Erik Myin

Two Sciences of Perception and Visual Art

Editorial Introduction to the Brussels Papers

Two kinds of vision science are distinguished: a representational versus a nonrepresentational one. Seeing in the former is conceived of as creating an internal replica of the external world, while in the latter seeing is taken to be a process of active engagement with the environment. The potential of each theory for elucidating artistic creation and aesthetic appreciation is considered, necessarily involving some comments on visual consciousness. This discussion is intended as a background against which various themes of the papers light up.

Representational Science of Vision

In May 1999 a 'Cognitive Science Conference on Perception, Consciousness and Art' was organized at the Free University of Brussels (VUB). It consisted of two thematically overlapping parts, one on 'Perception and Consciousness' (see Myin (in press, b) and the other on 'Perception and Art'.

The rationale for the conference was the enormous expansion in the science of perception in the last decades. As readers of this journal are well aware of, the study of visual perception is a blossoming field. Ever finer methods of directly observing the brain, and the use of these in contexts borrowed from experimental psychology, allow researchers to render transparent and peer into what used to be the black box of the brain. Indeed, the cognitive neuroscience of visual perception does not lack triumphant claims. It is widely believed that the overall architecture of the visual system is known, as a result of a kind of grand synthesis of research in computational vision, anatomy, physiology and empirical psychology. Two concepts dominate this research: the notion of *pathways* or *modules*, and the notion of *representation*. These two concepts ground the hope for a deep connection between the representational science of vision and the art of visually representing. Therefore, it seems good to probe a bit deeper into the motivation for each of them.

Journal of Consciousness Studies, **7**, No. 8–9, 2000, pp. 43–55

Both notions flow from the basic assumption that the visual stimulus is *ambiguous* and *fragmented*. It is *ambiguous* because, in principle, multiple and different distal stimuli can give rise to the same proximal stimulus. For example, a large square at a distance can project exactly the same image on the retina as a small square nearby. According to representationalists, this failure of one-to-one mapping between the distal and the proximal shows that vision requires internal computational processes, whereby additional knowledge, often considered to be 'inborn', is used to disambiguate the stimulus. The output of such a process is a re-representation of the proximal stimulus in a unequivocal format that truly codes for the distal stimulus (in the example given, it represents the square truly as either large or small). According to the classical view, perceptual input information is also *fragmented*. Fragmentation applies at a variety of levels. Input is not only fragmented over different sensory organs, the organs in one modality also come in pairs (think of the nose as two nostrils). Moreover, within every sensory organ, the input is spread out over thousands, if not millions of receptors.[1]

The representational solution for the problem of fragmentation lies in the notion of representation itself. It is assumed that the brain casts its representations in a certain code or form. It is at the level of this code that brain processes communicate and understand each other's computational products. Naturally then, it is at this level that the perceptual scientist must aim, rather than at the underlying processes that (merely) instantiate this code. This basic idea of a code underlies various representationalist alternatives: for 'symbolists' it is the level of structured items such as recursive lists; for connectionists, the code is constituted by the activation vector of a relevant set of neurons; for at least some neurophysiologists, the code is constituted by the receptive field properties or feature detecting propensities of the neurons that are activated at any moment in the brain.[2]

The representationalist account of the enormous and rapidly growing empirical evidence about the visual brain has stabilized into a fairly standard picture. The basic tenets of it are that the visual system is organized along what could be called a horizontal and a vertical dimension. In the vertical dimension, different stimulus attributes such as form, colour, motion and depth are computed, with some degree of independence or at least segregation (cf. for example, Zeki, 1993). The organization along the horizontal dimension is postulated because it is believed computations within every vertical module are carried out in stages. Early processes compute 'intermediate representations' which are then sent as output to further processes, with iteration. Representations are believed ever to become more powerful: while at early stages they code for simple stimulus features such as orientation or direction of movement, at later stages they code for three dimensional layout, or conceptual category.

---

[1] For some reason or other, even deeper levels of subcellular fragmentation are never considered. For a recent theory of perception without any fragmentation, see Stoffregen and Bardy (in press). Some of the points made later in this introduction are borrowed from my commentary on that paper (Myin, in press, a).

[2] See Shanon (1993) for more on the idea of a code, its crucial role in the representationalist tradition and a penetrating criticism of that tradition.

Of course, the actual theories presented, or, as is often the case, implicitly assumed, have various additional features. For one thing, information stream and influence between horizontal modules is assumed to occur in both an upward and a downward direction (a point stressed heavily, for example by Churchland, 1995). Moreover, there is mostly assumed to be a higher level of vertical organization, in which groups of modules cooperate. For example, there's the idea of basically two vertical streams, one dedicated to spatial aspects of visual perception, the other aimed at more abstract conceptual classification and recognition (Ungerleider and Mishkin, 1982). For a more recent and somewhat divergent version, cf. Milner and Goodale (1995).

It is quite natural that such a grand picture of what has become to be called 'the visual brain' (Milner and Goodale, 1995) is taken to have tremendous potential for understanding visual art. Many possibilities open up. An initial one flows from the notion of representation: given that both the brain and the artist are in the same business of representation, perhaps the overt representing of the artist is highly constrained by how the brain represents the visual world internally. Art could be classified in respect to how successful it is in manipulating the brain's representational schemes. The artist can then be portrayed as a kind of experimental psychologist who probes the visual system with pictures (Latto, 1995; Solso, 1994; Zeki, 1999). The modularity of vision leads to the related idea that different art styles could be correlated with different stages in there presentational cascade (Latto, 1995;Willats, 1997; Zeki, 1999). Their differences and specific characteristics could be accounted for in terms of their latching on exactly to any of the representational formats the brain is intrinsically using to represent visual scenes. 'Isolating' and uniquely stimulating one module by carefully selecting what she puts on the canvas, might in itself be a way for an artist to create unusual experiences of heightened intensity (Latto, 1995, p. 88; Ramachandran and Hirstein, 1999; Zeki, 1999). Relatedly, the artist might aim for and achieve her aesthetic goals by over-stimulating along a certain dimension of representation (Latto, 1995, p. 88; Ramachandran and Hirstein, 1999).

Alternatively, artists might not only be exploiting the visual system positively, but also taking advantage of some of its 'shortcomings' in order to obtain some effect or other. For example, Margaret Livingstone has argued that the dynamic impression of Mondrian's *Broadway Boogie Woogie* might be an effect skilfully obtained by casting yellow borders in low luminance contrast on a white background (Livingstone, 1988, p. 73). As the vertical spatial module is supposed to be fairly insensitive to such type of contrast, this creates the impression of uncertain and thus jumping borders (Livingstone, 1988).

Despite the almost universal acceptance of the representationalist paradigm as a framework for understanding visual perception, it faces many unsolved problems.

At the conceptual level, representationalism is vulnerable to a double-edged criticism: there seem both to be too *many* persons in the representationalist's brain, while at the same time, the most important person *seems to be missing*. The first aspect concerns the question whether it is really legitimate to explain the

end-product of perception, a person's representation of the world, in terms of sub-personal processes of the same kind, thus concerns the legitimacy of the very notion of internal representation itself (Ryle, 1949; Wittgenstein, 1953; Shanon, 1993). Simply stated, this objection goes as follows: we understand how whole persons interact with, look at or understand scenes or pictures, but how can we postulate that a somewhat downscaled version of this process goes on in the brain — when one functional unit handles the representational output of another one — without introducing the dreaded homunculus, or whole teams of them? The reverse side of the problem is that there seems to be a person *missing* too. In the computational interplay of these myriad representations, where is the conscious perceiver? A general tenet of the reprentationalist's theory is that only some representations are 'selected' for consciousness, while the others perform their jobs in the experienceless caves of the unconscious. Various answers have been proposed from within the representationalist tradition to the question of what this 'selection for consciousness' comes down to, from an avowed mysterious notion of 'projection' into consciousness of selected representations (see Jackendoff, 1987; for a neurobiological version, see Zeki, 1993) to a notion of a distinctive functional role played only by those representations that become conscious (see, for a philosophical version, Rey, 1993; for a psychological version, Baars, 1988).

Another family of problems that the representationalist faces could be called problems of *representational explosion.* Even if we forget for a moment about unconscious processes, and only assume that the contents of consciousness need to be built up out of underlying representations, we already encounter this problem in an acute version. For any focal content of consciousness seems to be possible only against a 'background' of memories, expectations, affections, etc., that give a precise and distinctive meaning to the focal content. If this background is to be modelled in representationalist terms we seem to open the door for a regress. On the other hand, if it doesn't, this shows there is a level of representation or intelligence that can be modelled *without* invoking representations, and then the question arises whether this kind of analysis could not be applied to the original problem of focal consciousness itself. A problem related to this representational explosion is the famous 'binding problem', how to account for the synchronic integration of all the fragmented modular contents (cf. Crick and Koch, 1990, in which it is suggested that synchronization of neural spiking frequencies in the 40 Hertz range is the solution). Moreover, though this seems less often noticed, the 'binding problem' has a diachronic aspect also. The contents of consciousness are not only bound in the synchronous dimension, but certainly also in the diachronous dimension. Consciousness is a *stream*, not a series of unconnected snapshots.

Because these problems potentially invalidate the whole representationalist framework, they are obviously indirectly relevant for its applicability to artistic phenomena. For one thing, if the representationalist framework is unfit to account for consciousness, it seems definitively the wrong choice to account for aesthetic perception, one of whose marks is an *intensification* of consciousness (cf. Mangan, 1999; Church, 2000). However, there are more direct challenges that

arise from considering how the representational framework can be and has been used to illuminate art.

One potentially problematic aspect of the explanation of art phenomena, as they have been offered from within the representationalist tradition, is that they typically concern fairly low level perception. Instead of being a deep problem, this might just be a reflection of the youthfulness of the cognitive neuroscience of vision. On the other hand, it might also be a diagnostic sign that the explanatory potential of the cognitive neuroscience of vision becomes increasingly less powerful when things get more complicated and, arguably, more interesting.

A probably more important and deeper problem is that there is a difference between 'goodness' for perception and 'goodness' for art and aesthetics. The ability of a stimulus to create a peak response in whatever area of the visual system might be an entirely different property from its capacity to create aesthetic appreciation. Indeed the former might neither be a necessary nor even a sufficient condition for the latter (a point recurring in the commentaries on Ramachandran and Hirstein, 1999, in *Journal of Consciousness Studies*, **6** (6–7) and in the current issue).

The difference between the areas of perception and aesthetics might also show up in the fact that the two areas face different 'binding problems': the binding problem of perceptual integration (seeing the world as not disintegrated) might be only a very low level aspect of — or even independent of — the 'structured unity' which we experience when perceiving art. Even if 'synchronization' in the brain were to supply a solution for the former problem, it might still not provide an answer to the latter question.

Nevertheless, either the representationalist tradition could find satisfactory answers to such criticisms, or, alternatively, it could find different ways to play an important role in the elucidation of art and aesthetics. Perhaps it could point out how some aspects of ordinary perception are crucially involved in aesthetic appreciation, perhaps in a transfigured form, or just as an aspect of a more complicated process created by the novel context of aesthetics. For example, perceptual 'binding' might play a crucial though somewhat different role in both perception and aesthetics.

Also, it should be borne in mind that at least some variants of the representational theory of mind are *very* ambitious. Building on the basic assumption that everything mental is to be accounted for in terms of brain-based representations, a tough-minded representationalist might hope for the discovery of the appropriate modular representational systems for art and aesthetics. Why not hope for an 'aesthetic representational module'? Art could then be elucidated by showing how this module interacted with different lower level modules and, perhaps, how the form of its representations — or of its representational primitives — constrain aesthetics. Of course, this might seem a non-starter because, if anything, aesthetic appreciation seems to lie at the extreme end of non-modularity. Everything one knows can affect one's aesthetic appreciation (Fodor, 1983). To give a rather

trivial example: a work might be considered mediocre until it gets looked at with different eyes because it is found out it is painted by an Old Master.[3]

In sum, the hope of applying the representational theory of vision in a fruitful way to art and aesthetics faces problems of two kinds. First, it might be questioned whether it will be applicable at all, and secondly, it seems that, if its applicability is granted, it cannot play the exclusive role some people want it to play. It seems clear it can only form part of an explanation. Extra explanatory force needs to come from other directions.

A Nonrepresentational Alternative

Though the representationalist framework has been and still is the dominant tradition in visual science, it has not been without contenders. In the latter part of the twentieth century, it has been subjected to vigorous philosophical criticism by philosophers such as Gilbert Ryle (1949) and Ludwig Wittgenstein (1953), and also by several philosophers in the phenomenological tradition, such as Maurice Merleau-Ponty (1945). In the field of visual science proper, the name associated most strongly with resistance to representationalism is that of James Gibson (1979). Gibson takes a fundamentally different approach towards visual perception by rejecting the — for the representationalist — fundamental notions of ambiguity and fragmentation. According to Gibson, the stimulus has these properties only when it is considered from the limited *spatial* perspective of the receptor's point of view, or from the limited *temporal* perspective of a single glimpse of a scene in an immobile posture.

The characteristic Gibsonian 'ecological' move is instead to consider vision and perception in general from the point of the whole perceiving organism, moving around in its environment. This nips the problem of fragmentation in the bud, because from the perspective of the whole organism, the stimulus is not fragmented. The problem of ambiguity is solved by bringing additional movements into play. The retinal projection of a large square at a distance and a small square nearby, after all, is no longer the same once the head is moved. External movements of the animal with respect to the perceived object replace internal inferential processes.

Having undercut their foundation, this view thus radically says goodbye to internal representations. Vision is not seen as building up an internal replica of the external, but as a process of resonating directly with the environment. Representations are replaced by 'invariants': robust patterns in the physical world that become accessible to the creature by actively exploring the world. For example, the distance of objects to the creature is grasped through patterns of 'optic flow', the patterns of expansion projected on the visual apparatus when objects are approached. Internal inferential processes and intricate learning are replaced by gradually becoming more sensitive to, by 'learning to pick up', those invariants (Gibson, 1979).

---

[3] This happened very recently in a small town near Brussels. A work in the local church, not considered particularly interesting, got reappraised after maintainance work uncovered Poussin's signature.

Gibsonian visual science has flourished ever since its inception as somewhat the official 'alternative'. Despite efforts to incorporate it into a representationalist perspective (Marr, 1982), it has remained a somewhat isolated strand of research with its dedicated set of followers, and its own journals, symposia, etc. Perhaps this picture is changing, as there is definitively a renewed and unprecedented surge of interest, if not in 'pure Gibsonianism', then certainly in the kind of approach advocated by Gibson. Partly arising out of intellectual dissatisfaction or the experienced inapplicability of the representationalist framework, researchers are stressing the importance for perception of 'embodied' activity in the real world, dynamical loops orbiting from the organism through the environment and back again (Hurley, 1998), 'active vision' in robotics (Blake and Yuille, 1992), or the importance of 'dwelling in the world' (Ingold, 1993).

A detailed theory of visual perception along these lines has recently been worked out by Kevin O'Regan and Alva Noë (in press a & b).[4] One of the cornerstones of this theory is formed by experiments in 'change blindness'. Typically, subjects in such experiments are shown successive pictures of scenes in which large changes have occurred. Much to their own surprise when later confronted with it, subjects seem unable to notice these changes, even when they are very big, sometimes making up more than thirty per cent of the presented scene. From such and other evidence, O'Regan and Noë conclude that the representationalist picture is false. Instead, they propose a conception of vision in which vision is more or less like *touch* (this metaphor is also used by Church, 2000). The eye is seen as 'a giant hand that palpates the environment' (O'Regan and Noë, in press b). Just as the haptically perceived object extends beyond the points where the fingers are in direct contact with it, so the visual world extends far beyond those few points where change blindness experiments have shown we are in direct visual contact with it.

The experience of a unified visual world 'out there', is thus not coming from a unified internal representation of it, but arises out of the implicitly mastered knowledge of what O'Regan and Noë call *sensorimotor contingencies.* Avowedly akin to Gibsonian invariants, these are regularities that pertain to the lawful interaction between light and objects, and objects and the moving perceiver. According to the theory, an organism sees an object as spherical, if it finds out that the stimulation by the object changes in certain lawful ways when either the object moves, the light changes, etc., or when the animal itself moves.

This approach to vision redefines the field in such a way that some of the pressing problems of the traditional approach either no longer arise or else have an obvious solution. Consider for example binding (cf. O'Regan and Noë, in press b, and Myin, in press a). On the one hand, there is no longer conceptual space to formulate the problem in its original form, because vision is no longer seen as the result of an interplay of internal representations. The problem of the unity of the subjective experience of the visual world becomes the problem of integrating

[4] Kevin O'Regan and Alva Noë were both speakers at the 'Perception and Consciousness' part of our conference (cf O'Regan and Noë, in press a; Noë, in press). Through a somewhat lucky coincidence,this journal does contain a paper by Alva Noë on art (Noë, 2000).

one's capacities to interact with the world when guided by one's visual apparatus. It is concerted activity, rather than an internal process like sychronization, that unifies experience. This seems to be borne out by evidence from psychopathology and experimental psychology. As an example of the former, hemineglect can be considered. According to one well-established theory of hemineglect (the condition in which patients neglect the existence of everything on one side in their world, including their body), the problem is due to an attentional deficit, rather than an inability to represent the world (Kinsbourne, 1995). Patients with hemineglect are simply no longer motivated to interact with anything on (usually) the left side of their world, because they are over-attentive to what happens on the other side. Additional evidence comes from famous experiments with distorting goggles (cf. O'Regan and Noë, in press b, and Hurley, 1998, for references and discussion). It appeared that when wearing goggles that distort the retinal image, by turning it upside down or mirror reversing it, people first experienced the visual world as distorted. But after a while, as they relearned how to carry out their normal everyday activities, their visual world returned to normal. This in itself shows the decisive role of action in subjective experience. What is particularly telling, however, is that, before complete adaptation was achieved, there sometimes was disunity in consciousness. A car, for example, was seen in its normal position, but the letters on its licence plate were distorted. The occurrence of disunity in experience was correlated with the different degree to which different capacities had returned to their normal level of functioning — thereby proving directly that behavioural integration is the key to experiential unity. For discussion, see Hurley (1998), pp. 347–8; O'Regan and Noë (in press b).

What about consciousness? Consciousness can be seen as a particular capacity for interacting with the world, with features such as flexibility, integratedness and goal-orientation, in humans certainly partly due to language. Being a capacity of the whole person, or whole organism, the double problem of the missing person and the homunculus is evaded. The experiencing person is there, not in the brain, but 'out in the open', as an embodied mind interacting with its environment (cf. Hurley, 1998). Because no attempt is made to reduce experience to computational processes in the brain, no homunculi are posited. Of course, much more needs to be said, but at least there seems to be potential here.

Is there potential to illuminate art also within this tradition? A first aspect to notice is that this approach in any case appears to be able to do justice to an aspect of art that is quite out of reach for the representationalist: the 'material aspects' of art, which are of extreme importance to both the artist (cf. Ione, 2000) and the spectator (cf. Kindy, 1999). If perception is seen as a process of actual interaction between a perceiver and the object of perception, rather than as an internal process in the perceiver's brain, all the aspects that shape this interaction might become important. Artists recorded self-reflections often testify of an extreme sensitivity to very subtle effects of light, reflection and texture. Monet, Cézanne and Van Gogh's repetitive depictions of the same scenes in different lighting conditions show how strong this preoccupation can become (see Hardin, 2000, on Monet; Ione, 2000, on Cézanne).

The materiality of art matters also to the spectator. It is what confers individuality on the exposed work, tying it to the specific viewing conditions of the place and time of exposition (cf. Noë, 2000). These 'external' conditions might, either by deliberate anticipation by the artist, or by historic contingency, become part of the art work itself.[5] Reflecting on these aspects, Julia Kindy (1999) remarked:

> Painting and sculpture must be experienced in their actual form and not in reproduction. One can never understand the all-encompassing, radiant atmosphere of a Mark Rothko painting, for example, unless standing in front of it. The scale alone of a Rothko canvas is meant to relate directly to the body, so that the painting can be 'absorbed' by more than the eyes. It is a direct physical experience. Looking at a reproduction is meaningless (p. 63).

Kindy's observations concern not only the materiality of the product of the artistic creation, but the full concreteness of the viewing situation. It seem natural to approach the process of creation from this more encompassing perspective too, and the nonrepresentational approach seems to invite us to do so. For if vision is not a phenomenon just going on 'inside' the artist's head, but rather is a process of give and take with the environment 'out there', and if the precise form of the interaction shapes the experience, this might give an unprecendented role of importance to the tools the artist uses in forging this interaction. The pencil, the palette, the canvas and its texture, sketches, even the record of preceding works, might all be seen to play an essential and irreplacable role in the very seeing and creation of something seeable. Indeed, once vision is brought back into the world, the process of creating might be brought back into the world with it. Laying out his general nonrepresentational theory of perception and cognition, Timo Järvilehto offers us the following description, eminently applicable in the present context:

> Let's look at the action of an artist when he is preparing a piece of art. Where is 'painting' located when the fine movements of the hand and fingers create a picture on the canvas? In the brain, in the hands, in the paintbrush, or on the canvas? If we destroy some of these elements it becomes more difficult to create this piece of art. Some of the elements may be more easily substituted than some other, but in the act of painting they are all necessary. Can we say that the process of painting is located in the part which seems to be most active or important?
>
> No, of course not, because painting is a process which is realized as a whole organization of elements which are located in different parts of the world. This organization is realized as a totality in the painting. If some element, even a very tiny one, was missing the painting would not be the same or it would not be ready at all. Therefore, all elements are active in relation to the result of action; none of them is passively participating in the result (Järvilehto, 1998, p. 331).

---

[5] Both the sensitivity for the material aspects andfor the viewing conditions under which works would be exposed was present to an extreme degree in the work of Jan Van Eyck. At the conference, this was shown in a visually compelling way by Marc De Mey and Erwin De Nil (De Mey & De Nil, 1999). Unfortunately, the dependence on computer-created illustrations and 3-D animations made it impossible to consider their presentation for inclusion in this issue. The self-consciously anticipated merging of artwork and environment is also discussed in this issue by Alva Noë in the contemporary context of Richard Serra's sculptures (Noë, 2000).

Most of the papers in the original issue of *Art and the Brain* (see *Journal of Consciousness Studies*, **6** (6–7), 1999) show that most people who have reflected on art and aesthetics feel a strong repulsiveness towards reductionism and fear that any approach to art from the perspective of visual science easily falls into reductionist traps. As is indicated by the quote from Järvilehto just given, the nonrepresentationalist approach towards vision, is inherently nonreductionistic. It is already so from the start, by conceiving of perception as the activity of the whole person. Some aspects of perception, including some aspects of aesthetic perception, might be explainable in terms of low-level organizational features of the visual system (think of Livingstone's explanation of Mondrian's creation of an impression of movement), but within the nonrepresentational framework such explanations remain incomplete when they are not related to the experience of the person. The artist experiments, observes certain effects and brings her judgment to pass on whether the technique that creates the effect is suitable for application. The visual system, rather than being a source of rigid constraints, becomes itself an exploratory tool, directed towards the goals the artist sets for herself. The plasticity of the visual system which is apparent in the experiments with distorting goggles, suggests that in the process of artistic creation and development, the artist might even recreate his tool and literally begin to see differently (as also suggested by the experiment described by Robert Solso's paper in this issue). In the end, the self-conscious perception and creation of the artist appear as ever more flexible capacities to modify lower level capacities.

A somewhat similar account might be true for aesthetic appreciation. Aesthetic value and the capacity to create and sense it, might be a self-standing capacity, a distinct way of interacting with an environment, arising out of, and deeply interconnected with other ways of interacting. The science of perception might elucidate it, but not in an hegemonic bottom-up way. Again, the science of perception might itself be elucidated by it. For if what was said above makes sense at all, our conceptions of aesthetic value might, in the intertwined process of organismic maturation and cultural assimilation, shape our perceptual apparatus itself.

The Papers

In her paper on Cézanne, Amy Ione highlights several of the themes discussed above in the light of the 'active' conception of vision. Approaching Cézanne both through his paintings and his writings, she unveils the delicate process in which, in her own words, 'seeing changes over time and the practice of art informs the entire brain over time'. The artist is both the subject and the object of this development. Ione's discussion establishes and vividly illustrates, among other themes, the importance of the body and in particular of touch for vision, and the role of experimenting and of finding novel ways of representing and of seeing itself.

Robert Solso invokes some highly interesting lines of experimental work in the neuroscience of art. Standard fMRI methods were used to observe an artist's brain while creating. Though, admittedly, the results obtained are not conclusive at this

stage, they do suggest that an experienced painter uses his 'visual brain' in a different way from the layman (an interesting extension would be perhaps to investigate whether the experienced art *consumer* would also show differences in brain response!).

Raf De Clercq approaches the question of the 'ineffable' character of art. Ineffability is almost universally agreed to exist, but notoriously resistant to explanation. De Clercq takes issue with a particular attempt at explaining ineffability, coming from cognitive science. The suggestion, made by Diane Raffman, roughly is that ineffability in art can be explained as the difference in 'grain' between pure and conceptualized perceptual experience. De Clercq shows that this move isn't valid, because it bypasses some of the characteristics which are present in aesthetic, but not in ordinary perception. He then suggests a way out, by applying Michael Polanyi's ideas on the structure of consciousness as having a dual focal/background structure.

Also writing from a philosopher's perspective, Jennifer Church analyses the phenomenon of 'seeing as'. She discerns a tension within the phenomenon of seeing as, because it requires both a conflict (something is seen both as what it is and as what it is seen as), and a convergence (nonetheless the perception is unified in space and time and in consciousness). Developing Kant's ideas on these matters, she gives an account of consciousness as emerging from the resolution of the two requirements of conflict and convergence. She discusses various solutions to the binding problem in the light of it. Finally, it leads her to an interpretation of aesthetic experience as a particular *intensification of consciousness*, thus both highlighting the particular nature of aesthetic experience and its relation to consciousness.

In his paper on colour, Larry Hardin shows how a particular scientifically successful theory of colour perception, opponent process theory, can explain aspects of artist's practice and viewer's reaction. He shows how painters often implicitly master regularities operative in perception and how they find delicate compromises between their goals and constraints set by their medium. For example, he shows how chromatic contrast sometimes is heightened to compensate for the material impossibility to achieve enough lightness contrast. He ends his paper with a speculation about the well-known 'warm–cool' contrast in colour perception. Building on recent experimental and theoretical work, he puts forward a speculation as to how this contrast might have a ground in hard-wired and phylogenetically old circuitry in the brain.

Acknowledgments

The conference could not have taken place without the financial support of the Ministry of the Flemish Community, Department of Science, Innovation and Media (agreement Caw 96/29b), the Flemish Fund for Scientific Research (FWO — Vlaanderen), the Free University of Brussels (Vrije Universiteit Brussel) and Professor Gosselin's Center for Empirical Epistemology, the Belgian National Center for Research in Logic (CNRL-NCNL), in particular Professor Jean Paul Van Bendegem, and the FWO Contact Group *History of Science*, in particular

Professors Marc De Mey and Fernand Hallyn. Finally, I am obliged to Kevin O'Regan for some very helpful last-minute advice.

Many thanks also to my co-editor Joseph Goguen and to Anthony Freeman for the very smooth and enjoyable cooperation during the preparation of this issue.

References

Baars, Bernard J. (1988), *A Cognitive Theory of Consciousness* (Cambridge: Cambridge University Press).

Blake, A and Yuille, A. (ed. 1992), *Active Vision* (Cambridge: Cambridge University Press).

Church, Jennifer (2000), '"Seeing as" and the double bind of consciousness', *Journal of Consciousness Studies*, **7** (8–9), pp. 99–111 (this issue).

Churchland, Paul. M. (1995), *The Engine of Reason, the Seat of the Soul: A Philosophical Journey into the Brain* (Cambridge, MA: MIT Press)

Crick, F., & Koch, C. (1990), 'Toward a neurobiological theory of consciousness', *Seminars in the Neurosciences*, **2**, pp. 263–75.

De Mey, Marc & De Nil, Erwin (1999),'Representation and reflection in Van Eyck: Varying sensibility to optics in early renaissance art'. Paper presented at the *Cognitive Science Conference on Perception, Consciousness and Art,* Centrum voor Empirische Epistemologie, Vrije Universiteit Brussel, 17–19 May 1999.

Fodor, Jerry A. (1983), *The Modularity of Mind: An Essay in Faculty Psychology* (Cambridge, MA: MIT Press)

Gibson, James J. (1979) *The Ecological Approach to Visual Perception* (Boston, MA: Houghton Mifflin)

Hardin, C. Larry (2000), 'Red and yellow, green and blue, warm and cool: explaining colour appearance', *Journal of Consciousness Studies*, **7** (8–9), pp. 113–22 (this issue).

Hurley, Susan (1998). *Consciousness in Action*. (Harvard: Harvard University Press).

Ione, Amy (2000), 'An enquiry into Paul Cézanne: The role of the artist in studies of perception and consciousness', *Journal of Consciousness Studies*, **7** (8–9), pp. 57–74 (this issue).

Ingold, Tim (1993), 'Technology, language, intelligence: A reconsideration of basic concepts', in *Tools, language and cognition in human evolution*, ed. Kathleen R. Gibson and Tim Ingold (Cambridge: Cambridge University Press).

Jackendoff, Raymond (1987), *Consciousness and the Computational Mind* (Cambridge, MA: MIT Press).

Järvilehto, Timo (1998), 'The theory of the organism-environment system: II. Significance of nervous activity in the organism-environment system', *Integrative Physiological and Behavioral Science*, **33**, pp. 331–8.

Kindy, Julia (1999), 'Of time and beauty', *Journal of Consciousness Studies* **6** (6–7), pp. 61–3.

Kinsbourne, Marcel (1995), 'Awareness of one's own body: An attentional theory of its nature, development and brain basis' in *The Body and the Self*, ed. José L. Bermúdez, Anthony Marcel and Naomi Eilan (Cambridge, MA: MIT Press).

Latto, Richard (1995), 'The brain of the beholder', in *The Artful Eye*, ed. Richard L. Gregory and S. Harris (Oxford: Oxford University Press).

Livingstone, Margaret S. (1988), 'Art, illusion and the visual system', *Scientific American*, **256**, pp. 78–85.

Mangan, Bruce (1999), 'It don't mean a thing if it ain't got that swing', *Journal of Consciousness Studies*, **6** (6–7), pp. 56–8.

Marr, David (1982), *Vision: A Computational Investigation Into the Human Representation and Processing of Visual Information* (New York: Freeman).

Merleau-Ponty, Maurice (1945), *Phénoménologie de la Perception* (Paris: Gallimard).

Milner, David A. and Goodale, Melvyn A. (1995) *The Visual Brain in Action* (Oxford: Oxford University Press)

Myin, Erik (in press, a), 'Fragmentation, coherence and the perception/action divide', *Behavioral and Brain Sciences*, **24** (1).

Myin, Erik, ed. (in press, b), *Perception, Action and Self-Consciousness*, Special Issue of *Synthèse.*

Noë, Alva (2000), 'Experience and experiment in art', *Journal of Consciousness Studies*, **7** (8–9), pp. 123–35 (this issue).

Noë, Alva (in press), 'Experience and the active mind', *Synthèse.*
O'Regan, J. Kevin & Noë, Alva (in press a),'What it is like to see: A sensorimotor theory of visual experience', *Synthèse*.
O'Regan, J. Kevin & Noë, Alva (in press b), 'A Sensorimotor Account of Vision and Visual Consciousness', *Behavioral and Brain Sciences.*
Ramachandran, V.S. and Hirstein, William (1999), 'The science of art: a neurological theory of aesthetic experience', *Journal of Consciousness Studies,* **6** (6–7), pp. 15–51.
Rey, Georges (1993), 'Sensational sentences', in *Consciousness*, ed. Martin Davies and Glynn E. Humphreys (Oxford: Blackwell).
Ryle, Gilbert (1949), *The Concept of Mind* (London: Hutchinson)
Shanon, Benny (1993), *The Representational and the Presentational: An Essay on Cognition and the Study of the Mind* (New York: Harvester Wheatsheaf).
Solso, Robert L. (1994), *Cognition and the Visual Arts* (Cambridge, MA: MIT Press).
Solso, Robert L. (2000), 'The cognitive neuroscience of art: A preliminary fMRI observation', *Journal of Consciousness Studies*, **7** (8–9), pp. 75–85 (this issue).
Stoffregen, T.A. & Bardy, B.G. (in press), 'On specification and the senses', *Behavioral and Brain Sciences*, **24** (1).
Ungerleider L.G. and Mishkin, M. (1982), 'Two visual systems' , in *Analysis of Visual Behavior*, ed. D.J. Ingle, M.A. Goodale and R.J.W. Mansfield (Cambridge, MA: MIT Press)
Wittgenstein, Ludwig (1953), *Philosophical Investigations* (Oxford: Basil Blackwell)
Willats, John (1997), *Art and Representation* (Princeton: Princeton University Press)
Zeki, Semir (1993), *A Vision of the Brain* (Oxford: Blackwell).
Zeki, Semir (1999), 'Art and the brain', *Journal of Consciousness Studies,* **6** (6–7), pp. 76–96.