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Symmetry and asymmetry in aesthetics and the arts

I. C. McMANUS

Department of Psychology, University College London, Gower Street, London WC1E 6BT, UK. E-mail: i.mcmanus@ucl.ac.uk

Symmetry and beauty are often claimed to be linked, particularly by mathematicians and scientists. However philosophers and art historians seem generally agreed that although symmetry is indeed attractive, there is also a somewhat sterile rigidity about it, which can make it less attractive than the more dynamic, less predictable beauty associated with asymmetry. Although a little asymmetry can be beautiful, an excess merely results in chaos. As Adorno suggested, asymmetry probably results most effectively in beauty when the underlying symmetry upon which it is built is still apparent. This paper examines the ways in which asymmetries, particularly left-right asymmetries, were used by painters in the Italian Renaissance. Polyptychs often show occasional asymmetries, which are more likely to involve the substitution of a left cheek for a right cheek, than vice-versa. A hypothesis is developed that the left and right cheeks have symbolic meanings, with the right cheek meaning 'like self' and the left cheek meaning 'unlike self'. This principle is evaluated in pictures such as the Crucifixion, the Annunciation and, the Madonna and Child. The latter is particularly useful because the theological status of the Madonna changed during the Renaissance, and her left–right portrayal also changed at the same time in a comprehensible way. Some brief experimental tests of the hypothesis are also described. Finally the paper ends by considering why it is that the left rather than the right cheek is associated with 'unlike self', and puts that result in the context of the universal 'dual symbolic classification' of right and left, which was first described by the anthropologist Robert Hertz.

Introduction

> ... symmetric means something like well-proportioned, well-balanced, and symmetry denotes that sort of concordance of several parts by which they integrate into a whole. *Beauty* is bound up with symmetry. (Hermann Wegl; Emphasis in original)[1]

In the first paragraph of his famous book, *Symmetry*, Hermann Weyl discussed

the possible link between symmetry and beauty.[1] Certainly it is not difficult to see how symmetries of various forms, be they in the natural world or the artificial world of human aesthetics, are credited with beauty: the reflection of a mountain in a lake, a starfish, flowers of many types, a honeycomb, snowflakes, the symmetry of a face, the facade of a cathedral, a Byzantine mosaic of Christ Pantocrator in a Greek church – the list could be endless. Neither does the symmetry have to be visual or spatial: music with the A-B-A structure of sonata form, a play with its balanced structure of beginning, middle, and end, the Doppler shift as a whistling train screams by, the lists could be endless. Symmetry is also an obvious feature of good, practical and effective design – a chair or table stands most squarely (a revealing term) when it is symmetric, a clock face is symmetric, tea-cups and dinner plates have their symmetries, and so on.

Ornamental or crystallographic symmetry

Weyl's examples from the arts concentrated mostly on what he called 'ornamental or crystallographic symmetry', with the manifold variations of the tilings of the Alhambra being the paramount example. It was sketching these tiles on several visits to the Alhambra, the first in 1922, that inspired the graphic work of M. C. Escher, perhaps the most mathematically sophisticated of all twentieth century artists.[2] Weyl tells how it was only in 1924 that George Pólya showed there that are exactly 17 mathematically distinct ways of tiling or tessellating a surface – if one likes, there are 17 fundamentally different types of wallpaper.[3] All of the 17 distinct types of pattern have been used by craftsmen using tiles or weaving or decorating walls or any of the other myriad ways in which humans cover their everyday objects with patterns,[4] imposing what Gombrich has called 'the sense of order'.[4] Interestingly, although all of the 17 types of pattern can be found in art from around the world, not all types are found in all cultures (and that may be because although the patterns are mathematically fundamental, it is not clear that they are easily distinguished *psychologically*.[6] Although it is sometimes claimed that all of the 17 types can be found in the Alhambra, it seems that only 13 of the types are actually there. Of the remaining four types it is said that two have been found elsewhere in Islamic art,[7,8] but that the other two, specifically *pg* and *pgg*, are not found anywhere in Islamic Art (although examples exist elsewhere from, for instance, Zaire and the Navajo[4]).

The tension between symmetry and asymmetry

Although undoubtedly aesthetically satisfying from a mathematical point of view, it is not so clear to aestheticians that the strict symmetries of tessellations are as

satisfying as some other less symmetric patterns. Weyl hints at this when he quotes from an article by the art historian, Dagobert Frey:[9]

> Symmetry signifies rest and binding, asymmetry motion and loosening, the one order and law, the other arbitrariness and accident, the one formal rigidity and constraint, the other life, play and freedom.

That pure symmetry is somehow too harsh, too rigid and unlifelike, was suggested by Immanuel Kant, who commented on how,

> All stiff regularity (such as borders on mathematical regularity) is inherently repugnant to taste, in that the contemplation of it affords us no lasting entertainment ... and we get heartily tired of it.

The art historian, Ernst Gombrich was of a similar mind,[10] seeing a banality within symmetry:

> Once we have grasped the principle of order, we are able to learn the thing by heart. [...] We have easily seen enough of it because it holds no more surprise,

so that, symmetry and asymmetry are seen as,

> a struggle between two opponents of equal power, the formless chaos, on which we impose our ideas, and the all too formed monotony, which we brighten up by new accents.

That same struggle was also emphasized by the psychologist Rudolf Arnheim,[10]

> Symmetry means rest and tie, asymmetry means movement and detachment. Order and law here, arbitrariness and chance there; stiffness and compulsion here, liveliness, play, and freedom there. [...] On the one extreme ... the stiffness of complete standstill; on the other ... the equally terrifying formlessness of chaos. Somewhere at the ladder between the two extremes, every style, every individual, and every artwork finds its own particular place.

Weyl recognized this tension, and described how 'occidental art, like life itself, is inclined to mitigate, to loosen, to modify, even to break strict symmetry'. That indeed seems to be true of the social, biological and physical worlds, where despite an overwhelming desire on the part of scientists to find symmetries, the world does seem resolutely to be asymmetric at all levels, despite the best efforts to make it otherwise.[11] Nevertheless there is an argument that symmetry forms the basis on which asymmetry can be built, manipulated and used: 'even in asymmetric designs one feels symmetry as the norm from which one deviates under the influence of forces of non-formal character', as Wyle puts it. The philosopher and aesthetician, Theodor Adorno, also saw the relationship of symmetry and asymmetry in a similar way, in a sort of dialectic: 'In artistic matters, asymmetry can be grasped only in relation to symmetry.'[10] Symmetry is the basis on which asymmetry can be built, just as the curves, irregularities and organic forms of a

Gaudì building are predicated on an underlying geometry of horizontal and vertical structures.

Arnheim[12] has also argued that there is an underlying cognitive scale beneath the dimension of symmetric–asymmetric, which corresponds to simplicity–complexity. In strict information theoretic terms that must be correct, for it requires more bits of data to specify an asymmetric object than a symmetric object. Amheim however takes the argument further in cognitive terms: 'a taste for symmetry is based on a more elementary propensity of the mind than its opposite.'[12] Lurking here is also a suggestion that art develops, with symmetry as a more primitive, simpler form of representation or portrayal which evolves, with all the (non-biological) connotations of progress, into asymmetry. Certainly that seems to be implicit in Wölfflin's distinction between the symmetry of Byzantium and the early Renaissance, and the asymmetry of the High Renaissance and the Baroque period,[13] and it is surely also a good description of the evolution of Greek art, from the near symmetric *kouroi* of pre-Classical Greece, to the elegant, fluid, lifelike forms of the fourth and fifth centuries BC.[14]

Table 1 summarizes these psychological and aesthetic properties of symmetry and asymmetry. Demonstrating them is easy, and has perhaps been most straightforwardly shown by Gombrich[15] using a leaflet designed to teach amateur photographers about composition. The two sketches in Figure 1(a) are as Gombrich prints them, and, as he says, 'a sailing-boat photographed in the centre

Table 1. Summary of the psychological and aesthetic properties of symmetry and asymmetry according to art historians and philosophers.

Symmetry	Asymmetry
Rest	Motion
Binding	Loosening
Order	Arbitrariness
Law	Accident
Formal rigidity	Life, play
Constraint	Freedom
Boredom	Interest
Stillness	Chaos
Monotony	Surprise
Fixity	Detachment
Stasis	Flux
Simplicity	Complexity

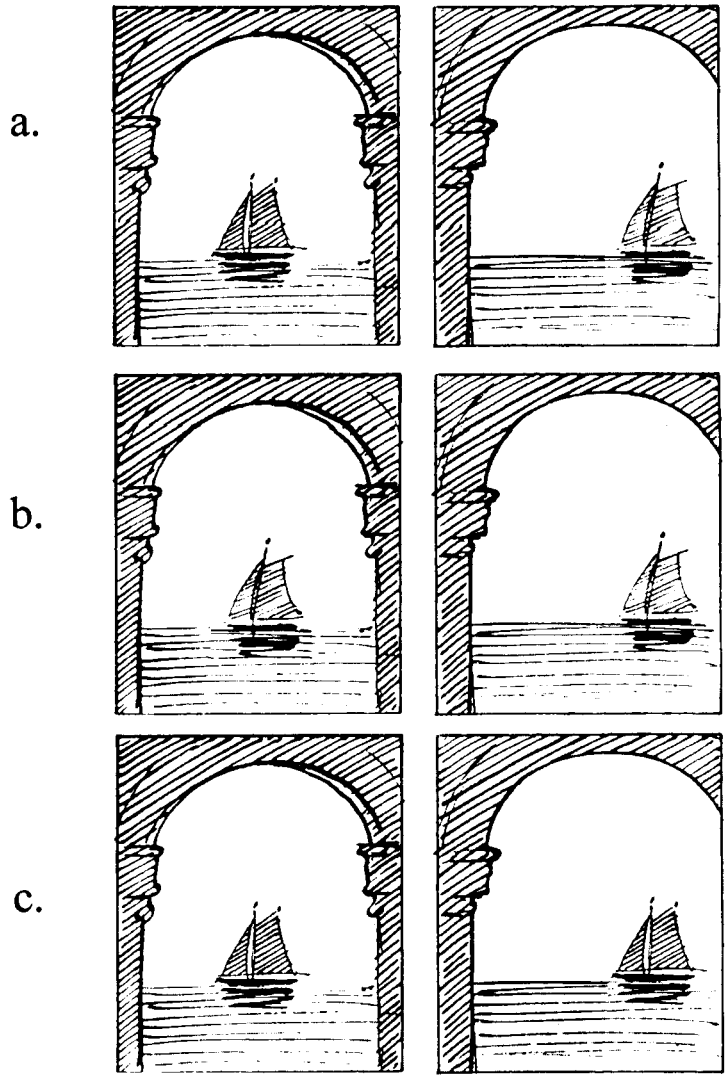

Figure 1. (a) Gombrich's demonstration that asymmetry results in a sense of movement. Because the boats are not identical in the left and right hand images, the images have been manipulated in (b) and (c) so that the boat is identical. Still the effect is compelling.

of a picture will look becalmed, one shown off-centre will appear to move'. And he then goes on to add, 'Of course, this applies with much greater force to sailing-boats than, for instance, to trees, which suggests that even here meaning has a large share in the resultant impression'. A potential problem with Gombrich's demonstration is that the boats in the original images are not quite identical, the sails in the 'moving' image billowing more than in the 'becalmed'

image. Figures 1(b) and 1(c) show the original images manipulated so that the boat is in fact identical in each image; the effect is still compelling.

The continuum of symmetry

That there is also a continuum between pure symmetry and its total absence is shown in another example from Gombrich, the computer-generated image *Schotter (Gravel Stones)* by Georg Nees,[16] seen in Figure 2. The strict symmetries of the original squares are slowly lost as the location and the angle of the squares is jittered progressively more and more as one moves down through the image. It is particularly interesting that, although in some sense the amount of symmetry drops away monotonically as one passes from the top to the bottom, the *interest* of the image is greatest perhaps a third of the way down. The original symmetries are still discernable but new possibilities and relationships are also opening up. Something here is reminiscent of the arguments of Stuart Kauffman,[17,18] who suggests that the evolution of life – that statistically most unlikely event – could neither occur in the rigid, frozen, ordered world of ice crystals, nor in the booming, Boltzmannian confusion of an ideal gas, but perhaps where ice is melting to water, where there is fluidity and change, but order is not lost to noise as soon as it is formed. Life evolved, he suggests, 'at the edge of chaos', and intriguingly that area is also the most interesting and pleasurable.

The investigation of the way artists use symmetry and asymmetry requires reference to images that are used repeatedly by many artists over a long period of time, in a cultural context that is relatively well understood. One such situation is the Italian Renaissance, with many examples being available and catalogued for pictures such as the Crucifixion, the Annunciation, the Madonna and Child, or the Madonna with Saints. Such images allow detailed statistics to be collected and analysed, as a test of ideas about the nature of symmetry and asymmetry in art. Nevertheless, not all art historians would see anything of use or interest in such work. For, as the great Bernard Berenson once said,

> The value of research depends on the field where it is carried out. The most meagre adept may make elaborate statistics of the number of times in the art of the middle ages our Lord blesses with three fingers, how many times with two and a half, and how many times with two only; or how frequently St. Catherine has her wheel, or St. Andrew his cross, to right or again to left.[19]

Despite his doubts about the enterprise, the data below could not have been analysed had it not been for Berenson's own industry in assembling his wonderful catalogues of Italian paintings.

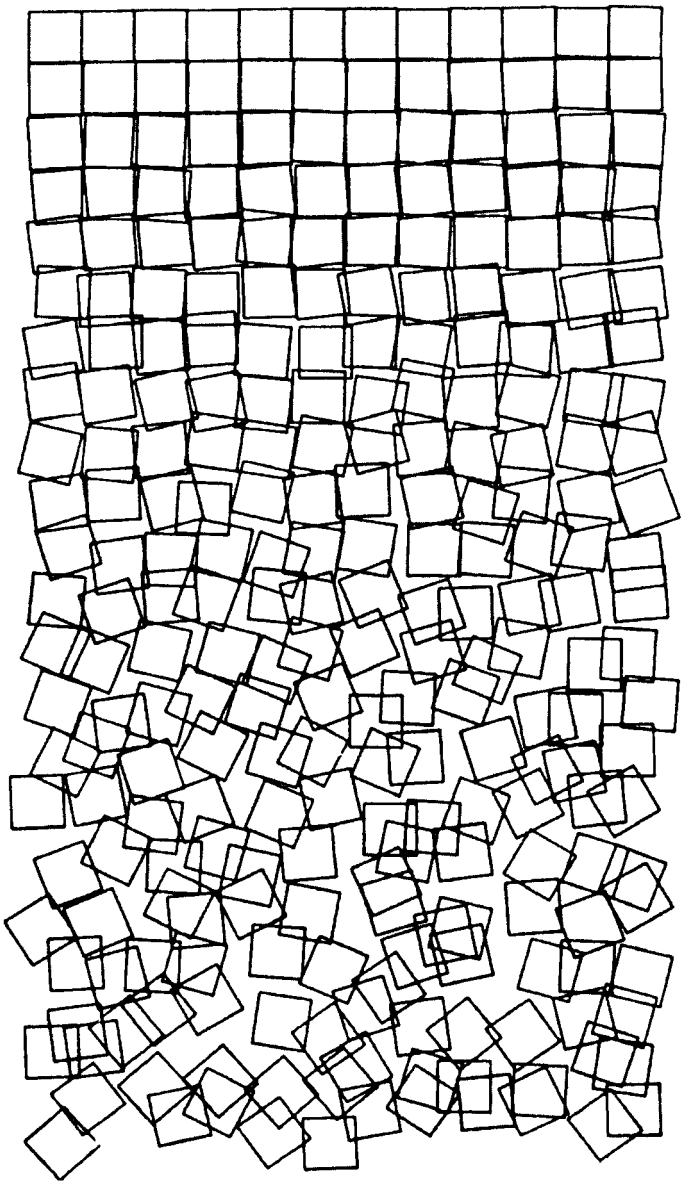

Figure 2. *Schotter (Gravel stones).* Computer-generated image by Georg Nees, 1968–1971. The work is also known as *Würfel-Unordnung (Cubic Disarray).* Reprinted with permission of the artist.

Symmetry and asymmetry in Italian Renaissance art

Renaissance polyptychs

The polyptych was a standard form of the early Italian Renaissance. One of the first, great pieces was the Baroncelli Polyptych of 1334 by Giotto and his school,

in the church of Santa Croce in Florence (Figure 3). The central panel shows the crowning of the Virgin, and there are two panels to the left and to the right, each containing portrayals of saints and of angels playing musical instruments. The two left-hand panels show 51 saints and 10 angels, and the two right-hand panels also show 51 saints and 10 angels. The overwhelming impression is of symmetry. And yet a closer examination shows a curious deviation from symmetry. All of the 51 saints and 10 angels in the right-hand panels are looking to the viewer's left, towards the Virgin who is being crowned (and therefore each is turned to their own right, and hence is showing the viewer their left cheek). However, although 50 of the saints and all 10 angels in the left-hand panels are looking towards the

Figure 3. The Broncelli Polyptych by Giotto and his school (1334). The lower parts show an enlargement of the inner, left-hand panel.

viewer's right, once more towards the Virgin, and hence showing their right cheeks, a solitary saint in the inner of the two left-hand panels is looking to the viewer's left and showing the left cheek. The apparent symmetry is broken. Quite clearly that cannot be attributed to chance or error, for Giotto must have known what he was doing, and it raises a question as to the underlying meaning.

Polyptychs are common in Italian Renaissance art. The eight volumes of Berenson[20–23] describing the paintings of this period contain 605 examples (for further statistical details on this and other pictures, see McManus[24]). Most polyptychs are simpler than the Baroncelli Polyptych, typically having two or four saints arranged to either side of the central image. Symmetry breaking is relatively common in these paintings, being found in 181 of the 605 cases (29.9%). More intriguingly, in 105 of these (58.0%), the substitution is of a left cheek for a right cheek, with only 76 cases (42.0%) where a right cheek is substituted for a left cheek; the difference is significantly different from chance expectations ($\chi^2 = 4.6$, 1 d.f., $p = 0.031$). Thus, not only are asymmetries frequent, but they are more likely to show an additional left cheek than a right cheek; the asymmetries are themselves asymmetric.

The meaning of the right and the left cheek

The 'errors' in the polyptychs predominantly involve the substitution of a left cheek for a right cheek. The implication must, therefore, be that left and right cheeks somehow differ in their meaning, for why else should a directional asymmetry override the otherwise overwhelmingly symmetric structure of this image? And understanding the meaning of the cheeks requires a more detailed analysis of left and right cheeks in a range of paintings.

Portraits

My first involvement with this problem was through the chance observation that painted portraits are more likely to show the left cheek than the right cheek; and of particular interest is that portraits of women are more likely to show the left cheek than are portraits of men:[25] 68% of 551 female portraits showed the left cheek rather than the right, as did 56% of 932 male portraits in art galleries. The proportions in each case were highly significantly different from 50%, and that has since been confirmed in other studies.[26–28] The excess of left cheeks is unlikely to result from the right-handedness of the artists since the same excess has been reported in photographs.[29]

Soon after we had published our data, Professor Walter Landauer wrote saying that he had looked at 302 self-portraits in a book devoted to the subject, and only 39% showed the left cheek, a significant excess of right cheeks. Once we had

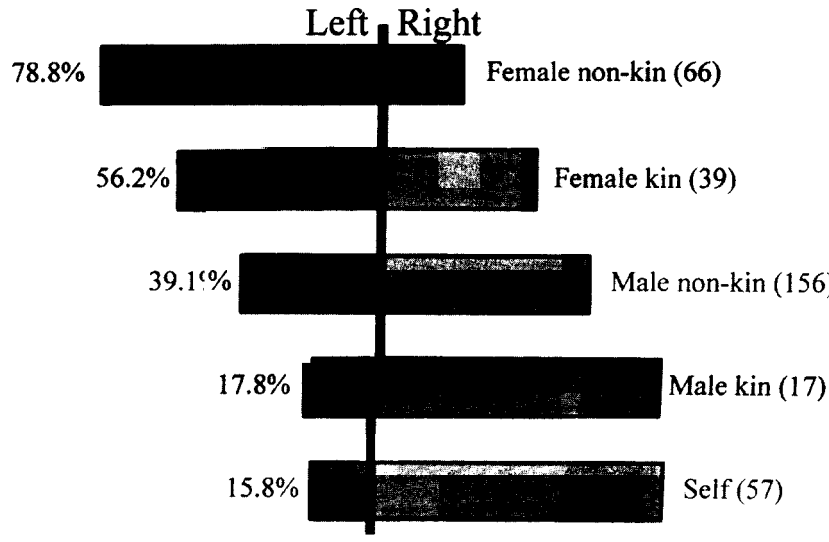

Figure 4. The use of the left and right cheeks in the portraits of Rembrandt. Male and female portraits are sub-divided according to whether the subjects are Rembrandt's kin or non-kin.[30]

become interested in self-portraits, an obvious artist to look at was Rembrandt, and we rapidly confirmed that only 16% of the 57 self-portraits then recognized as being by Rembrandt showed the left cheek. Although complex hypotheses could be erected around the right-handedness of artists, the relative ease of drawing left rather than right profiles with the right hand, the possibility that self-portraits were painted using a mirror (Rembrandt certainly had mirrors in his studio[30]) and the role of the sitter of the portrait,[28,31] we were becoming interested in a more subtle hypothesis – that left and right had a *symbolic* meaning, rather than being mere artefacts of handedness or turning tendencies. The key result was when we broke down the rest of Rembrandt's portraits by both sex and the relationship of the sitter to Rembrandt.[32] Portraits of kin were more likely to show the right cheek than were portraits of non-kin, be they male or female (see Figure 4). Such effects could not be explained away by mechanical factors, nor could other data showing that van Gogh was more likely to paint left cheeks for his middle-class subjects than when he painted peasants.[32]

The hypothesis we created was that left and right represented a continuum, with the right cheek representing 'like me' (and hence self-portraits particularly fitted into that category), and the left cheek representing 'unlike me' (and hence women and non-kin were unlike the predominantly male artists). Of course many other accidental, compositional features could also determine which might be shown in a particular portrait, but the broad picture could not be explained away in those

terms. The next step therefore was to explore the hypothesis further in the much more tightly constrained subject matter of the Italian Renaissance, where there were a large number of images that could be analysed.

The Crucifixion

The crucifixion of Christ is a very common picture in the Italian Renaissance, and nowadays there is hardly a church that does not have such an image. Intriguingly, of the 147 examples in Berenson's volumes, 99.3% show Christ with the left cheek, the sole exception being painted by Titian when an old man. There are also a host of other asymmetries associated with the crucifixion, many of symbolic or other value, such as the spear wound in Christ's right side, and the tradition that there was a good and a bad thief, with the good thief on Christ's right (to where he is looking), and the bad thief on his left. From the point of view of the present theory, it is sufficient to note that the crucified Christ is about as unlike self as possible.

The Annunciation

A more complex situation than either a typical portrait, or the Crucifixion, is the Annunciation, in which the Angel Gabriel informs the Virgin Mary that she is to be the mother of Christ. This situation is complicated because there are now two principle actors in the scene, each being important. The data in Berenson's volumes are clear enough: of 209 Annunications, the angel enters from the left side in 96.7% of cases, and hence the angel shows the right cheek and Mary shows the left cheek. Compositional constraints mean it is nearly impossible to create a satisfactory composition in which both the actors show their left cheek (and both are unlike the artist, that is clear enough). There is also a further constraint here, as can be seen in Figure 5, in which Veneziano's Annunciation is shown correctly and left-right reversed. The annunciation is about a message being conveyed from one person to another, and there is a strong tendency, in Western art at least, for such messages naturally to be read from left to right. The reversed version in the lower part of Figure 5 looks wrong in some sense, although that in part may be related to familiarity (see Blount *et al.*[33]). What is undoubtedly clear is that the Annunciation shows a strong asymmetry, with artists choosing to break symmetry in a highly consistent fashion.

The Madonna and Child

The Madonna and Child is another complex image, and as with the Annunciation, two major figures, the Madonna and the newborn Christ Child, dominate the

Figure 5. The Annunciation by Domenico Veneziano (ca 1442–1448); (Fitzwilliam Museum, Cambridge). The upper panel shows the picture in its original form, and the lower panel shows the picture left-right reversed.

composition (although sometimes there are other figures as well). The Madonna and Child is one of the most common images in Berenson's volumes, representing 913 (16.8%) of the 5432 images. Such numbers provide unparalleled opportunities for a detailed statistical analysis and, in particular, the consistency of the patterns can be assessed across the different Italian schools of art, and across time. Previous analyses of the Madonna and Child had concentrated on the side on which Mary holds the Child. Salk[34] found that in 80% of cases the child is held on the left side, a feature that he postulates is related to the natural tendency of mothers to hold children on the left side, which he suggests is close to the heart, which comforts the child. That explanation is now regarded as controversial,[35] and not particularly relevant to present purposes. What is interesting is that Salk obtained his data from a book entitled *The Christ-Child in Devotional Images in the Italy during the XIV Century*.[36] However, as Figure 6 makes clear, although during the fourteenth

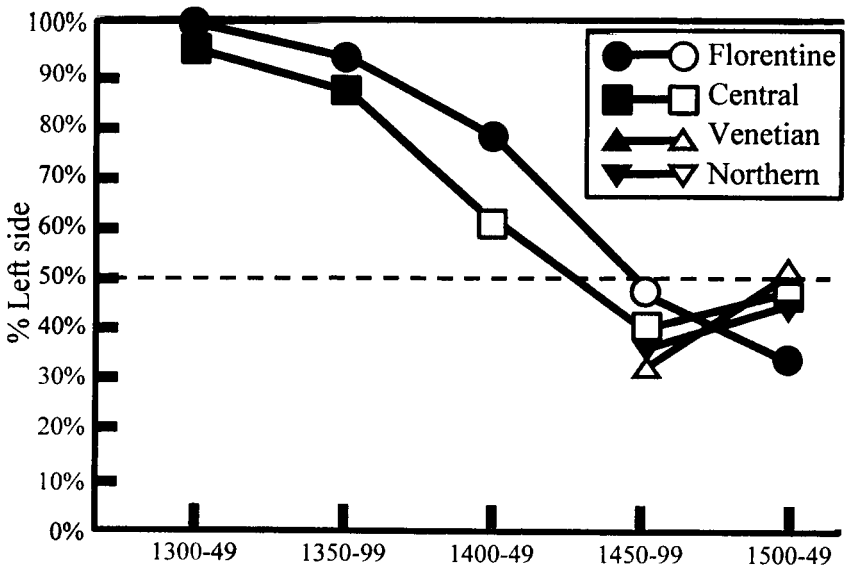

Figure 6. The percentage of portrayals of the Madonna and Child with the Child held on the Madonna's left side, according to date and school. Solid points are significantly different from 50%, whereas open points are not significantly different from 50%.

century a majority of Madonnas do carry the child on the left side, the figure before that is closer to 100%, and by the second half of the fifteenth century it has dropped to below 50%. The pattern in the four main schools of Italian art is remarkably consistent. Some explanation for these changes is required, and it is unlikely to come from real changes in the actual manner in which women held babies, and therefore a symbolic, compositional or other art-historical explanation must be sought.

Although Salk's analysis only considered the side on which the child was held, it is also the case that the Madonna and Child each typically show one particular cheek. At the beginning of the Renaissance the composition is fairly stereotyped, and is shown as a schematic in Figure 7: the child is held on the Madonna's left side, the Madonna looks at the child, and therefore almost always shows her right cheek, and the Child usually looks at the Madonna and therefore tends to show his left cheek. Figure 8 shows the actual proportions of right and left cheeks, for the Madonna, the Child and the two combined. Once again there are clear historical changes, but these are most marked for the Madonna, who starts the Renaissance almost always showing her right cheek and by the end of the Renaissance is most typically shown with her left cheek.

The data in figure 8 show an important problem. The Madonna has shifted the child from her left to her right side, and, quite naturally, for a mother would be

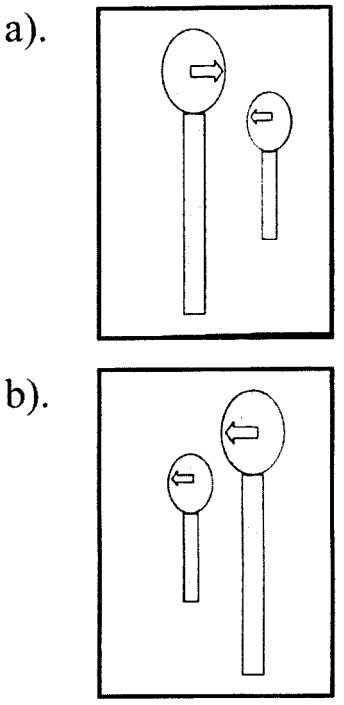

Figure 7. Schematic representations of the most frequent representations of the Madonna and Child at the beginning of the Renaissance (top) and at the end of the Renaissance (bottom).

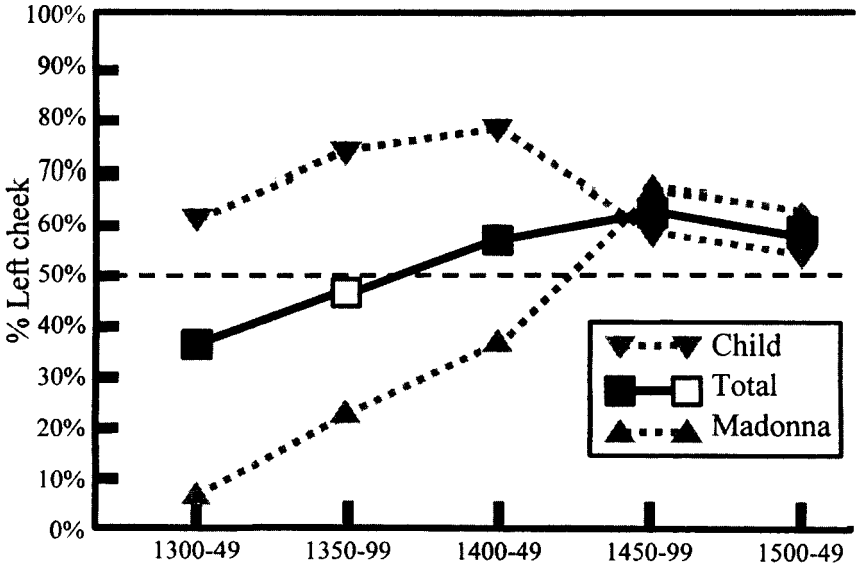

Figure 8. The percentage of portrayals of the Madonna and Child in which the Madonna, the Child and the Madonna and Child combined show the left cheek.

expected to be looking at her child, now also shows her left rather than her right cheek. However, the Child, who in the early Renaissance tends to return the gaze of the mother by showing his left cheek, continues to show his left cheek, and therefore looks *away* from the mother, which gives such images an awkward appearance. The compositional solution, often found at the end of the Renaissance, was either to have the Madonna and the Child looking at another figure, perhaps a well placed Saint, or the Infant St John. Alternatively it was to have the child holding an object towards which he is looking, perhaps a goldfinch, a book or a rose. Although these devices solve the compositional problems, they do not explain why the problem arose in the first place. The answer to that may lie in the changing status of the Virgin Mary.

The Cult of the Virgin Mary

The status of the Virgin Mary in Catholic theology is complex, and can only be touched upon here, but is discussed in detail elsewhere.[37–41] The important thing for understanding the changes in the pictorial representation of the Madonna and Child is the phenomenon known as the Cult of the Virgin Mary. Fundamental to Roman Catholicism is the doctrine of Original Sin, which all individuals have from conception onwards. To begin with, the only exception to this doctrine was Christ himself, since he was conceived not of man but of the Holy Ghost. In particular, as was emphasized by St Augustine (AD 354–430), the Virgin Mary was *not* an exception to the rule of Original Sin. During the 6th and 7th centuries, the Western and Eastern churches of Rome and Constantinople were splitting apart, and about AD 700, the Eastern Church began to celebrate a festival of the conception of the Virgin Mary. It should be emphasized however that this festival did not suggest that the conception of Mary was immaculate, and Mary would still have been seen as subject to the doctrine of Original Sin. In the 11th century, the Normans were in Sicily where there were also large numbers of Greeks celebrating the rites of the Eastern Church. With the invasion of England by the Normans, the Eastern Churches' festival of the conception of the Virgin Mary spread from Sicily to England, and thence to France, Germany and eventually Italy. In Italy, it caused much embarrassment, since it had mutated at some point to become the festival of the *immaculate conception* of Mary, an idea strongly opposed to church doctrine. The festival developed a populist momentum, and despite attempts by St Bernard (ca 1140) to neutralize it by declaring the Virgin Mary to be a Saint, the movement could not be stopped, despite the efforts of the thirteenth century church, including that of St Thomas Aquinas. The movement continued in the ensuing years, and further devices, such as suggesting that Mary was cleansed of Original Sin during her intra-uterine life were not sufficient to halt it; after a while it was supported even by scholars such as Duns Scotus

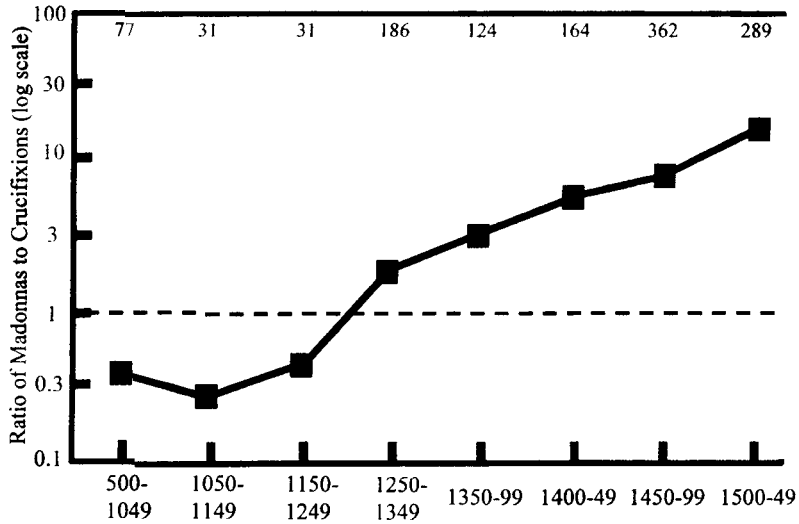

Figure 9. The ratio of portrayals of the Madonna and Child to those of the Crucifixion in the Mediaeval Period and in the Italian Renaissance. Data for the Renaissance are from the eight volumes of Berenson, and for the Mediaeval Period from the publicly displayed collections of the British Museum and Victoria and Albert Museums, and from three major reference works.[53–55]

(AD 1265–1308). The belief was then taken up by the Franciscans, after which it was only a matter of time before the Immaculate Conception became official church dogma, although that occurred only in 1854.

The effect of the Cult of the Virgin Mary on painting can readily be seen in Figure 9, which shows a rapidly rising proportion of paintings of the Madonna and Child compared with those of Crucifixions. The challenge therefore is to see whether the Cult of the Virgin Mary, which clearly developed throughout the Renaissance, can also explain the changing portrayal of the Madonna and Child, and in particular the shift of the child from the left to the right side.

At the beginning of the Renaissance, the two figures of the Madonna and the Christ Child are very different in status; Mary is an ordinary mortal, subject to Original Sin, whereas Christ was conceived immaculately and is the Son of God. It is clear which is the more important, the Christ Child, and since he is very different from the artist he is, therefore, like Christ in the Crucifixion, portrayed showing his left cheek. Since it makes sense for Mary to look at the Child and the Child to look at Mary, the child is therefore held on Mary's left side, and Mary, who is of less importance than Christ, has, *faute de mieux*, to show her right cheek. However, as the Renaissance progresses, and Mary is perceived, by popular acclamation as conceived immaculately, so she becomes of equivalent status to

that of the Christ Child. The immediate requirement is that since neither Mary nor the Child is now like the artist, then both should therefore show their left cheeks. If, however, the Child were to continue to be held on the left of Mary, then Mary would be looking away from the child, which would make little pictorial sense. The solution, as we have seen, is to move the child to Mary's right side, which immediately solves the problem of Mary otherwise looking away from the child, but introduces the new problem of the Child looking away from his mother. The introduction of some other object into the left hand foreground, be it saint, donor or a physical object, then solves that problem; the standard composition of the Madonna and Child at the end of the Renaissance has come into being.

Experimenting with the left and right cheeks

The analyses in this paper so far have been entirely descriptive. However, in principle it ought to be possible to carry out experimental analyses of the meaning of pictures showing the right or the left cheek. I did this many years ago in two experiments, which were never published (Ref. 24, ch. 14). The design of each study was similar. Subjects saw a series of slides of portraits, which were projected either as they were painted or with left/right reversed and so shown in mirror image (so that those painted showing the left cheek now showed the right cheek, and vice versa). Subjects rated their perceptions of the pictures using a semantic differential technique, in which there were 20 pairs of adjectives, such as good–bad, strong–weak or spiritual–physical. As is common in such studies, three factors were found to underlie the 20 judgements, which were labelled Evaluation, Dynamism, and Spirituality.

Since some subjects saw a picture showing its left cheek, and other subjects saw the same picture showing the right cheek, it is possible to compare the judgements, to see whether the left and right cheeks have different meanings to a typical viewer (the subjects in the studies were undergraduates who were not studying art history). The results were extremely straightforward: although there were clear differences in perception between the different portraits (some depending on head tilt[42] and head canting[43]), the judgements showed no difference at all according to whether, in the version seen by the subjects, a portrait showed its right or its left cheek.

At first sight that result seems to throw the 'like-self unlike-self' hypothesis into some doubt. However further analysis showed a much more intriguing result. Although subjects reported no difference in the perception of portraits, which were presented as showing the right or the left cheek, when the analysis was repeated in terms of *the cheek the artist had chosen to portray*, the portraits originally showing the right cheek were regarded more positive and more dynamic

than those showing the left cheek. In other words, even though viewers could not ascribe a difference in meaning to left and right cheek versions of the same picture, the artists had used the right and left cheeks differently. Clearly such a result needs repeating (the results of Schirillo[44] are a partial replication), but the findings do suggest that the cheeks may have different meanings, at the least to the artists themselves.

The origin of the meaning of left and right

If the 'like-self unlike-self' theory is correct (and even if it is not, then the large-scale changes in the use of left and right in paintings still need to be explained), there still remains one particularly difficult question, of why it is the *left* cheek that is associated with 'unlike self', and the *right* cheek that is associated with 'like self'.

Left and right have symbolic meanings in many societies,[45] so-called dual symbolic classifications. Even in classical Greece, the founts of rational, philosophical and scientific thought are everywhere touched with right–left symbolism.[46,47] Pythagoras said one should enter a sacred place from the right, which is the origin of even numbers, and leave from the left, which is the origin of odd numbers. In the *Metaphysics*, Aristotle describes how the Pythagoreans identified ten first principles, which were listed in the two parallel columns shown in Table 2, and which prominently include right and left. Right and left also have different meanings in a range of other cultures. For instance, Needham[48,49] has analysed the right–left symbolisms of the Purum,[50] a tribe living on the Indo-Burmese border, and found a host of left–right symbolisms, which are

Table 2. The ten Pythagorean principles described by Aristotle.

Limited	Unlimited
Odd	Even
One	Plurality
Right	**Left**
Male	Female
At rest	In motion
Straight	Crooked
Light	Darkness
Good	Evil
Square	Oblong

Table 3. The dual symbolic classification of the Purums in relation to right and left.

Right	Left	Right	Left
Male	Female	Kin	Affines
Masculine	Feminine	Private	Public
Moon	Sun	Superior	Inferior
Sky	Earth	Above	Below
East	West	Auspicious	Inauspicious
Life	Death	South	(North)
Good death	Bad death	Sacred	Profane
Odd	Even	Sexual Abstinence	Sexual activity
Family	Strangers	Village	Forest
Wife givers	Wife takers	Prosperity	Famine
Gods, Ancestral spirits	Mortals	Beneficent spirits	Evil spirits, ghosts
Back	Front		

summarized in Table 3, and show a striking similarity to the Pythagorean symbolisms. Western churches are also a rich source of symbolisms, which Sattler[51] has summarized in the diagram shown in Figure 10.

The first anthropologist to think seriously about the meaning of left and right was Robert Hertz,[52] who in 1909 published a monograph on the symbolism of left and right across a series of geographically and culturally disparate societies.

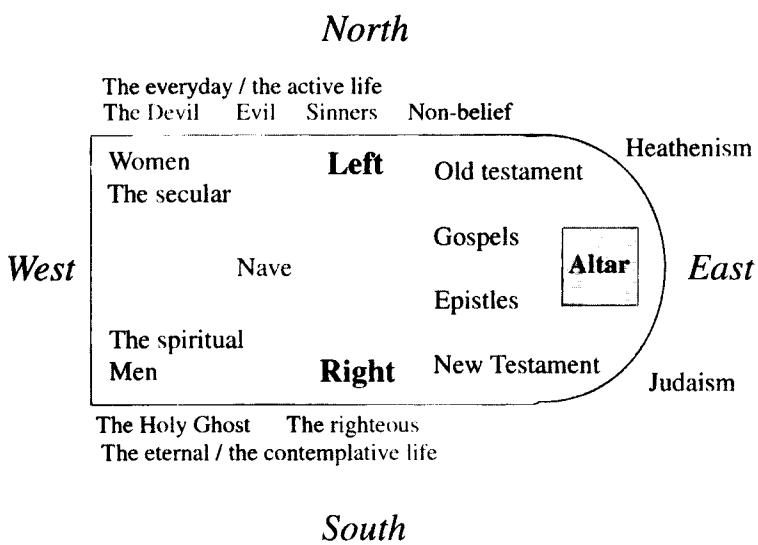

Figure 10. The symbolic meaning of the left and right sides of a Christian Church. Based on Sattler.[51]

Hertz's earlier work had studied funerary and mortuary practices in a similar way, and he had then been struck by the sheer variety of different ways in which humans dispose of their dead. It is therefore all the more powerful a conclusion when Hertz realized that there is universality in the meanings that societies attribute to right and left; everywhere, in all societies, it is the case that right equates to good and left to bad. As he puts it in his almost poetic introduction,

> To the right hand go honours, flattering designations, prerogatives: it acts, orders, and *takes*. The left hand, on the contrary, is despised and reduced to the rôle of a humble auxiliary: by itself it can do nothing; it helps, it supports, it *holds*.[52]

Hertz understood biology, and he realized that the universal symbolism of right and left must inevitably tie in with the universal predominance of right-handedness over left-handedness (and there is no known society in which the majority of people are left-handed rather than right-handed).[11] As Hertz puts it, 'We must therefore seek *in the structure of the organism* the dividing line which directs beneficent flow of supernatural favours towards the right side' (my emphasis); in other words by their handedness, and directly following on from that, from their brain asymmetry. Why most humans are right-handed is another story, and not one to be told here. What does matter for present purposes is that right–left symbolisms are not arbitrary, but are constrained by biology, and by a biology that extends back not merely to asymmetries of behaviour, but to asymmetries of the brain, to asymmetries of viscera (such as the heart), and indeed to asymmetries of the chemicals of which life is built, such as amino-acids and sugars.[11]

Conclusions

Symmetry is a wonderful theoretical concept for science, providing structure, organization and simplification for a host of complex, apparently unrelated phenomena across many disciplines. However, seductive though symmetry is as a concept, there is much evidence that not only is *asymmetry* found in the sub-atomic world of physics, and throughout the biological world at all levels, from biochemicals to brains, but that asymmetry is also exploited and developed in the arts as well. Symmetry, although mathematically fascinating, also has a coldness, a rigidity, a fixity, a sense of stasis, which is less interesting, less attractive, indeed less beautiful than asymmetry. Too much asymmetry is however mere chaos. Asymmetry, when it is used in the arts, is used to season symmetry. The *ur*-structure of much art, just as in biology, is symmetry, but some asymmetry is added to that symmetry to generate interest and excitement, for a little asymmetry, correctly used, makes objects optimally satisfying. When artists do use asymmetry they must also make choices; as symmetry can break in several

different ways. Even left–right symmetry can break in two ways, to left and to right, and an intriguing finding is that there are large-scale historical continuities in the ways artists choose to use left or right. The Italian Renaissance, with its large number of pictures portraying similar subject matter in the context of a well-understood theology, provides a good situation for studying such asymmetries. The origins of the symbolic meanings attached to left and right are not entirely clear, but probably have a universal human component, driven by the universal human predominance of right-handedness, which in turn is driven by brain asymmetries, body asymmetries and chemical asymmetries. However, without an understanding of the deep mathematical structures of symmetry we would not be able to realize how asymmetry is generated. Symmetry and asymmetry are therefore an essential dialectic for both science and aesthetics.

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References

1. H. Weyl (1952) *Symmetry* (Princeton, NJ: Princeton University Press).
2. D. Schattschneider (2004) *M.C. Escher: Visions of Symmetry*, Revised edn (London: Thames and Hudson).
3. G. Polyà (1924) Über die Analogie der Kristallsymmetrie in der Ebene, *Zeitschrift für Kristallographie*, **60**, 278–282.
4. D. K. Washburn and D. W. Crowe (1988) *Symmetries of Culture: Theory and Practice of Plane Pattern Analysis* (Seattle: University of Washington Press).
5. E. H. Gombrich (1979) *The Sense of Order* (London: Phaidon).
6. N. Thiobodeau and C. Martindale (2004) The psychological reality of the 17 plane symmetry groups, *Proceedings of the XVIII Congress of the International Association of Empirical Aesthetics*, Lisbon, pp. 664–667.
7. B. Grünbaum (1993) Interlace patterns in Islamic and Moorish art. In G. C. Shephard (Ed), *The Visual Mind* (Cambridge, MA: MIT Press), pp. 147–155.
8. B. Grünbaum, Z. Grünbaum and G.C. Shephard (1986) Symmetry in Moorish and other ornaments, *Computers & Mathematics with Applications Part B*, **12**, 3–4, 641–653.
9. D. Frey (1949) Zum Problem der Symmetrie in der bildenden Kunst, *Studium Generale*, **2**, 268–278.
10. J. Schummer (2003) Aesthetics of chemical products: materials, molecules, and molecular models, *HYLE – International Journal for Philosophy of Chemistry*, **9**, 73–104.

11. I. C. McManus (2002) *Right Hand, Left Hand: The Origins of Asymmetry in Brains, Bodies, Atoms and Cultures* (London, UK; Cambridge, MA: Weidenfeld and Nicolson/Harvard University Press).
12. R. Arnheim (1986) *New essays on the psychology of art* (Berkeley: University of California Press).
13. H. Wölfflin (1952) *Classic Art: an Introduction to the Italian Renaissance*, translated by P. and L. Murray (London: Phaidon).
14. A. Stewart (1990) *Greek Sculpture: An Exploration* (New Haven: Yale University Press).
15. E. H. Gombrich (1982) *The Image and the Eye. Further Studies in the Psychology of Pictorial Representation* (London: Phaidon).
16. E. H. Gombrich (1984) *The Sense of Order*, 2nd edn (London: Phaidon).
17. S. Kauffman (1996) *At Home in the Universe* (London: Penguin)..
18. S. A. Kauffman (1993) *The Origins of Order: Self-organization and Selection in Evolution* (New York: Oxford University Press).
19. B. Berenson (1950) *Aesthetics and History* (London: Constable).
20. B. Berenson (1957) *Italian Pictures of the Renaissance: Venetian School*, 2 vols (London: Phaidon).
21. B. Berenson (1963) *Italian Pictures of the Renaissance: Florentine School*, 2 vols (London: Phaidon).
22. B. Berenson (1968) *Italian Pictures of the Renaissance: Central and North Italian Schools*, 3 vols (London: Phaidon).
23. B. Berenson (1967) *The Italian Painters of the Renaissance* (London: Phaidon).
24. I. C. McManus (1979) *Determinants of Laterality in Man*. Unpublished PhD thesis, University of Cambridge.
25. I. C. McManus and N. K. Humphrey (1973) Turning the left cheek, *Nature*, **243**, 271–272.
26. O. J. Grüsser, T. Selke and B. Zynda (1988) Cerebral lateralization and some implications for art, aesthetic perception, and artistic creativity. In I. Rentschler, B. Herzberger and D. Epstein (Eds) *Beauty and the Brain. Biological Aspects of Aesthetics* (Basel: Birhauser Verlag), pp. 257–293.
27. M. E. R. Nicholls, D. Clode, S. J. Wood and A. G. Wood (1999) Laterality of expression in portraiture: putting your best cheek forward, *Proceedings of the Royal Society of London, Series B*, **266**, 1517–1522.
28. C. ten Cate (2002) Posing as professor: laterality in posing orientation for portraits of scientists, *Journal of Nonverbal Behavior*, **26**, 175–192.
29. M. LaBar (1973) Turning the left cheek examined using modern photography, *Nature*, **245**, 388.
30. N. Konstom (1977) Rembrandt's use of models and mirrors, *Burlington Magazine*, **99**, 94–98.
31. M. E. R. Nicholls, D. Clode, A. K. Lindell and A. G. Wood (2002) Which cheek to turn? The effect of gender and emotional expressivity on posing behavior, *Brain and Cognition*, **48**, 480–484.
32. N. K. Humphrey and I. C. McManus (1973) Status and the left cheek, *New Scientist*, **59**, pp. 437–439.

33. P. Blount, J. Holmes, J. Rodger, M. Coltheart and I. C. McManus (1975) On the ability to discriminate original from mirror-image reproductions of works of art, *Perception*, **4**, 385–389.
34. L. Salk (1973) The role of the heartbeat in the relations between mother and infant, *Scientific American*, **228**(May), 24–29.
35. J. S. Sieratzki and B. Woll (1996) Why do mothers cradle babies on their left?, *Lancet*, **347**, 1746–1748.
36. D. C. Shorr (1954) *The Christ-Child in Devotional Images in Italy during the XIV Century* (New York: Glickstadt Press).
37. G. Ashe (1976) *The Virgin* (London: Routledge and Kegan Paul).
38. M. P. Carroll (1986) *The Cult of the Virgin Mary* (Princeton University Press).
39. A. Lagarde (1915) *The Latin Church in the Middle Ages* (Edinburgh: T & T Clark).
40. E. O'Connor (1967) Immaculate conception. In *A Catholic Dictionary of Theology* (London: Thomas Nelson).
41. M. Warner (1976) *Alone of all her Sex. The Myth and the Cult of the Virgin Mary* (London: Weidenfeld and Nicolson)
42. A. Mignault and A. Chaudhuri (2003) The many faces of a neutral face: head tilt and perception of dominance and emotion, *Journal of Nonverbal Behavior*, **27**, 111–132.
43. M. Costa, M. Menzani and P. E. R. Bitti (2001) Head canting in paintings: an historical study, *Journal of Nonverbal Behavior*, **25**, 63–73.
44. J. A. Schirillo (2000) Hemispheric asymmetries and gender influence Rembrandt's portrait orientations, *Neuropsychologia*, **38**, 1593–1606.
45. R. Needham (1973) *Right and Left: Essays on Dual Symbolic Classification* (Chicago: University of Chicago Press).
46. I. C. McManus (1976) Scrotal asymmetry in man and in ancient sculpture, *Nature*, **259**, 426.
47. I. C. McManus (2004) Right-left and the scrotum in Greek sculpture, *Laterality*, **9**, 189–199.
48. R. Needham (1958) A structural analysis of Purum society, *American Anthropologist*, **60**, 75–101.
49. R. Needham (1979) *Symbolic Classification* (Santa Monica, California: Goodyear).
50. T. Das (1945) *The Purums: An Old Kuki Tribe of Manipur* (Calcutta: University of Calcutta Press).
51. J. B. Sattler (2000) *Links und Rechts in der Wahrnehmung des Menschen: Zur Geschichte der Linkshändigkeit* (Donauwörth: Auer Verlag).
52. R. Hertz (1960) *Death and the Right Hand* (Aberdeen: Cohen and West).
53. J. Beckwith (1970) *Early Christian and Byzantine art* (Harmondsworth: Penguin Books).
54. P. Lasko (1972) *Ars Sacra 800–1200* (Harmondsworth: Penguin Books).
55. M. Rickert (1954) *Painting in Britain: The Middle Ages* (Harmondsworth: Penguin Books).

About the Author

Chris McManus is Professor of Psychology and Medical Education at University College, London. He is author of *Right Hand, Left Hand*, which was awarded the 2003 Aventis Prize and is co-editor of *Laterality*. He is a Fellow of the International Association for Empirical Aesthetics.