



From Two Visual Systems to Two Forms of Content?

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PSYCHE 13/2, April 2007

KEYWORDS: Two visual systems hypothesis; Content of perception; Control of action; Visuomotor content

COMMENTARY ON: P. Jacob & M. Jeannerod. (2003). *Ways of Seeing: The Scope and Limits of Visual Cognition*. Oxford: Oxford University Press, + 287pp. ISBN 0198509200.

ABSTRACT: This commentary on Jacob and Jeannerod's *Ways of Seeing* evaluates the conclusions that the authors draw from the two visual systems hypothesis about the nature and phenomenology of visual experience.

1. Introduction

Jacob and Jeannerod's *Ways of Seeing* contains a number of striking and interesting claims about the cognitive architecture of vision, the nature of visual perception and the visual control of action, and the relation between cognitive architecture and visual perception. The authors present an eloquent case for a version of what they call "the dualistic model of visual processing", developing and extending the general two visual systems hypothesis originally proposed by Ungerleider and Mishkin (1982) and (in a somewhat different form) by Milner and Goodale (1995). In developing their version of the dualistic model they draw upon neurophysiological studies on monkeys (Ch.2), studies of brain-damaged human subjects (Ch. 3), and psychophysical studies on normal human subjects (Ch. 4). Jacob and Jeannerod provide interesting modifications to earlier ways of thinking about the anatomical distinction between the ventral and dorsal pathways, rejecting a simple dichotomy between vision-for-action and vision-for-perception in favor of a more more nuanced model that takes into account, for example, the complexities of human pragmatic processing of objects—in particular the contribution of the parietal lobes (part of the dorsal pathway) to high-level pragmatic

processing, including complex tool use and the perception of other people's actions (see the Epilogue). From a philosophical perspective, however, one very interesting feature of their book is that they tackle a topic that has not really been addressed within the scientific literature—namely, the implications of the two visual systems hypothesis for how we think about the nature and phenomenology of visual perception at the personal level.

Jacob and Jeannerod make three key claims about personal-level visual perception.

The first is that cognitive neuroscientific study of the visual system has uncovered a new kind of content, which they term *visuomotor content*. This type of content represents the pragmatic properties of objects—those properties that are relevant to how we act upon objects. Visuomotor content is, they argue, distinct both from what philosophers have described as the nonconceptual content of visual perception and from the conceptual content of visual perception (or what we might think of as *seeing-as*). Visuomotor content and perceptual content (of the nonconceptual variety) have different frames of reference and different levels of fineness of grain. Whereas perceptual processing takes place relative to an allocentric frame of reference, the frame of reference of visuomotor processing is egocentric, and in contrast to the detail and informational richness of perceptual content, visuomotor content represents only a limited range of features.

Second, visuomotor content does not enter into conscious awareness and hence is not part of what is standardly thought of as *visual experience* (taking visual experience to be, of necessity, conscious). In fact, as the research on visual illusions discussed in Ch. 4 seems to suggest, a single visual stimulus can be processed in conflicting and contradictory ways at the perceptual level and at the visuomotor level. Subjects experience objects one way (two lines in the Muller-Lyer illusion as being different lengths, for example), but act in ways that suggest that at the visuomotor level they are representing the objects completely differently (the two lines as being same length). These are cases where conscious visual experience is trumped by non-conscious visuomotor representations.

The third claim is an obvious consequence of the first two. It is an explicit rejection of an idea that has driven much research into the nonconceptual content of visual experience. Theorists such as Evans (1982) and Peacocke (1992 Ch. 3) have argued that visual perception represents the distal environment nonconceptually in a manner that facilitates the fine-grained control of action. In opposition to this view, which Clark (2001) has termed the hypothesis of *experience-based control*, Jacob and Jeannerod maintain that “the nonconceptual content of visual experience is not geared towards the guidance and control of action. Rather, it is geared towards the ‘selection’ of objects that can be either goals for visually guided actions or food for thought.” (p. 16) In Clark's phrase, *experience-based selection* replaces experience-based control.

Plainly, the interest and significance of the distinction between perceptual and visuomotor content is a hostage to the case that can be made for the second and third claims. It would not be particularly surprising to be told, for example, that we can distinguish, within visual experience, semantic and pragmatic elements or aspects. In fact,

it would be difficult to find philosophers who would deny such a claim, so deeply rooted is it in both commonsense and philosophical thinking about vision that we act upon objects in virtue of how they appear. It is because Jacob and Jeannerod do deny this claim that their book is so interesting. In evaluating the case they make we should begin with the basic distinction between visuomotor and perceptual content, as they characterize them.

Visuomotor and perceptual content can, according to Jacob and Jeannerod, be distinguished in two respects. First, they have different degrees of informational richness. Visuomotor content carries much less information than perceptual content, since the actions and intentions that depend upon visuomotor representations require only minimal information about the spatial properties of the objects being acted upon. The second difference is that the two forms of content deploy different frames of reference. The frame of reference of visuomotor content is egocentric – that is, it is centered on the viewer. Jacob and Jeannerod think of visuomotor content primarily in the context of reaching behavior and, as they note, successful reaching depends upon representing the position of the relevant object relative to the axis of the agent's body. In contrast, perceptual representations of objects are, they argue, coded on allocentric frames of reference—that is, frames of reference centered on a non-bodily object or location.

It is significant that the second difference, if it is well-grounded, will itself provide an argument for locating visuomotor content outside the sphere of visual experience, since it plainly has the consequence, as Jacob and Jeannerod note, that “the position of one and the same object can be visually coded in two radically different representational formats and/or frames of reference” (p. 181). Given that it is part of their thesis that a given object can be *simultaneously* coded on different frames of reference, it follows immediately that we would have contradictory experience if visuomotor content and perceptual content were both part of conscious visual experience.

Jacob and Jeannerod are surely correct that visuomotor spatial information for reaching needs to be coded egocentrically. But just how plausible is it that perceptual content is coded on an allocentric, rather than an egocentric frame of reference? Some of the illustrations they give are not very helpful. They write, for example, that “in order to deliver a perceptual representation of the glass to the left of the bottle, the visual system must code the position of the glass relative to the position of the bottle in an allocentric frame of reference” (p. 181). This is unfortunate, because the to-the-left-of relation is a canonical example of a spatial relation that seems to make most sense on an egocentric frame of reference. No two things stand in this relation *simpliciter*. They only do so relative to a third thing, which is typically the perceiver. I do not simply perceive that the glass is to the left of the bottle. I perceive that the glass is to the left of the bottle *relative to me*. Of course, I could also perceive that the glass is to the left of the bottle relative to you, where you are on the other side of the table from me, but that is hardly the standard case (and in fact would require working out how things would look egocentrically from your perspective).

There is more going on here than an unfortunate choice of example. It seems that Jacob and Jeannerod are conflating two rather different ideas. The first is the idea of an allocentric frame of reference. What makes a frame of reference allocentric is simply the fact that it is centered on a non-bodily object, so that the location of a given object is

given by coordinates relative to that non-bodily object, which might, for example, be a prominent landmark. The second is the idea of the spatial position of an object being coded relative to another object. This is something that can be done either on an egocentric or on an allocentric frame of reference. As the to-the-left-of example shows, it is perfectly possible (and indeed very common) for the spatial position of an object to be coded relative to another object on an egocentric reference frame.

It seems to me that much if not all that Jacob and Jeannerod want to say about spatial perception can be put in terms of a distinction between what we might term *focused perception* and *relational perception*, where focused perception involves representing the relation of the perceived object solely to the perceiver and relational perception involves representing the perceived object in the context of, and relative to, other objects. If I am reaching for a particular pen on the table in front of me then it is clear that what is required is focused perception, while if I am looking for my car in a carpark then what I need is relational perception. While focused perception can only be egocentric, relational perception can either be egocentric or allocentric.

This point blocks one of the conceptual arguments offered by Jacob and Jeannerod for the distinction between visuomotor and perceptual content. This is what they term the argument from contrastive identification. It runs as follows:

In order for such visual attributes of an object as its orientation, size, and shape to be available for perceptual judgment and/or experience, it must be available for comparison. What is distinctive of the perceptual representation (as opposed to the motor representation) of the orientation, size, and shape of an object is that it satisfies the constraint of contrastive identification. To make such a comparative judgment is to be able to represent simultaneously the orientation, size, and shape of at least two distinct items in a visual array. . . It follows that unless the visual system codes the relative locations of at least two distinct objects in an allocentric frame of reference, no perceptual comparison is possible. . . Unless they are part of a representation of the relative locations of at least two objects in an allocentric frame of reference, the orientation, size, and shape of an object will not be available to conscious visual perception. (p. 195)

The problem with this argument should be clear. The key premise is that two objects can only be compared on an allocentric frame of reference, but this seems false on any standard understanding of the distinction between egocentric and allocentric frames of reference.

Since Jacob and Jeannerod insist that perceptual content falls within the sphere of visual experience and forms part of our conscious awareness of the world, we need to attend to the phenomenology of perception. And the phenomenology of perception seems clearly to suggest that we perceive the world within an egocentric frame of reference. It is puzzling that Jacob and Jeannerod cite J. J. Gibson (Gibson 1979) in support of their claims about visuomotor content, since Gibson (quite possibly the most perspicuous commentator on the phenomenology of perception since Merleau-Ponty) is emphatic that visual spatial perception is fundamentally egocentric. One of Gibson's major contributions to the study of vision is the proposal to reconstrue the visual field as a constantly moving and constantly reconfiguring set of illuminated surfaces and

concomitant solid visual angles, rather than in terms of empty space containing bounded objects (figures on a ground). We do not, he thinks, ever see empty space surrounding discrete objects. What we see is a complex and gapless structure of surfaces. Some of these surfaces are surfaces of objects, while others are not (the various surfaces in the sky, for example). To each surface there corresponds a solid visual angle with its base at the face of the visible surface and its apex at the point of observation. As the observer moves through the environment the solid angles change, as one surface moves in front of another (relative to the perceiver) or as the observer approaches or moves away from the surface. This is what Gibson terms *optic flow* and the particular pattern of changes in the optic flow specifies the perceiver's trajectory through the environment (for further details of the implications of Gibson's ideas for how we think about the phenomenology of perception see Bermúdez 1995 and 1998 Ch. 5).

Even this sketchy characterization of Gibson's claims about the phenomenology of perception make clear that, at least as far as Gibson is concerned, visual perception takes place relative to an egocentric frame of reference, since the key feature of the phenomenology of perception is optic flow, which is itself determined by the shifting texture of visual solid angles centered on the observer. Of course, Jacob and Jeannerod can dig their heels in and argue either that Gibson is simply mistaken about the phenomenology of perception or that he is not really offering an account of the phenomenology of perception at all. Either way, however, it looks as if they face an uphill struggle and the burden of their case will fall on the empirical considerations that they bring into play for the key claim that visuomotor content is not part of visual experience. Let us look then at those empirical considerations.

The first point to make is that the functional independence of perceptual processing and pragmatic processing is not in itself an argument for any sharp distinction between two fundamentally different types of content—any more than is the anatomical distinction between two different information-processing channels. Functional independence can be demonstrated by finding double dissociations—subjects capable of perceptual processing but not of pragmatic processing, and subjects capable of pragmatic processing but not of perceptual processing. That such double dissociations can be found seems fairly indubitable, as Jacob and Jeannerod show in Ch. 3. But this actually tells us very little about the visual experience of normal subjects, since the fact that the two forms of processing can come apart in brain-damaged subjects does not imply that there are two distinct forms of content in normal, non-brain-damaged subjects. Still less does it imply that visuomotor content is not part of conscious visual experience.

The empirical case for the key claim that visuomotor content is not part of visual experience rests upon the psychophysical experiments described in Ch. 4 (and which are, of course, carried out on normal subjects). Here too we find a dissociation, but in this case the dissociation is between the reports that subjects make about how objects look to them, on the one hand, and how they behave relative to those objects, on the other. If we take verbal reports at face value as accurate accounts of the phenomenology of visual experience, and if we assume (surely correctly) that the visual experience of these subjects is not cognitively dissonant in the way that it would have to be were they consciously representing a single object in conflicting ways, then it certainly seems to

follow that whatever information is being used to guide the subjects' visually-guided actions is not consciously represented.

But is this enough to give us the key claim that visuomotor content is not part of visual experience? There is room for considerable skepticism.

Let us look more closely at a sample case of conflict. In the Titchener illusion, as is well known, there is a striking disparity between perceptual judgments and grasping behavior. Subjects reliably perceive a disk surrounded by an annulus of smaller disks to be larger than a disk of the same size surrounded by an annulus of larger disks. Nonetheless, when subjects are asked to grasp the disks their grip is not affected by the illusion (Aglioti et al. 1995 and Haffenden and Goodale 1998). This conclusion is based on the fact that the subjects' *maximum grip aperture* (MGA – the widest that the fingers stretch during the movement towards the object being grasped) is reliably correlated with the real size of the object, rather than the reported size. This does indeed seem to show, as Jacob and Jeannerod state, that “MGA must result from an anticipatory, automatic, non-conscious visual process of calibration” (p. 119).

But it is a long step from the claim that the information determining maximum grip aperture is not part of conscious visual experience to the much more striking and controversial claim that everything that Jacob and Jeannerod include under the label of visuomotor content falls outside conscious visual experience. It is not particularly surprising that many aspects of the fine-tuned control of grasping behavior are controlled by forms of information-processing that never make their way to consciousness. But Jacob and Jeannerod seem to want to claim much more than this. Their claim is that *no* information on an egocentric frame of reference relative to the control of action is part of conscious visual experience – where this is supposed to include, for example, all of the affordance-based information that Gibson and others have characterized. And this by no means follows from the various experiments reported in Ch. 4.

It would seem, then, that Jacob and Jeannerod face a dilemma. On the one hand, they might be making a true but uncontroversial claim, to the effect that some aspects of the fine-grained control of grasping behavior are non-conscious. This seems far too weak to support the much stronger claims that they make about the distinction between visuomotor and perceptual content and about the non-conscious nature of visuomotor content. On the other hand, however, those stronger claims seem not to be supported either by the empirical evidence that they cite or the arguments they offer. The empirical evidence is either not obviously relevant (in the case of the pathological data) or too weak to support the conclusions drawn from it (in the case of the psychophysical data). The arguments that they offer, most particularly the argument from contrastive identification, are vitiated by some very questionable assumptions about the distinction between egocentric and allocentric frames of reference.

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