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Abstraction in art with implications for perception

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The relationship between people and art is complex and intriguing. Of course, artworks are our creations; but in interesting and important ways, we are also created by our artworks. Our sense of the world is informed by the art we make and by the art we inherit and value, works that, in themselves, encode others' world views. This two-way effect is deeply rooted and art encodes and affects both a culture's ways of perceiving the world and its ways of remaking the world it perceives. The purpose of this paper is to indicate ways in which a study of abstraction in art can be used to discover insights into, to quote the call for papers for this issue, 'our perception of the world, acquired through experience' and 'the way concepts are formed and manipulated to achieve goals'.

Keywords: art; abstraction; perception; abstract art; painting

1. INTRODUCTION

A story is told about a meeting between Picasso and an American soldier stationed in France during the Second World War. The soldier took Picasso to task for not producing realistic pictures and, to illustrate the ideal from which Picasso has fallen so far short, he pulled out a photograph of his fiancée back home saying: 'This is what a picture should look like'. Picasso looked carefully at the photograph and said: 'Your girlfriend is rather small, isn't she?' (recounted in Solso 1996).

This story reminds us that all artworks, all pictorial representations, are abstractions. Picasso makes the point about size, but similar points can be made about the soldier's fiancée's stillness, lack of a third dimension, and so on. However, as we will see, these abstractions do not detract from a picture's ability to represent reality, but are inextricable from the power of these representations. This point is made explicitly in a parable by Jorge Luis Borges, in which a group of cartographers make increasingly larger, more accurate maps of their mythical country until they finally arrive at a full-size completely detailed map (Borges 2000). This final map, this entirely non-abstracted map, is completely useless to all but lovers of the art of cartography, and, at the end of the tale, this super-map is left tattered and rotting in the desert. It is difficult to decode the irony in the parable's title: 'On Exactitude and Science'. The story may be a critique of science as a way of describing the world or it could be read as saying that exact sciences must be built on inexact representations. In either case, there is a sure insistence on the need to abstract away from exactitude if we are to arrive at meaningful representations.

This paper considers abstractions and the meaningfulness of representations. In particular, it concerns dis-

cussions of abstraction and representation in art, and the implications of these discussions to the sciences of minds and brains. Several psychological accounts are enumerated and discussed uncritically. It is not the purpose of the paper to evaluate these accounts, but only to suggest ways that the accounts could be used as part of an exploration of how abstraction is applied in forming our perception of the world and in manipulating concepts to achieve goals. The only ambitions for this paper are: (i) that the reader will come away with a sense that studying abstraction in art can shed light on the issues of perception and concept manipulation; and (ii) that he or she will gather some clues as to where to begin that study. The first section gives a brief history of abstraction in art; this is followed by a section concerning relations between that art history and issues about minds and brains.

2. WHAT IS ABSTRACTION IN ART?

The word 'abstract' comes from the Latin *abstrahere*, which means to draw away. The connotations of the word and its cognates can be either negative—as in the use of 'abstracted' for 'absent-minded'—or positive—as in the 'abstract universal truths' that are the theorems of geometry. The question of value is a matter of what has been left behind, and what we are left with after the drawing away: the abstracted man has left the world behind; the abstract truth has left behind all vagaries and contingencies. The tradition of abstraction in art is a series of attempts towards something approaching the second example.

Since at least the eighteenth century, the contention that an artist has used abstraction in creating a work of art means that he or she has uncovered the essence of a thing (Morgan 1994). The artist is thought to arrive at this essence by throwing away everything that is peculiar to a particular instance of an object or a particular moment of time, leaving only the essential, universal properties of the object or scene. The history of art is filled

One contribution of 16 to a Theme Issue 'The abstraction paths: from experience to concept'.

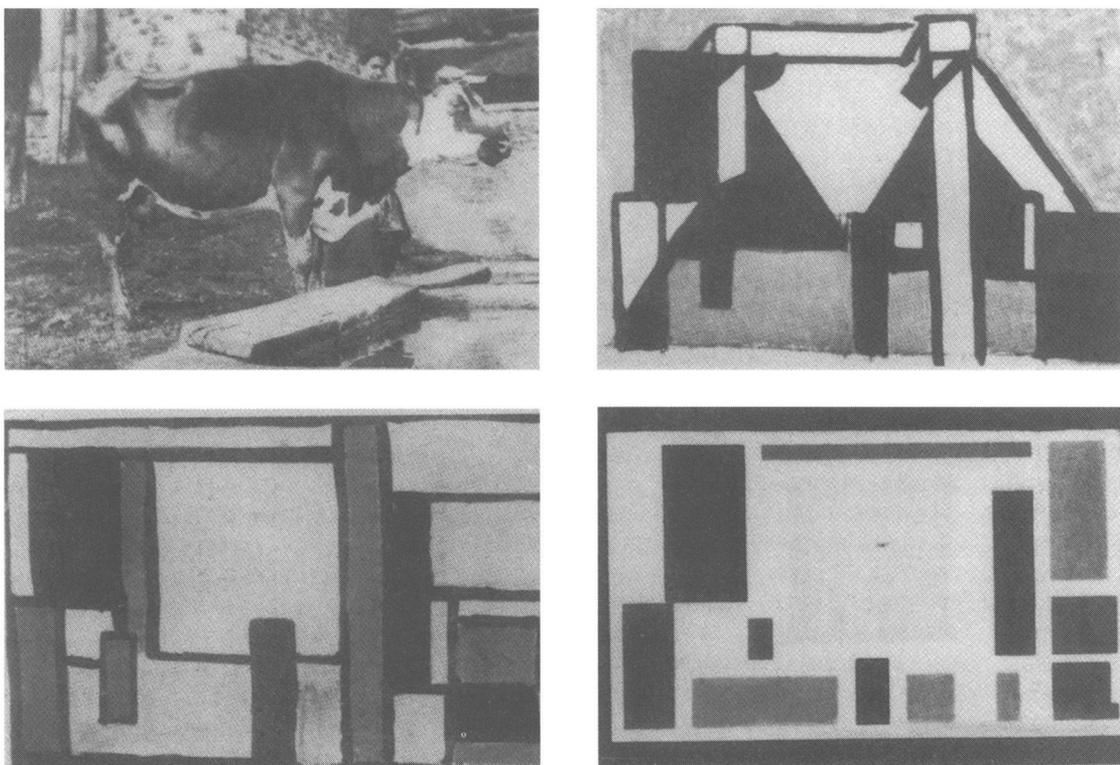


Figure 1. Theo Van Doesburg, *An object aesthetically transfigured*. (First published in Van Doesburg 1925.)

with restatements of this point. For example, Matisse wrote: 'Underlying this ... superficial existence of things ... one can search for a truer, more essential character, which the artist will seize so that he may give to reality a more lasting interpretation' (Matisse 1978).

The status of this essential thing that the artist wishes to seize is much debated, and the question had a certain urgency in the nineteenth century. To Schopenhauer, for example, the essence is the Platonic Ideal, an ideal figuration that predates all specific instances (Schopenhauer 1958). To Hegel, the 'essence' or 'universal idea' is something man-made; he writes of the process of abstraction as allowing painters to recreate 'the existent and fleeting appearance of nature as something generated afresh by man' (Hegel 1975). The Hegelian view currently holds sway, and fits better with the project that underlies this paper.

As is made clear in the Hegel quotation, abstraction did not at first entail a move away from the figurative. However, once the process of abstraction is to the fore, the goal of capturing the essence of an object becomes something different from painting the most accurate, most detailed, likeness. This in turn opens up the possibility of a sequence of moves progressively away from direct figurative art. The history of much of nineteenth- and twentieth-century European painting can be mapped out in this way: as bridges, cathedrals and trees become patches of colour in Impressionism, these patches become objects in their own rights in Pointillism and beyond that to pure geometric abstraction.

Something akin to this history can be glimpsed in a series of studies made by Theo van Doesburg, an early abstractionist painter and organizer of the abstractionist magazine *De Stijl*, in 1919.

In figure 1, the sequence from the upper left picture to the lower right one is a clear development from a naturalist picture of a cow to a geometric composition. The assumption behind this sequence is that what is essential to the original picture not only remains as we move through these stages, but is in fact enhanced, or concentrated by the removal of what is inessential. The implication is that this essence is most powerfully expressed through the language of geometry.

At some point, this language of geometry takes on its own concreteness. Van Doesburg came to view 'Concrete Art' as a more fitting description of his style of painting than 'Abstract Art'. Similarly, Mondrian wrote: 'Abstract art is concrete and, by its determined means of expression, even more concrete than naturalistic art' (Mondrian 1945, p. 19). Max Bill put it even more strongly: 'Concrete art is the opposite of abstract... Concrete is the 'representation' of something that was previously not visible, not palpable... The purpose of concretion is to translate abstract ideas into reality so that they can be perceived...' (quoted in Madrazo 1998).

This is a fascinating turnaround. The claim is that non-figurative paintings are not more abstract versions of a real world but more concrete versions of mental constructs. The relation between the abstract ideas and the palpable world is quite left behind here. That relationship, however, is central to this paper, and studying these abstract or concrete paintings will bring insights into what Bill has forgotten: that is the relationship between abstract ideas and the world from which they have sprung.

3. PSYCHOLOGY AS ART

Having surveyed the role of abstraction in art, this section turns to studies of the relations between art and

minds and brains. The section is still focused on abstraction, with the intention of deploying psychological accounts of abstraction in art to help answer questions concerning our perception of the world. The study of the relationship between art and perceptual psychology has an active and distinguished history and is presently enjoying a vogue. There is not the space to survey the whole subject here but, as much of the major thinking on the subject will be redeployed in this paper, it is hoped that the paper will give the reader some sense of the field.

(a) *Schemata*

We begin with a discussion of the work of Sir Ernst Gombrich, who has written extensively on the links between perception and art. The main plan of his programme is to apply principles of perception to gain an understanding of the production and reception of artworks. Within Gombrich's work lies an undercurrent that, in parallel to the goals of this paper, moves in the opposite direction, suggesting that the main findings will force a reconsideration of the psychology of perception. This is sometimes said explicitly and sometimes less so, as in the following:

[T]he true miracle of the language of art is not that it enables the artist to create the illusion of reality. It is that under the hands of a great master the image becomes translucent. In teaching us to see the visible world afresh...'

(Gombrich 1960)

The artwork trains the viewer—it teaches him or her to see the 'world afresh'—and, as Gombrich makes plain throughout his work, the painter has been trained by looking at other paintings. Half of *Art and illusion* is an exploration of the ways that artists' perceptions of the world are informed by interpretations that are founded on the schemata (strategies of interpreting and recreating the world) that they have learned from other art and modified. As Gombrich writes, '...the simple demand "paint what [you] see" is self-contradictory'. What the painter sees is always dependent on his learned schemata. Gombrich traces this right through the history of art: 'primitive artist[s] built up], say, a face out of simple forms rather than copy a real face,' 'Egyptians [represented] in a picture all they knew rather than all they saw', going on through the Renaissance and on to Impressionism. This insistence that the artist needs to interpret nature is matched by Gombrich's stress on the viewer's need to work at an interpretation of the artwork: 'the beholder's share in the readings of images, his capacity, that is, to collaborate with the artist and to transform a piece of coloured canvas into a likeness of the visible world.'

Both kinds of interpretive work are quite active. Gombrich follows Karl Popper in critiquing a view of mind in which sense impressions are passively received, only later to be worked upon. Theories must be, subconsciously, hypothesized before anything can be perceived; what is perceived is either a corroboration or a refutation of the theory. Perception is a process of matching a simple visual scheme with the sensory images: 'Without some initial system, without a first guess to which we can stick unless it is disproved, we could indeed make no "sense" of the millions of ambiguous stimuli that reach us from our

environment.' (Gombrich 1960). In the case of painting, this means that there cannot be such a thing as a direct copy of nature. To depict nature faithfully, a painter first needs to have the schema in his mind. Thus, the artist 'begins not with his visual impression but with his idea or concept', meaning that 'every artist has to know and construct a schema before he can adjust it to the needs of portrayal'. The mental abstractions that lead to the creation of abstract paintings, are not just immanent in the things being abstracted but are somehow derived as a function of both the thing and the worldview of the beholder.

The theme of analysing the effort needed to decode an artwork is common throughout much of the work on art and minds. For example, Max Bill writes: 'Art is unthinkable without the effort of the individual. Order on the other hand is impossible without an objectifying structure. This means that art can originate only when and because individual expression and personal invention subsume themselves under the principle of order of the structure and derive from it a new lawfulness and new formal possibilities' (Bill 1965, p. 151). Bill's insistence on structuring as a fundamental part of perceiving the artwork is a keystone of Gestalt Psychological accounts of art, which obtain their most direct exposition in Kepes (1947). In the introduction of that book, Kepes writes: 'The experience of an image is ...a creative act of integration. Its essential characteristic is that by plastic power an experience is formed into an organic whole. Here is a basic discipline of forming, that is, thinking in terms of structure, a discipline of utmost importance in the chaos of our formless world'. The perception of an artwork is an active process of abstracting an ordered structure from the formless.

(b) *Gestalt psychology and art*

The writings of Bill and Kepes show that applying gestalt principles to abstract art is a way of discovering things about abstraction in perception. R. Arnheim, through a long and active career, has trodden this path well; for example, see Arnheim (1954, 1969). The work that, perhaps, follows this path most faithfully is *Perceptual abstraction and art* (Arnheim 1947).

In that article, Arnheim looks first at the drawings of young children. What he finds is that a portrait drawn by a small child tends to be less a likeness of a particular person, than a generic head. The child has more easily come to terms with what we may term the more general qualities of heads, such as roundness, than with the details of a particular head. One possible explanation put forward for this is that children may draw more from memory than from perception. Arnheim dismisses this explanation by appeal to what is known about children's minds, namely that children rely more than adults on direct perceptual experience. The argument that Arnheim favours is that perceptual abstraction is, in fact, a basic operation. The child, and this does not just apply to children, perceives the abstraction more readily than the particular.

If this is so, it seems to sit uneasily with the history of abstraction in art given above. In that account, it would appear that abstracting is quite a sophisticated operation that appears at a later stage of cultural development than naturalistic perception. However, the history looks very different if we take a longer view, including early and

non-European art. Much of the art that is looked on as 'primitive', and thought of as poor attempts at naturalistic representations, is more correctly looked upon as abstract representations in themselves. Artworks produced by early cultures, as well as those produced by children, show much higher degrees of abstractness than the work of the European Renaissance. It is worth noting that many twentieth-century painters were inspired both by children's drawings and by tribal art. Picasso, for example, admired children's art and kept a collection of African masks, the influence of which is apparent in many of his paintings and sculptures. Abstraction, then, is a quite fundamental perceptual operation. This leads to a gestalt-inspired theory of perception in which the abstract is perceived first and the particular derived later. That Arnheim sees this as applicable to human perception in general is clear: 'In the field of art—and this is probably true also for the psychology of thinking—highly abstract forms appear at the most primitive stages'.^{1,2}

The parallel implicit in Arnheim between the development of child art and the evolution of art through history—this artistic *ontogeny recapitulates phylogeny* law—is controversial. The weight of argument is against it in its strongest form: many of the child's developmental changes appear to relate more to the child's intentions than to limitations in his or her cognitive structures, and a society's predominant artistic modes are complicated cultural constructs. However, as J. Gavin Bremner points out: 'There are strong arguments to support the hypothesis that cultural evolution is closely tied to cognitive evolution of the individuals within it. Assuming that this is true, there may still be an important sense in which the evolution of art occurs on a developmental sequence, not because it reflects directly the developing cognitions of the artist, but because it reflects an adaptation to the developing demands of cultures that are evolving new ways of thinking about the world' (Bremner 1996, p. 151).

Even without the assumption of comparability between the development of a culture and the development of a child, there is a strong argument here that attention paid to certain artworks—the work of children and tribal cultures—can change radically the view of what abstraction is. Here, the account changes the view of abstraction as a highly developed skill to a view of abstraction as a primal part of perception.

(c) *The principles underlying art*

Where Arnheim applies principles gleaned from Gestalt psychology to understand the making and the beholding of artworks, Vilayanur Ramachandran, an eminent neurologist, has turned the process around and has been looking to the history of art to help inform a theory of mind. The hope is that this theory will, in turn, lead to a well-founded theory of aesthetics. Ramachandran and William Hirstein set out eight principles as the laws that subconsciously underlie the production and perception of all art (Ramachandran & Hirstein 1999). The authors see their rules as playing a role analogous to that played by the linguistic rules uncovered by Chomsky and his followers. The article has generated a good deal of commentary, and two issues of the *Journal of Consciousness Studies* are half-filled with other people's discussions of Ramachandran and Hirstein's ideas (Ramachandran & Hirstein 1999;

Ramachandran 2000). At least four of Ramachandran and Hirstein's principles seem pertinent for our discussion:

- (i) the beholder's ability to group parts of a picture, viewing them as a whole;
- (ii) the 'peak shift' principle;
- (iii) the beholder's tendency to isolate a single cue when looking at a painting;
- (iv) the pleasure people find in solving problems.

The first of these is related to the Gestalt work already discussed; the second principle is the one that is perhaps most interesting: it is certainly the one that is treated most extensively in the paper and the one that has generated the most controversy. To understand this principle, consider the following experiment: a rat is put in an environment consisting of full food bins labelled by 3 in × 5 in (1 inch = 2.54 cm) rectangles and empty bins labelled by squares. Not surprisingly, the rat will easily learn to seek out the rectangles. What is surprising, though, is that given a choice between a 3 in × 5 in rectangle and a rectangle that is a bit longer—and therefore a bit further from being a square—the rat will prefer the longer rectangle to the one on which it has been trained (Hansen 1959). Ramachandran and Hirstein see this as a principle that works throughout art creation and reception: we are drawn to exaggerations. Consider one of their examples: the sculpture shown in figure 2.

The sculpture is made attractive by exaggerating the features—both in terms of the figure and of the pose—that differentiate women from men. In essence, the sculpture is a caricature of a woman. One of the principal arguments of the Ramachandran and Hirstein paper is that all art has an aspect of caricature about it, to take advantage of a peak-shift effect with people.³ If conceptual abstractions match artistic ones, this theory suggests that conceptual abstractions contain exaggerations of the most important features of what is being abstracted.

The question for art, at least, is: how can you decide what features should be exaggerated? The answer is: find the things that sum up the essence of your subject. And these are, as it is in all caricature, the things that are furthest from some sense of normality, some anchor point. In standard facial caricatures, this anchor point is taken to be an average face. In the example in figure 2, the anchor point is an average body. This may limit the applicability of the theory. As Christopher Tyler notes in a review of the article: 'For each kind of enhancement, this explanation requires that one identify both the form of the anchor point and the appropriate direction away from it, which may not be so easy for landscapes or scenes of particular human activities' (Tyler 1999, p.163).

Whatever the limitation, Ramachandran, as he spells out in his reply to Gombrich's criticism of the paper with Hirstein, sees this principle as an explanation of all abstraction, including non-figuration, in art (Ramachandran 2000). The argument begins with an observation that Niko Tinbergen made of seagull families (Tinbergen 1954). Tinbergen noticed that young seagull chicks learn to peck at a red spot on their mothers' beaks to beg for food. Having learned this, the chicks will then peck with equal vigour at a red dot painted on a plank. Surprisingly, it turns out that the chicks will actually peck



Figure 2. A Chola period (*ca.* eleventh century) statue of the Goddess Parvathi. (The statue is in the Ramachandran collection; the picture is reproduced from the *Journal of Consciousness Studies* 6, 1999, with permission from Imprint Academic.)

more vigorously at a stick with three red stripes than they will at the stick with the red spot. Ramachandran argues that three red stripes is a caricature of a red spot to seagull chicks. This example shows that a caricature need not be easy to detect consciously. The inference that for seagull chicks the red stripes are a caricature of a red spot is based on an assumption that the chicks have no reason to be hungrily pecking at anything other than their mothers' beaks. The situation with people is considerably more complex. Purely abstract, geometrical pictures could well be caricatures for anything we find attractive in the real world. This offers possibilities for exploring the connections between the human visual and limbic systems by, in part, exploring abstract art. This exploration might involve, for example, checking for similar brain reactions to some real world referents and some pure abstractions.

(d) *Isolating cues*

The third of Ramachandran and Hirstein's principles listed above is that isolating a single modality can intensify the interest of a work. Ramachandran and Hirstein take preferences for outline drawings over detailed pictures as evidence for this principle. There is, for example, considerable pleasure in simple Matisse paintings and collages. Looking at such simple abstracted representations

can help us understand this mental principle, and perhaps, too, something about the functions of brains.

Indeed, this principle parallels the arguments about brain function and art put forward by another eminent neurobiologist who has turned his attention to the perception of art: Semir Zeki. Zeki, who is a leading figure in the study of the human visual system, discusses the perception of art in terms of the processing that the perception entails through various areas of the visual cortex of the brain (Zeki 1998a). The main processing is done in the region called V1. The importance of V1 to vision has been known for some time. What has been discovered more recently (by Zeki among several others) is that V1 is surrounded by, and connected to, other regions—called V2–V5—that are largely responsible for very specialized visual processing. V1 acts as a sorting office that sends signals to the appropriate specialized visual regions, which act in parallel but not in synchronicity (Zeki 1998b). For example, adequate colour vision is not possible without a functioning V4, and V5 is necessary for effective processing of movement. This brain modularization can provide a mechanism for the kind of abstraction that accompanies isolating cues. It also suggests that aesthetics is also modular. Both Zeki and Oliver Sacks have written about the same patient, *Jonathan I*, who is an artist who, as the result of an accident, suffered damage to V4 and is unable to perceive (even to perceive *of*) colour (Sacks 1995; Zeki 1999). This changed the kinds of art he appreciated and the kinds of art he produced. But the modularity of vision/art allowed him to develop a new black and white painting style in which colour is abstracted away.

(e) *The visual system as artist; the artist as neurologist*

Zeki's analysis of art and the brain uncovers deep parallels between the functions of the human visual system and the functions of an artist. Zeki sees the main function of both as making a timeless sense of a continually changing environment. Again, this is a kind of abstraction. The real essence of the scene must be kept, while the distracting vagaries are thrown away. The visual system needs to do this with the most fundamental of judgements. For example, to perceive something as being coloured red requires the discounting of a large variation in the actual wavelengths of light that our visual system receives.³ *Art and the brain* is largely an exploration of how both artists and human brains achieve this kind of abstraction. By exploring this coincidence much can be learnt about the brain: '... I hold the somewhat unusual view that artists are neurologists, studying the brain with techniques that are unique to them and reaching interesting but unspecified conclusions about the organization of the brain' (Zeki 1998a). Studying the works of these artists allows us to discover these 'interesting but unspecified conclusions' about the brain. For example, the Fauvist group of painters produced some works that are natural in outline but painted in peculiar colours. The relationship between these paintings and abstraction is interesting. Rather than abstracting away any properties, by re-colouring the objects they stand out in new ways. It turns out that the mental processing of these paintings involves different parts of the brain than the processing of naturally coloured

paintings. The implications of this fact for our understanding of the brain are profound. Exploring how minds and brains react to the perceptual experiments (what Zeki calls 'techniques unique to [artists]') inherent in some abstract art will lead to new insights about perception and conceptualization.

(f) *Perceptual problem solving*

Returning to Ramachandran and Hirstein, one of the principles enumerated above remains unexplored: perceptual problem solving as reinforcing. The principle states that a picture whose interpretation requires the solution to a puzzle can be more alluring than one whose meaning is direct. This principle is given surprisingly short shrift in the article: indeed, there is no section about it in the main body of the text. As Tyler laments in his review of the article: 'Had they included the section, perhaps it would have included an extensive analysis of how the principle accounts for many of the diverse manifestations of 20th century art . . . Th[e] effort [required to solve perceptual problems] itself forms an essential component of the artistic experience; by slowing down the perceptual processes of decoding the art work the viewer becomes aware of their evolution and interplay over time, and then experiences a sense of achievement when the full composition falls into place (or of continued mystery if it does not)' (Tyler 1999, p. 164).

The puzzles may not only slow down the apprehension of a painting, but may also provide the beholder with a more obviously active role in the encounter.⁴ For example, consider Briony Fer's account of a Malevich abstract painting '*Black Square* powerfully expresses the fantasy of a place of origin without actually inhabiting it. By fantasy I mean [following (Laplanche & Pontalis's 1998) reading of Lacan] the putting in place of a scenario in which the spectator must play an active role. Human figures and objects have been expelled from the pictures but there is always at least one body which remains in this scene and that is the spectator's' (Fer 1997, p. 10). This may go some way to explaining the will to abstract in the first place and the sense of getting lost in an artwork.

4. CONCLUSIONS

This paper is part of a larger project, involving several people at Goldsmith College, exploring relations among computing, the arts, and cultural and psychological studies; for descriptions of other parts of this project see Zimmer (2003). In this paper, relations between art and psychology have been studied, with a particular focus on how abstraction features in both. The paper was never meant to be conclusive; it was intended to raise new questions. The main ambition for this paper, as set out in the preamble, is to give the reader a sense that studying abstraction in art can shed light on the issues of perception and concept manipulation.

The main method used was to review accounts of abstraction in art and accounts of the psychology of art, and extract from these guidance towards the ways we can attain new insights about perceptual abstraction by studying abstraction in art. Gombrich provided the idea that the mental abstractions that lead to the creation of abstract paintings are not immanent in the things being abstracted,

but are somehow derived as a function of both the thing and the worldview (or schemata) of the beholder. This can lead to explorations of how these schemata interact with the perception of the world. Various Gestalt theorists were seen to consider the perception of art as an active process of structuring and organization, and concluded that applying Gestalt principles to abstract art could be a way of discovering things about abstraction in perception. Arnheim followed this path and discovered, among other things, that abstraction is a surprisingly basic part of perception. Ramachandran and Hirstein demonstrated that the use of the peak-shift principle could explain the way abstractions exaggerate important features. This may lead to an explanation of all non-figurative art and may point to particular connections between perceptual abstraction and brain function. These connections can be explored by checking for similar brain reactions to some real world referents and some pure abstractions. Following Zeki, we inferred that the notion of modularity in the brain leads to modularity in aesthetics, and certain kinds of modular abstractions. Artists were viewed as experimental epistemologists, and studying their experiments can lead to benign perceptual pathologies that will raise new questions and bring a new understanding of brain function and conceptualization.

ENDNOTES

¹The idea that a child grasps global class characteristics first and differentiates only secondarily finds echoes in J. J. Gibson's work on vision: 'The progress of learning is from indefinite to definite, not from sensation to perception'.

²In a related argument, Colin Martindale uses the peak-shift principle to explain the evolution of painting styles (Martindale 1990).

³It should be noted, in parallel to the Gombrich work on schemata discussed above, that the ability to make this judgement is dependent on the beholder having been raised in an environment with red things and in a culture that classifies red in that way.

⁴For an account of the active role of the spectator in interactive, primarily digital, art, see Zimmer (2003).

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