind, someone whom he loved from a distance. Dante was acquainted with the ingenious view of Greek philosophers, that objects take their form by virtue of what the observer vests in them. In the *Convivio*, (Tractate III, ix), he writes, “In truth, Plato and other philosophers affirmed that our vision was brought

about, not because the object of sight came to the eye, but because the visual power went out to the object,” though he adds that “this opinion is censured as false by the Philosopher [Aristotle] in his book “On Sense and the Object of Sense” (Dante, 1304?, see Jackson, 1909). Evidently however the Aristotelian view prevailed because when he first sees Beatrice, “the animal spirit, the one abiding in the high chamber [la secretissima camera] to which all the senses bring their perceptions, was stricken with amazement, and speaking directly to the spirits of sight said these words, “Now your bliss has appeared”. But though metamorphosed in The Divine Comedy, and especially in the Paradiso, into an object of Wisdom and Truth, the relationship has an early erotic component, acknowledged through its denial. In his commentary to Canzone XVIII of the Vita Nuova he writes, “I speak of certain beauties pertaining to her whole body [and then] I speak of certain beauties pertaining to particular parts of her body”. But “so that here and now every perverse thought may be extinguished, let him who reads this remember what has been mentioned previously concerning this lady’s greeting, which is an act performed by her mouth; namely that it was the goal of all my desire so long as I was able to receive it”, from which one may conclude that the thought of kissing her never crossed his mind!

There are erotic allusions in the Convivio too. There he says, “the sight of this lady was so generously ordained for us – not just to see her face, which she shows us, but to long to win what she keeps hidden” (Tractate xiv, 13). Writing long before Freud had started to profane the secrets of fantasy, he was able to convey unashamedly the idea of Beatrice as the “mother” and himself as a “child” who falls asleep “like a little boy crying from a spanking”, since he was protected from having to acknowledge the source of his phantasms.

Dante's writing thus leaves little doubt that, though she was to be metamorphosed into Truth and Wisdom by him in his work, culminating in the Paradiso, his love of her was the love of a woman. There is acknowledgement, too, that the complete joy one desires in a relationship with a woman may never happen. In the *Convivio*, (Tractate III, xii) he writes that "In other intelligences she exists in a lesser fashion, as it were like a mistress in whom no lover can take complete joy, but contents his longing by looking at her" (my emphasis). Death was a solution to this predicament earlier in his life. In Canzone XXIII of *Vita Nuova* comes the surprising dream, possibly even the wish, of her death, which in fact anticipates her real death. In the introduction to his translation of the work, Musa (1992) has emphasized that this Canzone occupies the important, central, part of the *Vita Nuova*, whereas her actual death is mentioned in passing later, without comment, as if it is the death in the mind that is the more important event. Realising that such a heavenly love, much of it created by the mind and of the mind, is not in reality possible, he writes, "And so it seemed to me that when I went to see the body in which that most worthy and blessed soul had dwelt...so strong was the hallucination that it actually showed me this lady dead". Perhaps also anticipating the death wish of Tristan and Isolde, to whom romantic love was also an illusion, he wishes his own death (before her real death), writing,

ch'io dicea: "Morte, assai dolce ti tegno;
 tu dei omar esser cosa gentile,
 poi ché tu se' ne la mia donna stata
 e dei aver pietate e non disdegno
 Vedi che si desideroso vegno
 d'esser de' toi, ch'io ti simiglio in fede
 Vieni, ché 'l cor te chiede"

I said, "Death, I hold you very dear;
 by now you ought to be a gracious thing
 and changed your scorn for sympathy
 since in my lady you have been at home
 I yearn so to become one of your own
 that I resemble you in every way
 My heart begs you to come"

His realisation in the *Vita Nuova* that his desire can never be fulfilled leads him in a different direction. Since true happiness cannot come from something as changeable as the lady to whom he is devoted, he looks for something less mutable,

more certain -- of dedicating himself to her praises and of saying of her what has not been said of any woman [*“io spero di dicer di lei quello che mai no fue detto d'alcuna”*]. And thus through his unfulfilled desire he creates a great work of art. Into that art he disgorges the ideals in his brain, as they are metamorphosed through his life. In the end, Beatrice, the earthly woman whom he could never love as a woman, herself changes from being an earthly and desirable, but unattainable, woman to the embodiment of beauty, wisdom and virtue. Thus transformed, she leads him in successive stages through Hell, Purgatory and Paradise to the Empyrean.

The non-finito of Michelangelo

If Dante's work was inspired by a brain concept that could, he knew, never be realised in life (which is presumably why he killed Beatrice off in the *Vita Nuova* before she actually died), and could therefore only be lived in a great work of art, it is not at all obvious that the same is true of the mighty Michelangelo. Yet it is plausible to argue that what made Michelangelo leave so much of his work unfinished can be traced to the same source as that which made Dante create his art -- the impossibility of realising the ideals formed by the brain in the experience of particulars in real life.

All his life, Michelangelo had been dominated by the overwhelming desire to represent not only physical but also spiritual beauty and divine love. There is little doubt that in his Platonic culture, physical and spiritual beauty were entwined and not easily separable, that he formed amorous relations with men, that he yearned for a physical and spiritual dimension to these relationships and that what he experienced had left him largely unsatisfied. The most enduring of these relationships was with Tommaso de' Cavalieri, the young Roman nobleman who had overwhelmed him with his physical and intellectual beauty and who had come to dominate his emotional life

in his later years. Yet for all the brilliant work that the relationship unleashed, he felt a prisoner -- "*resto prigion d'un Cavalier armato*" -- [" I remain the prisoner of an armed Knight"]. The conflict within him is expressed in one of his *Rime*:

S'un ardente desir mortal bellezza
ferma del tutto, non discese insieme
dal ciel con l'alma, e dunque umana voglia:

ma se pass' oltre, amor tuo non me sprezza
ch'altro Dio cerca; e di quell più non teme
ch' a lato vien contro a sì bassa spoglia.

If mortal beauty be the food of love,
it came not with soul from heaven, and thus
that love itself must be a mortal fire:

but if love reaches to nobler hopes above,
thy love shall scorn me not nor dread desire
That seeks a carnal prey assailing us.

It is against this background of Michelangelo's ideal of love that I want to approach his unfinished work. These constitute three fifths of his sculptures and thus are not a negligible part of his work. This may seem surprising in a man who despised unfinished works in others and the reason for it has been debated. There may have been technical reasons for this. A correspondent, Anna Winestein, has pointed out to me the difficulties of working with marble, especially of restituting what has been chipped away, thus making it difficult to have many tries. While acknowledging these difficulties, I find it hard to believe that they alone can account for the unfinished status of so many of his works. Like Michelangelo's disciple, Condivi, Giorgio Vasari believed that "Michelangelo's *non-finito* reflects the sublimity of his ideas, which again and again lay beyond the reach of his hands" (Schulz, 1975). I would modify that statement somewhat and say that time and again he felt that he could not represent in a single work the inseparable concept of love and beauty that had formed in his brain. His solution was to leave the work unfinished. For Michelangelo, leaving a work unfinished was perhaps an improvement on another characteristic, not undertaking a work at all for fear that he would be incapable of representing on canvas or in sculpture the same ideal that had formed in his brain. We know that this was the reason for his general refusal to execute portraits, two exceptions being those of Andrea Quaratesi and Tomasso de' Cavalieri. In another one of his *Rime*, he wrote:

Se ben concetto ha la divina parte
il volto e gli atti d'alcun, po' di quell
doppio valor con breve e vil modello,
dà vita a' sassi, e non è forza d'arte

When that which is divine in us does try
to shape a face, both brain and hand unite
to give, from a mere model frail and slight,
life to the stone by Art's free energy.

I interpret "forza d'arte" to mean the unhindered concept formed in the artist's brain. But the difficulty of translating all the concepts of love and beauty formed by his brain makes Michelangelo yearn for death, just as Dante saw death as a solution in Vita Nuova and Wagner's Tristan and Isolde see death as the salvation for the unrealisable state of the perfect union in love that they yearn for (see below). In one of his Rime, Michelangelo wrote:

Deh quando fia, Signor, quell che s'aspetta
per chi ti crede? Ch'ogni troppo indugio
tronca la speme, e l'alma fa mortale

When will that day dawn, Lord, for which he waits
who trusts in Thee? Lo, this prolonged delay
destroys all hope and robs the soul of life

Che val che tanto lume altrui prometta,
s'anzi vien morte, e senz' alcun' rifugio
ferma per sempre in che stato altri assale?

Why streams the light from these celestial gates,
if death prevent the day of grace, and stay
our souls forever in the toils of strife?

There is little doubt that many of his unfinished sculptures were not left hastily unfinished. They were instead brought to a certain state of completion and not continued beyond, even though Michelangelo sometimes kept working on them. A notable example is the Rondanini Pietà (Palazzo Sforzesca, Milan), which Michelangelo was still working on when he died. Charles De Tolnay wrote that, in the Rondanini Pietà, "Michelangelo subordinates the representation of physical beauty to the feeling of emotional life [through the use of] flat surfaces, straight lines and the inertia of an amorphous mass lacking contrasts of light and shade". The work, he believed, "comes to represent in the personal life of the artist the fulfilment of his longings, that state of beatitude toward which his unsatisfied soul aspired" (Tolnay, 1934). Though unfinished, the evocative power of the work is such that, read without

reference to its subject, this is really a description of a finished work. What Michelangelo has done, without acknowledging it, is to leave it to the brain of the spectator to complete it. And De Tolnay has done so in his fashion while others may complete the work in a different way, by seeing in it other qualities and evocative powers.

In fact, Michelangelo himself alluded in one of his last sonnets to his belief that the concepts of beauty translated into works of art may pale into insignificance when compared to concepts of beauty formed in the brain. This, among other reasons, led one of the greatest artists the world has produced to turn against art:

Onde l'affettuosa fantasia, Che l'arte mi fece idol' e monarca Né pinger né scolpir fia più che quieti l'anima volta a quell'Amor divino	Now I know how fraught with error was that fantasy That made art my idol and my king No brush, no chisel can quieten the soul Once it turns to the Divine love of Him who from the Cross, ch'aperse, a prender noi, in croce le braccia. Outstretched his arms to take us unto Himself.
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Ambiguity

It is interesting to introduce here ambiguity, which constitutes another way of leaving a work unfinished. I use the term ambiguity -- a characteristic of all great art - - in a neurological sense, not in the dictionary sense of vagueness and uncertainty. By it I mean that a work of art is 'unfinished' enough to offer several solutions, all of equal validity, so that there is no right answer to the puzzle offered by the work of art. It may fit any of the concepts in the viewer's brain. Indeed the more of the concepts it approximates, the greater the work of art. "Something", Schopenhauer wrote, "and indeed the ultimate thing must be left over for the mind to do". Leaving a work unfinished or making it ambiguous engages the brain more intensely. That is precisely what Michelangelo's unfinished Rondanini *Pieta* and Vermeer's ambiguous *Girl with a Pearl Earring*, among his other works, do. Marcel Proust's just description of

Vermeer as *'un artiste à jamais inconnu'* (an artist who is forever unknown) applies to more than just the scanty details of his life. It applies with even greater force to his great paintings, in which the spectator can find many solutions, but none which is dominant or more valid than the others.

Here we can come to a definition of art, and to speculating about what, in neurobiological terms, constitutes great art. The translation of concepts in the artist's mind onto canvas, or into music or literature constitutes art. Great art is that which corresponds to as many different concepts in as many different brains over as long a period of time as possible. Ambiguity is such a prized characteristic of all great art because it can correspond to many different concepts. Its close affinity with the unfinished is easy to understand, for they both offer the spectator the luxury of choosing from many alternatives, and even picking the alternative that best fits brain concepts at any given time. It was Wagner who combined both ambiguity and the unfinished, or unresolved, as never before. Through the use of this dual but linked device (linked in terms of brain mechanisms), he produced one of the supreme artistic achievements of our culture, his romantic opera *Tristan und Isolde*. A highlight of the opera is the use of what has been called "premeditated irresolvability" (Langerholc, 1986).

The Unrealisable in Wagner's Art

Dante's solution to his unfulfilled desires and his unfinished earthly love was to metamorphose that love to spiritual and philosophic dimensions in a work of literature. Michelangelo, deprived of the ability to experience that combination of spiritual and physical beauty that he yearned for, and finding it difficult to combine and portray the concepts of love, and of spiritual and divine beauty formed in his

brain in a single work of art, found a solution in leaving many of his sculptures unfinished. Wagner the great womaniser understood that the concepts of romantic love formed in his brain were not even realisable in life, and this led him to convey the message in a work of art. But that work of art was achieved because of the realisation that an unrealisable concept had formed in his brain, though of course Wagner did not think or write about the brain.

Wagner wrote *Tristan und Isolde* relatively late in life. The opera has unmistakable roots in an earlier work, the *Wesendonk Lieder*. The latter had been composed when Wagner was staying in Zurich to work in the home of a banker, Otto von Wesendonk. There he developed a passion for Wesendonk's wife, Mathilde. The relationship had marked Wagner deeply, even though, and perhaps because, it was probably never consummated. But whether it was or not is immaterial to the argument. It is quite evident that the ideal of romantic love as it had developed in his brain is not one that he had actually encountered. Why else would he describe *Tristan und Isolde* as the greatest of all monuments to the greatest of all illusions, romantic love? An illusion is, after all, a creation of the brain.

This may seem surprising. To external appearance at any rate, Wagner did have passionate attachments and, for a time at least, a more or less happy domestic life. Unlike the total silence of Dante on his wife, Wagner seems to have delighted in his second wife, Cosima, and composed music for her. But if his statement above and the message of his opera are to be believed, he craved for something that he was unable to attain and decided in the end that it was unattainable in life. In fact, in a letter to Liszt, he wrote: "since never in my whole life have I tasted the real happiness of love, I mean to raise a monument to that most beautiful of dreams" (Newman, 1949). In his

work, he conveyed the idea that the brain concept – at least as it relates to romantic love – has no counterpart in the experience of particulars.

The legend of Tristan and Isolde, probably born in Wales or Cornwall, had had much currency throughout Europe. Virgil, Dante's guide in the *Inferno*, points Tristan out to him:

Vedi Paris, Tristano: e più di mille
ombre mostrommi e nominommi a dito
ch'amor di nostra vita dipartille

See Paris, Tristan: and more than a thousand
shades he pointed out to me and named
who were parted from our life by love

his presence in hell being presumably the consequence of his amorous escapades.

Wagner dispenses with many of the legend's details in his opera. In his hand, the relationship of Tristan and Isolde becomes entirely ascetic, possibly the most ascetic love relationship ever described. Right from the start, in the *Prelude*, the impossibility of the "dream" of love finds musical expression. Wagner stated in his own programme notes that "it expresses the incessant projection and recoil upon itself of a single emotion – that of longing without satisfaction and without end" (Newman, 1949). The *Prelude* was in fact originally referred to as the *Liebestod* (love death) by Wagner, who described it as a progression from "the first timidest lament of unappeasable longing, the tenderest shudder, to the most terrible outpouring of an avowal of hopeless love", the music "traversing all phases of the vain struggle against the inner ardour, until this, sinking back powerless upon itself, seems to be extinguished in death" (Newman, 1949).

Musically, the *Prelude* and especially the dissonant Tristan chord (see Figure 1), which is left unresolved, introduces a much commented on ambiguity². When

² John Langerholc has pointed out to me that the ambiguity of the Tristan harmony resides in the progression of the four 4-note chords. The first chord in itself, however, generally referred to as *the* Tristan chord, is one of the least ambiguous in all tonal music, being diatonic (i.e. without chromatic alteration) in only one minor key, the "hidden" key of D#/Eb-minor, and in its parallel F=-major, after enharmonic respelling. This respelling is necessary as the chord is nowhere endemic. On its entrance,

musicians and musical theoreticians speak of dissonance and irresolvability in the music, they imply

The Tristan Chord



Figure 1. The Tristan chord. Diabolic intervals are shown in red; *appoggiatura* to the diabolic interval is shown in green.

that there is something dissonant and irresolvable in the music. Even those sympathetic to the importance of incorporating brain studies in theorizing about music follow this trend. Benzon (2001) writes: “I believe memes – such as music – reside in the external world”, memes being a term introduced by Richard Dawkins to signify the cultural counterpart of the biological gene. My view is that the music, the dissonance, the consonance, the tonality, and the ambiguity all reside in the brain, are indeed a manifestation of brain activity. It is the brain that is incapable of resolving the chords, or of determining them as irresolvable or, better still, resolving them in a number of different ways. The situation is not vastly dis-similar to that obtaining in colour vision. Colour is a property of the brain, not of the world outside, though of

this chord abruptly contradicts the seeming A-minor of the beginning, which makes the expectation and curiosity of the listener all the greater

course the brain makes use of different wavelengths of light to construct colour. This was recognized by Newton (1704) who wrote: “For the Rays, to speak properly, have no Colour. In them there is nothing else than a power and disposition to stir up a sensation of this Colour or that”.

It is sometimes claimed that in the *Prelude* Wagner destroyed tonality, even against the protestations of musicians like Wilhelm Furtwängler that in *Tristan und Isolde* “so often cited as a crown witness for musical progress, there is not one note which is not to be understood tonally” (Furtwängler 1949). (Langerholc 1983, 1986) is right to draw attention to the similarity, in terms of brain organization, of the effects produced by the ‘dissonant’ and ‘unresolved’ chords of *Tristan*, the impossible figures of Escher and ambiguous bi-stable images such as the Necker cube or the Rubin vase, that grace every textbook of vision. The latter have two equally compelling perceptual interpretations (Logothetis *et al.*, 1996) and are therefore being increasingly used to study the neural basis of perception. The question asked in the physiological experiments is simple: to what extent do the cells’ responses follow the perceived interpretation? The answer to date has been that there are cells in all visual areas whose responses correlate with the perceived figure, the largest number being observed in the temporal lobe. Equally striking is the number of cells in early visual areas that remain active when the stimulus is ‘suppressed’ (Logothetis, 1998). Taken together, these results suggest that the conscious perception of a stimulus may be mediated by only a sub-set of cells in any given area, which is not to say that the others do not contribute to the responses of what we may loosely call the ‘perceptual cells’. Human brain imaging experiments suggest that the perceptual dominance of one image over another in bi-stable images is controlled by a network of cortical areas, which includes the frontal and parietal cortex (Lumer *et al.*, 1998; Kleinschmidt

et al., 1998). What this really means is that the brain has a perceptual machinery which is labile enough to allow it to interpret an image in more than one way, and that there is an additional neural machinery that dictates, supervises, or governs which of the two images holds sway. It needs to be emphasized yet again that we are not at all aware of the processes in the brain that result in the perception of one of the two images at any one time, but only conscious of the image that we perceive at a given time. In general, however, one of the two images is not given absolute dominance, and hence the bi-stability and hence, too, the ambiguity. It must be a neural process of a similar kind that allows for the ambiguity in the music of Wagner. That musical theoreticians should not have been unable to agree even on which key or how many are used in the Tristan chord merely serves to emphasize that Wagner, knowledgeable about the operations of the brain without knowing anything about the brain, was able to construct the chord so ambiguous that different musicians found different keys in it. Wagner in fact combined the ambiguous with the unfinished by tapping this brain organization which, though studied best in the visual brain, is not unique to it. He introduced the *appoggiatura* into the chord and the diabolic interval into both the harmony and the chord, thus achieving ambiguity, and fortified the effect by leaving it unresolved until the last Act. He thus left it initially to the listener to complete the chord, and it is significant that the chords are followed by long silences which in fact engage the listener's brain, leading one musical expert to write that no one "has ever composed silence as eloquently as Wagner" (Crosby, 1999). Nor is this ambiguity and irresolvability limited to the progression of the Tristan chord; the irresolution continues right to the end and is finally resolved in the coda of the last Act, in the *Liebestod*. In creating this remarkable work, Wagner was thus really following the potentialities of the brain, except that in this case he left it to the brain of the listener

to complete the chord progression, while he himself only completed it at the very end of the last Act,. And in that sense, Wagner too was a neurobiologist, who had a profound understanding of the workings of the musical brain, without knowing anything about the brain. It is for this reason that I have argued elsewhere that artists are also neurobiologists who study the brain with techniques that are unique to them (Zeki 1999). Langerholc (1986) is right when he says that “Escher and Wagner both relied on ancient laws of perspective and tonality *deriving from the nature of our perceptive mechanisms* [our brains] to draft their illusions. Otherwise they would not have worked.” (my emphasis). Probably the only way to understand the mysteries of the Tristan chord progression, about which so much has been written, is to understand the neural mechanisms underlying musical perception. And since he was able to instill the ‘unfinished’ quality into the progression of the chord, this in itself becomes the musical metaphor for something that can only be finished in annihilation, when final salvation and the dream of romantic love are achieved in death.

While Wagner furnished his music with qualities that fully engage the listener, his libretto is no less compelling in conveying the idea of a frustrated brain concept, one that has no hope of being satisfied in reality. For our purposes here, it is sufficient to look at Act 2 and the coda of the work. It is here that Wagner relays his message in music and in language that only in death and annihilation can the ideal of romantic love be found. In other words that the ideal constructed by the brain is remote from reality. The music of Act 2 is orchestrally humid and fervid, but throughout the libretto Tristan and Isolde remain indifferent to a physical consummation or a happy outcome on earth, which they indeed consider to be unattainable. The Act begins with an exaltation of the night, where the imagination reigns supreme, and fear of the day, where the reality intrudes:

dem tückischen Tage
dem härtesten Feinde
Hass und Klage!

for spiteful day
the most bitter foe,
hatred and grievance!

Wie du das Licht
o könnt' ich die Leuchte
der Liebe Leiden zu rächen
dem frechen Tage verlöschen!
Gibt's eine Not
Gibt's eine Pein
die er nicht weckt
mit seinem Schein

Just as you extinguished the light
would that I could
extinguish the light of insolent Day
to avenge the pangs of love!
Is there any distress,
is there any anguish
which it does not revive
with its beams

in lichten Tages Schein
wie war Isolde mein?

in the bright light of Day
how could Isolde be mine?

Together they sing, each wishing for the “Night of love to descend and grant oblivion, that I may live” (O sink hernieder/ Nacht der Liebe/ gib Vergessen/ dass ich lebe). When Tristan longs for death, Isolde asks, “Must Day then waken Tristan” – as if the reality would shatter the hoped-for perfect bliss. The preoccupation with night and death echo similar sentiments expressed earlier by Michelangelo in one of his

Rime:

O nott', o dolce tempo benchè nero
e dall'infima parte all più alta
in sogno spesso porti ov'ire spero.

O night, a sweet though sombre span of time
often by thee in dreams upborne, I wend
from earth to heaven, where yet I hope to climb.

O ombra del morir, per cui s'è ferma
ogni miseria l'alma al cor nemica,
ultimo degli afflitti e buon rimedio;

O shade of death, through whom the soul at length
shuns pain and sadness hostile to the heart,
whom mourners find their last and sure relief

tu rendi sana nostra carn'inferma
rasciug'i pianti, e posi ogni fatica,
e furi a chi ben vive ogni'ir' e tedio.

You restore our suffering flesh to strength,
driest our tears, assuagest every smart,
Purging the spirits of the pure from grief.

And, Isolde goes on, if Tristan were to die, what would become of her and their love:

Doch unsre Liebe,
Heißt sie nicht Tristan
Und – Isolde?

But our love,
is it not Tristan
and Isolde?

But it is precisely because the ideal of love cannot be attained even with Tristan and Isolde that Tristan yearns for her death as well, for only in that way can the illusion be annihilated:

So starben wir
um ungetrennt,
ewig einig

Thus might we die,
that together,
ever one,

ohne End'
ohn' Erwachen,
ohn' Erbangen,
namenlos
in Lieb' umfängen
ganz uns selbst gegeben,
der Liebe nur zu leben

without end,
never waking,
never fearing,
namelessly
enveloped in love
given up to each other,
to live only for love

There is, in Act 3, a brief moment of doubt, for both Tristan and Isolde. He longs to see her. But that joyful anticipation is tempered by the realisation of the fearful consequences that the love draught that he was given to drink in Act 1 have had:

da ward der zehrendste
Zauber erlesen:
daß nie ich sollte sterben,
mich ew'ger Qual vererben!

then was the most searing
magic unleashed:
that I might never die
But inherit eternal torment!

For Isolde too, the longing for life and the disorienting delights of love is still there:

Nur eine Stunde
bleibe mir wach!

betrügt Isolden
betrügt sie Tristan
um dieses einzige
ewig kurze
letzte Weltenglück?

Just for one hour
Stay awake for me!

Will Tristan
deny Isolde
this single
eternally brief
Final worldly joy?

And if Tristan must die, it must be for love, not from the physical wounds inflicted on him:

an der Wunde stirb mir nicht:
uns beiden vereint
erlösche das Lebenslicht!

do not die from the wound.
Unite us both,
Extinguish the light of life!

At the end of the opera, in the famous Liebestod, Isolde ends by singing:

in des Weltatems
wehendem All -
ertrinken,
versinken, -
unbewusst, -
höchste Lust!

in the universal stream
of the world-breath -
to drown,
to founder -
unconscious -
utmost rapture!

The opera conveys clearly the notion that the ideal of love can never be lived in this life, and that the only hope left is in its annihilation through death. Some producers have tried to resurrect Tristan and Isolde at the end of a performance. Peter Konwitschny did this in his Munich production. In his Covent Garden production of the opera in the 1970s, Peter Hall had Tristan and Isolde rise at the end of the opera and leave the stage holding hands. A Wagner purist in the audience shouted, “Disgusting!”, presumably believing that it was a negation of what Wagner had intended. In fact, Wagner had originally referred to the present *Liebestod* as the “*Verklärung*” (Transfiguration), and the Tristan legends speak of Tristan and Isolde being buried side by side, with a vine growing from one grave and an ivy from the other, the branches of the two inter-twining.

It is of course well known that Wagner had been deeply influenced by his reading of Schopenhauer, the great inheritor of Kant. Schopenhauer had been led to his highly pessimistic view of life through his philosophical studies, and above all through considering the foundations of knowledge. Through these studies, he had come to the conclusion that much was unattainable, to which one needs to add that much is unattainable because of the constant clash between concepts formed by the brain from the experience of many particulars and the continual experience of particulars. This of course is not the only source of his pessimism, but it is an important one. It was left to Wagner to translate that pessimism into a work of art, using his own experience of the unattainable and his profound knowledge of the mechanisms of the brain and its potentials.

CONCLUSION

In the past, I have tried to account for the characteristics of some works of art, for example kinetic art (Zeki and Lamb, 1994), in relatively simple neurobiological terms, basing my analysis on the physiology of visual areas in the cerebral cortex. The account I give here goes beyond and tries to explore the relationship between artistic creativity and appreciation on the one hand, and what I believe to be a ubiquitous operation performed throughout the cerebral cortex on the other. Here, I have approached one of the most complex sentiments that we are capable of, that of romantic love, and tried to show that, exalted though it is, there is a sense in which it, too, obeys a universal rule of brain activity, namely the formation of ideals, a product of the abstractive powers of the brain. Taken together with my exploration of the neurological basis of simpler works of art, we can perhaps see that the neurological motive force for both is the same and can be traced to a necessary stage in the brain's quest to acquire knowledge. That operation is abstraction and its consequence is the formulation of ideals. In trying to understand the biological foundations of art we have, I think, to first try to understand the biological foundations of knowledge, since art is one means of acquiring that knowledge. I have thus based my analysis of art not on psychology but on the organizing principles that dictate the functioning of the brain. I have tried to show that we can, even today, and even in our imperfect state of knowledge about the brain, try to comprehend even the most exalted works of art by reference to the functions and functioning of the brain. I have of course been vague about the precise neurological way through which ideals are constructed by the brain. But this represents only a beginning in an enquiry which I hope will grow in scope and stature as we learn more about the brain and as we begin to accept that there is merit and intellectual profit in considering art as a product of the brain, determined by it and obeying its rules.

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I would like to record my gratitude to colleagues who have read the manuscript and commented on it. I owe special thanks to Anna Winestein who corresponded with me about several aspects of the manuscript, John Langerholc who illuminated me about the Tristan chord and Per Aage Brandt, who discussed it with me extensively. It is hardly worth mentioning that what errors and weaknesses remain are entirely mine.

For my discussion of Plato, I have used *The Collected Dialogues of Plato*, edited by E. Hamilton and H. Cairns, Princeton University Press, 1961 for the Bollingen Foundation. I have used W.W. Jackson's translation of Dante's *Convivio* (The Clarendon Press, Oxford, 1909) and for the *Vita Nuova* I have used M. Musa's translation (Oxford University Press, Oxford, 1992) and the original Italian edition edited by J. Petrie and J. Salmons (Belefield Italian Library, 1994). I have used JA Symonds's translation of Michelangelo's Sonnets, but changed them here and there to modernise the translations (*The Sonnets of Michelangelo*, translated by JA Symonds, Vision Press, London, 1950). Finally, for the English version of the Tristan und Isolde libretto, I have used that accompanying the 1972 recording by the Berliner Philharmoniker, conducted by Herbert von Karajan.

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