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Commentary on Zeki's *Inner Vision*

The late vision theorist David Marr identified three levels of explanation that he argued needed to be addressed in order to understand vision[1]: (i) the psychological, functional or computational level of processes; (ii) the physical or neurological which is the level of explanation employed by Zeki; and (iii) the algorithmic – the level of implementation. For Zeki's purpose of drawing upon vision-theory in order to better understand art and aesthetics, there is no need to focus on the third level. I would argue however that in order to draw upon brain science to understand art, the first two levels of explanation are necessary.

The relationship between psychological processes and neurology is not symmetrical. Neurological findings provide the explanatory constraints of psychological explanation, if you like. However, in order to understand what visual processing needs to do in order to work for us, we need to discuss vision at the psychological-computational level. For example, psychologists and computationalists involved in developing theories of object recognition reason that considering that the information picked up by the retina amounts to varying light intensities and that the output of vision is a form which can be differentiated from a background and recognised, that somewhere in the visual process there are principles of form which constrain and contribute to the construction of form. These principles of form are very interesting to aestheticians concerned with the nature of aesthetic form and beauty. Zeki, on the other hand, adheres to the neurological data which at this stage is silent on

[1] Marr, David. (1982). *Vision*. New York: W.H.Freeman and Company. p.27

how visual form is constructed from the various independent processes engaged in processing colour, line and motion. Consequently, Zeki's expertise can be drawn upon for understanding art work which exploits shallow levels of visual processing like Mondrian and Malevich but in order to understand artwork which may exploit higher level processes like the principles of form construction, Zeki would need to consider psychological vision-theories. And his contribution to the latter would be to sort through incompatible theories according to which were compatible with the neurological data.

For example, Picasso's typical early (analytic) cubist works[2] define the surface and volume of figures according to their smallest perceivable units. These units are defined by either the slightest change in surface orientation or a change in direction of central axis. Eventually (in what is known as his synthetic cubist works) he began to distort these units in relation to the main axis of the object or figure, so that a unit might be turned 45 or so degrees, or enlarged. Because in these synthetic works the principal axis was left intact, we are still able to recognize the figure or object. In some of his post-cubist works he actually moves the parts around as well as changing their axes, surface orientations and volumes. The distortions that Picasso imposes on the objects and figures in his paintings and drawings during this phase of his career are largely distortions of the units of a form description; that is, a distortion of relative volumes and the angle at which units are related to the whole. They involve perceiving the image in terms of its shape primitives (axes and volumetric parts), and then distorting the way these elements are combined. Picasso, during his cubist phase, violated to varying degrees, the principles underlying perceptual form construction.

The above explanation of cubism draws upon computational vision theory to describe the features of cubism in terms of the elements processed by vision. Zeki by

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[2] This does not include Les Demoiselles of 1907 which is a precursor to cubism and strangely seems to embody a synthesis of what was to develop as the aims of both analytical and synthetic cubism.

contrast engages in some spurious speculations about cubism's aims, none of which seem specifically derived from his neurological studies but rather from certain art critics' opinions. According to Zeki, the aim of vision is to gain knowledge about the world. At a shallow level of processing, this information is extracted in a piecemeal fashion, with colour, line and motion extracted by separate and independent processes. Zeki claims that art's main purpose (one is not sure whether he thinks himself prescribing or describing art) is the same as vision's; to gain knowledge of the world which it does via a breakdown of visual elements into basics (in art this is the equivalent of seeking the essence of things according to Zeki). This claim seems respectable in his discussion of Mondrian and Malevich which is enlightening. But this is because these artists' works promote a focus on the output of shallow visual processing, the very level about which neurology has something to say. When he attempted to discuss cubism, on the other hand, his analysis was forced; quite apart from the fact that he referred to Picasso's analytical cubist work *Man with a Violin* of 1912 as later than his synthetic cubist work *Frauenbilnis* (Portrait of a Woman) of 1940, (pp.53-54). His discussion of the artwork of Vermeer, Michelangelo and Monet were similarly uninformed by his neurological students in any interesting way.

The lesson to be learnt from this is that given neurology's current knowledge base regarding vision, if one is to rely solely on this level of explanation for explaining art, then one should only attempt to explain that art which exploits those processes about which neurology has something to say. Mondrian and Malevich are good examples which Zeki does discuss, and so might he have applied his specialist knowledge to the work of Jackson Pollock and his ilk.

For the philosopher who draws upon vision-theory in order to reconstrue philosophical problems in more fruitful and illuminating ways, Zeki's work offers some assistance in deciding between incompatible vision theories. For example, Zeki tells us

that there are cells responsive to view-invariant aspects of an image and also those that are responsive to view-dependent aspects of an image, the latter by far the most prevalent. The presence of cells that are responsive to view-invariant aspects of the image suggests that structural theories of object recognition (see Glyn Humphries et al[3]) are vindicated while the presence of cells responsive to view-dependent aspects of the image vindicates image-based theories of object recognition (see Michael Tarr et al[4]). Remember I said earlier that theories of object-recognition are conceived at the level of psychological and computational explanation. According to image-based theories of object recognition, form recognition involves something like template matching with the retinal image. On the other hand, structural theories of object recognition involve a processing of form from primitives that are not based on the one view-point, such as for example, volumetric and orientational primitives. Humphries had already suggested that view-invariant cells may be responsible for object recognition (recognising within-object relations) while view-dependent cells may be primarily involved in recognising between-object relations (judging distances). The notion of cells specialised to recognise within-object relations, and hence able to decide which elements of a scene cohere within the one object, are very suggestive for the understanding of the nature of aesthetic form. Perhaps it is possible to exploit these principles so that the relations between shapes within a design or artwork actually engage those processes involved in apprehending within-object relations and hence result in the kind of visual coherence normally reserved for within object relations. Because of the extraordinary employment of these principles, they may come to our attention to be experienced as a

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3 Humphreys, Glyn W and Dietmar Heinke. (1998) 'Spatial Representation and Selection in the Brain: Neuropsychological and Computational Constraints'. *Visual Cognition*, 5:1-2, 9-47.
Humphreys, G., M.Riddoch, & M.Boucart. (1992). 'The Breakdown Approach to Visual Perception: Neuropsychological Studies of Object Recognition' in G. Humphreys (ed), *Understanding Vision, An Interdisciplinary Perspective*, Oxford: Blackwell.

4 Tarr, Michael J. & Heinrich H. Bülthoff. (1998). 'Image-based object recognition in man, monkey and machine'. Cognition, vol.67, 1-20.
_____.(1995). 'Is Human Object Recognition Better Described by Geon Structural Descriptions or by Multiple Views? Comment on Biedermann and Gerhardstein (1993)'. Journal of Experimental Psychology: Human Perception and Performance, vol.21:6, 1494-1505.

solution to a problem; the problem of constructing a coherent form from elements, which is the problem that vision is designed to solve.[5] Aesthetic pleasure may be the experience of perception as a solution to a problem. This also provides a clean way to differentiate between aesthetic and sensuous pleasures.[6]

In addition, Zeki's work vindicates the idea that vision involves an ascending level of processes, even though some levels consist of parallel processes; it vindicates the idea that the processing of colour, line and form are carried out in separate modules; and the fact that orientational primitives are the building blocks of form. It also suggests that somewhere in the system, the various elements are brought together so as to be apprehended as the one scene or object, although neurologists have not discovered the physical base of this yet.

I found the book valuable in promoting the idea that art making is constrained by perceptual processes and that art arguably exploits certain features of normal perceptual processing. However, in order to argue for or demonstrate the latter claim one would need to explain how art making and appreciation engages perceptual processes differently from the way they are engaged in normal object recognition and judging distances (the latter two refer to the kind of perceptual processes engaged in differentiating between food, predator and mate and just getting around in the world respectively). Zeki, however, settles for simply claiming at the end of a discussion of a certain brain activity, say that of processing movement, that the aesthetic appreciation of kinetic sculpture would be impossible without the brain's ability to process movement. This does alert us to the fact that there may be a connection between art appreciation and brain constraints but it does not explain this connection.

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5 McMahon, Jennifer (1999). 'Towards a Unified Theory of Beauty' in *Literature and Aesthetics*, Vol.9, 2-27;
_____ (forthcoming) *Aesthetics and Cognition in Visual Beauty. Towards a Unified Theory of Beauty.*

6 McMahon, Jennifer (2000, forthcoming). Chapter on 'Beauty' in Berys Gaut and Dominic Lopes (eds), *The Routledge Companion to Aesthetics*, London; Routledge.

I found his book interesting for what it provided in terms of neurological evidence for certain aspects of current psychological, computational theories of vision. However, I did not find the discussion illuminating to my understanding of art (his discussion of Mondrian and Malevich being a notable exception).