

EXPERIENCE WITHOUT THE HEAD

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Some cognitive states — e.g. states of thinking, calculating, navigating — may be partially external because, at least sometimes, these states depend on the use of symbols and artifacts that are outside the body. Maps, signs, writing implements may sometimes be as inextricably bound up with the workings of cognition as neural structures or internally realized symbols (if there are any). According to what Clark and Chalmers [1998] call active externalism, the environment can drive and so partially constitute cognitive processes. Where does the mind stop and the rest of the world begin? If active externalism is right, then the boundary cannot be drawn at the skull. The mind reaches — or at least *can* reach --- beyond the limits of the body out into the world.

Can one extend active externalism to perceptual consciousness? There is a consensus that this question should be answered negatively.<sup>1</sup> The fact that we dream, and that neuroscientists can produce sensations by direct stimulation of the brain, shows that consciousness is a matter of what is going on in the head alone.

Or does it? The fact that some experiences can be produced by neural activity alone does not show that all experiences could be. Nor would the supposition that some not-yet-invented technology might one day enable us to produce any perceptual experience by direct neural intervention show that neural states were sufficient for experience. Just as the fact that one can manipulate a car's behavior by manipulating its engine is not enough to show that the engine is alone sufficient for the car's behavior, so the fact that one can manipulate experience by manipulating the brain is not enough to show that the brain is sufficient for experience. — We spend our lives in tight coupling with the environment (and other people). Why are we so confident that there could be a consciousness like ours independent of active exchange with the world? Why are we so certain consciousness depends only on what is going on inside us? Are we too hasty in dismissing externalism about perceptual experience?

These questions are not unmotivated. As of now, there is no account, even in roughest outline, of how the brain produces consciousness. This is widely admitted, even by leading proponents of the “consciousness is in the head” point of view, such as

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<sup>1</sup> Two philosophers who reject this consensus are Susan Hurley (1998) and Mark Rowlands (2002). Some philosophers (e.g. Dretske 1994 and Dennett 1987) are externalist about the content of perceptual experience, but internalist about the vehicles of content. On this sort of hybrid view, mental states are comparable to sunburns (Davidson 1987; Wilson 1997): The sunburn (or mental state) is literally on the skin (or in the head), but its nature depends on its world-involving causal history. In this paper I advance an externalism about the vehicles of experience.

neurobiologists Frances Crick and Christof Koch. They write: “No one has produced any plausible explanation as to how the experience of the redness of red could arise from the action of the brain” (2003: 119). In light of this “explanatory gap,” talk of neural substrates of experience can seem empty. Beyond brute correlation, we lack any intelligible connection between neural substrate and experience, and so we lack, it seems, sufficient reason to believe, of any given neural structure, that it is or could be the substrate of an experience.

Whether or not neural activity is sufficient for an experience is, or at least ought to be regarded as, an empirical question. Hurley and I have recently proposed that the explanatory gap gives us a reason for thinking that we ought to consider expanding our account of the substrate in terms of which we hope to explain perceptual experience (Hurley and Noë 20003).<sup>2</sup>

In this paper I pursue related themes. My focus, however, is not on neural substrates, but rather on the phenomenology of perceptual experience. The robust “consciousness is in the head” consensus rests, I suspect, on bad phenomenology. There is a tendency to think of perceptual experiences as like snapshots, and to suppose that what is experienced, like the content of a snapshot laid out on paper, is given all at once *in the head*. But experiences are not like snapshots. Experienced detail is not given all at once the way detail in a picture is. In ways that I will try to explain, *what* we experience visually (for example) may outstrip what we actually see. From this it follows not that experience could not be in the head. What follows, rather, is that it might not be, or rather, that some aspects of some experiences might not always be. A modest conclusion, but one that allows that, at least sometimes, the world itself may drive and so constitute perceptual experience. The world can enter into perceptual experience the way a partner joins us in a dance, or – to change the image slightly – the way the music itself guides us.<sup>3</sup>

### 1. A puzzle about perceptual presence

It is a basic fact about perception that solid, opaque objects, when seen, have visible and invisible parts [Koenderink 1984]. When you see a tomato, for example, you see its visible aspect. Euclid captured this thought when he wrote: “Nothing that is perceived is seen at once in its entirety.”

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<sup>2</sup> We also argue that a range of phenomena of consciousness can be explained best not in terms of the intrinsic properties of neural activity, but in terms of the relation between those properties and the larger sensorimotor context in which the *animal* finds itself.

<sup>3</sup> In *Action in Perception* (2004, in press) I extend a criticism of the snapshot conception and develop an alternative view of perceptual experience. In the final chapter of that book I take a stab at developing an externalist account of perceptual experience. This project – the elaboration and defense of this kind of externalism – is also the subject of joint work (in progress) by me and Susan Hurley.

No surprise here. What could be more evident than that you can't see the occluded portions of objects that you perceive? When you see a tomato, you can't see its back. When you see a cat behind a picket fence, you only see, strictly speaking, those parts of the cat that show through the slats.

There is a way of thinking about experience – a reasonable way – according to which these Euclidean truisms can come to seem untrue. Yes, to use Euclid's formulation, a perceived object is never perceived at once in its entirety. Nevertheless, one can hardly dispute that we take ourselves, when we see the tomato, or the cat, to have a sense of their presence – a *perceptual* sense of their presence – as wholes. In the case of the tomato, for example, you have a sense of the presence of a voluminous, ovoid, furrowed whole.

It is in defense of this reasonable way of thinking about perceptual experience that Thompson Clarke [1965] insisted that seeing is like nibbling. When you nibble a piece of cheese, you nibble it, the cheese, not merely a part of it; and so, when you see a tomato, you see precisely *it*, the tomato. It is only in special circumstances that it is correct to say, when you see a tomato, that you see only a part of it (just as, I presume Clarke would say, it is only in special circumstances that it is correct to say, when you see a tomato, that you see *the whole of it*.)

P. F. Strawson [1979] aims at a related idea – also in defense of this reasonable way of thinking about experience – when he claims that one *distorts* the visual experience of a tomato, one misdescribes or mischaracterizes it, if one describes it as a visual experience as of a tomato *part* (let alone as of tomato-like sense-data). The visual experience of the tomato, when one takes it at face value, presents itself to one precisely as a *visual experience as of a whole tomato*.

There is much to be said on behalf of these defenses of familiar beliefs about perception. It would be a mistake, however, to think that they give us reason to doubt the Euclidean observation stated at the outset. For the Euclidean observation is no less well entrenched in our ordinary thought and phenomenology. Both sides in this philosophical standoff – Euclid on the one side, common sense on the other – show a tendency to lapse into dogmatism. The Euclidean insists, dogmatically, that when we take ourselves to perceive tomatoes, we “go beyond” what we really see. The “reasonable” philosopher, no less dogmatically, finds him or herself wanting to deny that our perceptual experience is confined by the limits of immediate perspective. “The plate doesn't look elliptical, it looks round!”

What I am calling the problem of perceptual presence comes clearly into focus when we acknowledge that both sides in this standoff are, in a way, right. The plate looks circular, and it looks elliptical. That is, we have a sense of the presence of the plate's circularity despite the fact that, plainly, it looks elliptical from here. And so for the tomato. When you see a tomato, you only see, strictly speaking, the visible face of the tomato; but it is also true that you are visually aware of the presence of the parts of the tomato which you don't actually see.

How can both these facts about perceptual experience be, well, just that, *facts about perceptual experience*? How can it be true, as I think it is, that we are perceptually aware, when we look at a tomato, of parts of the tomato which, strictly speaking, we do

not perceive? This is the puzzle of perceptual presence: in what does our sense of the perceptual presence of a strictly unperceived feature of the world consist?

Before proceeding, two warnings. First, the puzzle of perceptual presence should not be confused with another nearby and closely related problem, namely, the epistemological problem of *the given* in perception. The problem is not with whether what is given provides sufficient rational basis for perceptual judgment, but rather with the question, *what is given?* The focus is phenomenological, on the nature of perceptual content itself. The point is that what is given is, at least apparently, rife with conflict. The plate looks round *and* it looks elliptical from here; we encounter only the visible parts of the tomato *and* we take ourselves to be aware of the presence of its strictly unperceived parts; two trees appear to be the same size *even though* the nearer tree looks larger than the farther one; a wall appears to be a uniformly colored surface, *despite* the fact that one part of the wall is visibly brighter (where it falls in direct sunlight) than a different part of the wall (which is cast in shadow).

Second, as the immediately preceding remarks indicate, the problem of perceptual presence is of surprising generality, comprising a range of perceptual phenomena not usually grouped together, including those already mentioned – occlusion shape, color constancy, apparent size – but also others as well (as we shall see).

## 2. First stabs at a solution

It may be tempting to bite the bullet and concede that we *don't really* see the whole tomato, or the roundness of the plate, or the whole cat, etc. We go *beyond* what is strictly given in an account of our experience when we in this way describe what we see. Our feeling that we see the whole tomato, say, is an illusion.

But this objection misses the point. The puzzle is not that it seems to us as if we see the whole tomato, when we only see part of it, or that we experience the color as uniform, when in fact it is nonuniform. This is the epistemological problem mentioned in the last section. The puzzle is that it seems to us *at once* as if we only see part of the tomato *and* as if the whole is perceptually present. It seems to us as if we see the circularity of the plate *even though* it looks elliptical. We take ourselves to sense the presence of a uniform color, even though the surface is dappled in light and thus variegated in apparent color. We take ourselves to have a perceptual sense of features we manifestly do not see and that we feel no inclination to believe we see.

Nor can it help us here to be told that although we don't *see* the hidden parts of the tomato, or the cat, we *infer* their presence. There is something to this line of thought, no doubt. After all, we know what tomatoes and cats are, we have these concepts; we make use of these concepts in fleshing out or indeed in “cognitively filling in” what is given to us. I think this must be right; however it provides no solution to the problem of perceptual presence. It can't be the whole story. For what we want is an account not of the *thought* or *judgment* or *belief* that there is a whole tomato there, or a whole cat there, or a uniformly colored wall there. What we want is an account of our *perceptual* sense of their presence.

Crucially – and this is a phenomenological point – the cat does seem present, as a whole, *perceptually*. The voluminous tomato seems *perceptually* present. We do not merely *think* that they are present; it looks as if they are. Indeed, this sense of perceptual presence does not depend on the availability of the corresponding belief.

As an illustration of this last point, consider Figure 1, an illustration of Kanizsa's. It is natural, when looking at this picture, to say that we see a picture of a rectangle partially occluding four disks. We experience the occluded portions of the disks as visually present even though we know that they are not there (after all, this is a drawing).

[Figure 1 About Here]

In this example, then, it neither seems to us as if we see the occluded portions of the disks, nor is it the case that we think they are present but occluded. We *know* it is just a flat picture. Nevertheless, it looks as if the disks are present but occluded. We experience the presence of the occluded bits even as we experience, plainly, their absence. They are present *as absent*.

Psychologists call this phenomenon *amodal* perception: perception, as it were, but not in any modality. This is not quite adequate as a characterization, however. The paradoxical quality is sharper. The phenomenon would be better characterized as *amodal visual* perception, that is, as a kind of seeing without seeing. For crucially, even though we don't see the disks (in this case), the way in which we take them to be present perceptually is visual.

### 3. Presence as absence

Perceptual *presence-in-absence* – amodal perception – is, as already noticed, a widespread perceptual phenomenon. Let us consider three examples. The purpose of these examples is to illustrate the nature of the phenomenon, and to call to attention how difficult it is to give an adequate description of the relevant phenomenology.

#### *Filling in at the blind spot.*

In his recent textbook, Steven Palmer [1999] suggests that the brain fills in to make up for the gap or discontinuity at the retinal blind spot.<sup>4</sup> We know this, he explains, because of the results of demonstrations such as the following. Consider Figure 2. If you shut the right eye, and fixate the cross with the left eye, you can adjust the illustration of a broken line so that the break falls in the blind spot. (This will occur when the page is about a foot from the face.) When the break falls on the blind spot, we have the experience of an unbroken line. This experience must in turn be underwritten by a neural process whereby

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<sup>4</sup> See Pessoa, Thompson and Noë [1998] and Thompson, Noë and Pessoa [1999] for discussion of the blind-spot phenomenon.

an internal representation which has a gap in it is filled in. As Palmer writes: “The line on the retina actually has a gap in it at the blind spot, but we experience it as complete and uninterrupted when the gap falls within the blind spot. The important point is that what we experience visually conforms not to the firing of retinal receptors, but to some higher level of neural activity” [1999, 617]. Neural processes of filling-in in a higher-level neural representation are what bridge the gap between low-level retinal input and experience.

[Figure 2 about here]

Dennett [1991] has criticized this style of reasoning on the grounds that one isn’t entitled to assume that the brain produces the filled-in percept by a neural process of perceptual completion. Perhaps, he suggests, the brain instead ignores the absence of information corresponding to the blind spot, thus giving rise to the gap-free percept, without requiring the actual construction of a gap-free internal representation. This line of thinking relies on the Kantian point that representations needn’t have the properties they represent the world as possessing.

It is striking that Dennett, no less than Palmer, takes for granted that *it visually seems to you as if the line is filled in*. But this is a mistake, or rather, it is an equivocation. In the relevant sense of “the line looks unbroken,” it isn’t the case that the line looks unbroken. Perform the demonstration and pay careful attention to what you see. Notice, it does not seem to you as if you look at the break and see it is filled in there, or that the line is complete there. A better description of your experience would be: when you shut one eye and fixate the cross, you cannot see a gap in the line in your peripheral field. You do not perceive the break in the line. But not perceiving the break is different from perceiving the line filled in, or even from perceiving the absence of a break. We naturally *say* that we perceive the line as unbroken, but in saying this we are not committing ourselves to the proposition that we are in qualitatively the same state as when we actually visually examine an unbroken line.

One proposal, advanced by Durgin, Tripathy and Levi [1995], is that the experience of the line as filled in at the blind spot is, phenomenologically speaking, like the experience of the far side of the tomato, or of the hidden portions of the disks in Kanizsa’s illustration. They are visually present, but not *as seen*. As support for this point, look at Figure 2 with one eye shut, but hold up your thumb so that it blocks the gap. You now enjoy amodal visual completion of the line behind your thumb. Phenomenologically, so Durgin, Tripathy and Levi suggest, the experience of the line as complete when the break falls on the blind spot is just the same as the experience of the line as complete when the gap is occluded by the thumb.

This is a controversial issue and there are arguments ranging on both sides.<sup>5</sup> My point here is phenomenological, rather than empirical. The phenomenology of the experience of the filled-in broken line is not like that of the visual experience, in normal perceptual circumstances, of a solid line. The phenomenology is the phenomenology of presence in absence, not of simple presence.

Once we get clear about the phenomenology we can observe that even if Dennett's criticism of Palmer's argument is right, Dennett and Palmer share a commitment to a misdescription of what the experience of the line is like.

### *Color constancy.*

Color constancy is illustrated by such facts as that we do not experience a change in the color of a surface when illumination changes, and we do not experience a wall as variable in color even though it is lighter where it falls in direct sunlight than it is where it is cast in shadow. Standard thinking in visual theory would have it that the problem of color constancy is to explain the experience of sameness of color despite variation in the character of reflected light entering the eyes.

This framing of the problem of color constancy is problematic. It is true that we can perceive a wall that is illuminated unevenly as uniform in color. Nevertheless, it is also the case that when a wall is in this way illuminated unevenly, it is also visibly different in respect of color across its surface. For example, to match the color of different parts of the wall you would need different color chips. Standard ways of characterizing color constancy as a phenomenon have a tendency to explain away the fact that we experience the wall as uniform in color even when we experience the surface as visibly differentiated in respect of color across its surface. The problem of color constancy, then, is better framed as a problem about perceptual presence. We experience the presence of a uniform color which, strictly speaking, we do not see. Or rather: the actual uniform color of the wall's surface is present in perception *amodally*, it is present but absent, in the same way as the tomato's backside, or the blocked parts of the cat.

Peacocke [1983] used color constancy to illustrate the difference between the *representational content* of an experience (how the world is represented by the experience), and the *qualitative* or *sensational properties* of experience (what the experience is like apart from its representational features). The experience of the wall here and there are the same in their representational content, but they differ nonrepresentationally in their qualitative character. This seems wrong: just as our experience can present the circularity of the plate, even though the plate looks elliptical from here, so the experience can present the uniform color of the wall, even though the surface looks irregular in color. The problem of perceptual presence is a problem,

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<sup>5</sup> See, for example, Ramachandran and Gregory [1991]. For a general discussion of issues in this vicinity, see Pessoa, Thompson and Noë [1998].

precisely, about how experience can have this sort of apparently conflicting representational content.<sup>6</sup>

Crucially, we can experience the wall as uniform in color *and* as differently colored across its surface. Just as we can see that the plate looks circular *and* elliptical, so we can see the color is uniform *and* variable. Just as we see the circularity in the elliptical appearance, so we see the invariant color *in* the apparent variability.<sup>7</sup> The color of the wall is present in absence; it is implicitly present.

Sean Kelly has urged (in personal communication) that although it is true that we can see the wall as varied in color across its surface, and that we can see it as uniform in color, we can't have these experiences at the same time. Either we attend to the uniformity of the underlying color, or to its nonuniformity, but we can't do both simultaneously. He proposes that we think of the way color appearance varies as an effect of background context. When you experience the variability of the wall's surface color, you are experiencing the different ways the single color looks as lighting varies. I am sympathetic to the idea that the way a color looks changes as lighting conditions change – and so with the idea that not every change in lighting is a change in color. I am also sympathetic to the idea that one cannot attend, simultaneously, to the constancy and the variability of color. Nevertheless, Kelly's position seems to explain away the problem of presence and constancy without explaining it. When I look at my wall now I see its uniform color *in* the variations of its apparent color across the surface. In so far as I see the constancy in the variation, I see them both at once. Experienced perceivers understand that colors, like three-dimensional objects, have aspects, and so they understand, implicitly, that changes in conditions of viewing (in position and in lighting, say, like changes in position) bring about changes in the way things look with respect to color.<sup>8</sup>

*Change blindness and the experience of detail.*

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<sup>6</sup> Kelly [2001] locates the problem in a somewhat different place than Peacocke [1983 *and* 2001]. Kelly proposes that there is a qualitative difference between our experience of the two parts of the wall, and he grants that this is a difference in the representational content of our experience, a difference in how the experience presents the wall as being. But he doubts that this difference is a difference in color (and, in particular, that it is a difference that makes a difference to our use of color concepts).

<sup>7</sup> Wollheim (1968/1980: 205-226) has laid emphasis on the idea of *seeing in*. We see an object *in* a picture, for example. Just as it is the case that you see a picture, and, in seeing the picture, see what the picture depicts (and so in that sense see the depicted item in the picture), so I want to suggest that we see the uniform color of the wall *in* its variegated surface. I take up these issues in Noë [2004], chapter 4.

<sup>8</sup> I develop this approach to color and constancy in Noë 2004.

A fascinating phenomenon of perceptual presence is the visual experience of detail. Visual theory has tended to take as its starting point a way of thinking about seeing according to which visual experiences are like snapshots. The idea is that visual experiences represent the world the way pictures do – all at once, in sharp focus, from the center out to the periphery. This snapshot conception is captured in pictorial form by Mach’s famous drawing of the visual field; it is caricatured in Gursky’s well-known photograph of a Los Angeles 99 Cents Shop. The central aim of visual theory, as it has been practiced for the last century, has been to understand how the brain gives rise to this sort of snapshot-like, richly detailed experience. The problem is hard for two reasons. First, it is *ill-posed*, i.e. the two-dimensional retinal projection does not uniquely determine a three-dimensional layout. Second, the retinal image itself is defective (distorted, gappy, of uneven resolution). How, on the basis of such an impoverished stimulus, do we come to enjoy richly detailed experiential snapshots? The orthodox strategy for answering this question is to hypothesize that the brain integrates the information available in successive fixations to form a detailed internal representation, which then serves as the substrate of the experience. *What* we experience is *what* is represented in this internal representation. Vision, according to the orthodox view, is the process whereby this internal representation is constructed.

Recent work in perceptual psychology on scene perception challenges the orthodox conception of vision precisely by challenging whether experiences are snapshot-like in the way that orthodoxy has tended to suppose. If they are not, then we are not saddled with the problem of explaining how the brain gives rise to picture-like experiences. For example, work on change blindness (and related phenomena such as inattentive blindness) weighs against the snapshot conception.<sup>9</sup> Our success as perceivers depends on the fact that we are very good at noticing flickers of movement and other attention-grabbing concomitants of change. We spontaneously direct our eyes to these transients and so discover change as it happens. It turns out that if we are prevented from noticing the associated flickers, or if there are no flickers – because, say, the relevant changes are too gradual – we will remain unaware of the changes going on around us, even when they are large-scale and pertinent to our interests and background concerns. In one noteworthy recent demonstration, due to Kevin O’Regan, perceivers are shown a photograph of a Paris street scene. Over the seconds that they look at the picture, the color of a car, prominently displayed in the foreground, changes from blue to red. Perceivers overwhelmingly fail to notice this change in color, even though the change is dramatic and occurs over a short period of time. When the color change is pointed out, perceivers laugh aloud and express astonishment that they could have failed to miss the change.

Change blindness does not demonstrate that ordinary perceivers tend to overestimate what they see. Given normal circumstances, we are very good at noticing changes. What change blindness illuminates is the degree to which this ability is vulnerable to disruption. Importantly, the fact of change blindness reveals that a certain

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<sup>9</sup> For reviews of this and related phenomena, see O’Regan in press; Simons and Levin 1997; Simons 2000; Noë, Pessoa and Thompson 2000.

theoretical account of what seeing is – the snapshot conception, and the associated idea that seeing is a process whereby a detailed representation is built up corresponding to what is seen – must be wrong. We don't seem to have easy access to such a detailed internal representation when we contemplate our environment.<sup>10</sup>

Scientists and philosophers have sometimes suggested that change blindness reveals that our visual consciousness is a kind of confabulation (a “grand illusion”). It seems to us – doesn't it? -- as if when we open our eyes we see *everything*, the whole scene, in sharp focus, and uniform detail, right out to the edges of the visual field. We do not, however (as revealed by change blindness and many other experiments and demonstrations). Therefore, so this reasoning goes, the visual world is a grand illusion. Perceptual consciousness is a confabulation.

But this confabulation hypothesis is wrong.<sup>11</sup> Granted, we do not enjoy snapshot-like experiences, as the orthodox view had supposed and as change blindness demonstrates. But – and this is crucial – it is not the case that it *seems* to us as if we enjoy such snapshot-like experiences. We take the world to be densely detailed, yes. But we do not take ourselves to represent all that detail in consciousness at a moment in time, in the way that a picture might represent that detail at a moment in time. The snapshot conception is no part of ordinary perceptual phenomenology.

A little consideration is enough to bring this out. Consider your current visual experience of, say, the view out your window. You no doubt have a sense of the scene outside as dense and rich in detail. If you pause to reflect, however, you will notice it is not the case that it seems to you, *now*, as if all that detail is seen by you all at once, in an instant, in sharp focus and high resolution. Some things are clearly in view, others are present only indistinctly as background elements, and some items are not really experienced at all. To bring detail into consciousness, it is necessary to probe the environment, by turning your eyes, and your head, by shifting your attention from here to there.

The suggestion that visual experience is a grand illusion rests, therefore, on a misdescription of the character of the experience of seeing. If this is so, then why do we find change blindness so surprising? Why do audiences gasp with astonishment when presented with immediate evidence of their own change blindness? Dennett [2001, 2002] has pressed this point: surprise, he has suggested, is an indicator of a foiled epistemic commitment. The question is, *what* epistemic commitment is thus shown to be foiled? It is enough to explain the surprise, I would suggest, to point out that we don't realize quite how vulnerable to disruption our ability to detect change really is. This doesn't entail that we take ourselves to see everything at once!

But there is stronger evidence that we are not committed to the snapshot conception. In daily life, we continuously move our eyes and head in order to get better

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<sup>10</sup> See Simons, Chabris, Schnur, & Levin (2002); Angelone, Levin, & Simons (2003); Levin, Simons, Angelone, & Chabris (2002); Mitroff, Simons, & Levin (in press).

<sup>11</sup> See the papers collected in Noë 2002a for discussion of this issue.

looks at objects around us in the cluttered environment. Why are we *not* surprised by our need constantly to adjust and probe if in fact we take ourselves to carry around a detailed internal model with us? Moreover, if you ask me to describe my room, I don't shut my eyes and reflect on my memory of the room; rather, I look around to see what is there. Why don't we find *this* surprising? The absence of surprise at our need to move around and look is a clear indicator of the absence of epistemic commitment to the snapshot conception.

Even if we grant that the snapshot conception distorts our phenomenology, surely it remains that case that we take ourselves, at least to some degree, to be perceptually aware of unattended features of the scene? After all, we do take ourselves to be aware of the environment as densely detailed, even if we do not take ourselves literally to see it all. The problem we face here is a further incarnation of the problem of perceptual presence. In what does our sense of the perceptual presence of strictly unperceived detail consist?

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Each of these phenomena – filling in at the blind spot, color constancy, the perceptual experience of detail – is an instance of the perceptual phenomenon of presence in absence. We have a sense of the presence of strictly unseen or unattended visual detail; we experience the presence of a uniform color despite the apparent difference in color across the surface of the wall; we experience the line as complete even though it is not the case that we actually see the break filled in. In each of these cases, as with our examples of the tomato and the cat, what we experience visually goes beyond what we see (strictly speaking).

#### 4. Presence as access

Do you take yourself, when you open your eyes and look, to be aware of the whole scene before you, in sharp detail, all at once? The correct answer to this, we have seen, ought to be: yes and no. Yes, in so far as you take yourself to have a sense of the presence of a richly detailed world. But *no*, in so far as it does not seem to you as if you actually see every bit of detail. There is no such thing as seeing all the detail at once, just as there is no such thing as seeing the tomato from all sides all at once.

Phenomenologically, the world is given to perception *as available*.

To solve the problem of perceptual presence – comprising as it does, a broad range of phenomena – we need to make explicit this feature of the relevant phenomenology.

We visually experience the scene before us as densely detailed without seeing all that detail, just as we visually experience the tomato as voluminous and three dimensional even though we don't see all of it. The presence of the detailed environment – of the occluded parts of the tomato, of the uniform color of the wall's surface – consists, then, not in our feeling of immediate contact with those features, but in our feeling of *access* to those bits of detail. The detail is present *now*, though absent (unseen, out of view, partially occluded, etc.), because we *now* possess the skills needed to bring the relevant features into view.

The scene is present to me now as detailed, even though I do not now see all the detail, because I am now able – by the exercise of a repertoire of perceptual skills – to bring the detail into immediate perceptual contact. For example, I need but move my eyes, or move about, or direct my attention here or there, to bring the relevant detail to focus. The detail is present because it is, as it were, *within reach*.

The basis of our feeling of access is our possession of the skills needed actually to reach out and grasp the relevant details. We are familiar, as a general rule, with the ways our sensory experience changes as we move. Moving the eyes, blinking, turning the head, moving the body – all this produces familiar kinds of sensory change. Familiarity with the ways sensory stimulation changes as we move is the ground of our perceptual access. Perceivers *know how* to gain access, to make contact, with the environment around them.

This is the key to the problem of perceptual presence: our sense of the perceptual presence of the detailed world does not consist in our representation of all the detail in consciousness *now*. Rather, it consists in our access *now* to all of the detail, and in our knowledge (itself practical in character) that we have this access. This knowledge takes the form of our comfortable mastery of the rules of sensorimotor dependence that mediate our relation to the world, to the surrounding detail, the cat, the wall. My sense of the presence of the whole cat behind the fence consists precisely in my knowledge, my implicit understanding, that by a movement of the eye or the head or the body I can bring bits of the cat into view that are now hidden. And so for the tomato: My relation to the strictly unseen portions of the tomato is mediated by familiar visual laws of sensorimotor dependence. The presence of the tomato to me as a voluminous whole consists in my knowledge of the sensory effects of my movements in relation to the tomato.<sup>12</sup>

### 5. Intramodality and intermodality

Presence is to be explained in terms of access. The *modality* of presence – whether the presence is perceptual, or merely *thought* (as it were), or whether it is visual, or tactile, say – is explained by the different *kinds of access* required, and by the different sorts of skills needed to secure access.

Contrast the felt presence of peripheral detail in the visual scene with the sense of the presence of the far side of the tomato. In both cases, the feature in question is strictly unperceived, but is sensibly felt to be present. In each case, however, the features are present, but absent, in different ways. In the one case, detail is grasped or obtained by the movement of the eye, by turning the head to the left or right. Your sense of presence at the periphery depends on your confidence that *by doing these things* you can obtain the detail. In the other case, however, you need to do very different things to obtain the detail. For example, you must move around the tomato to bring the far side into view. To the qualitative differences in the felt presence of the features, there corresponds the

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<sup>12</sup> Here, and in what follows, I build on the ideas presented first in O'Regan and Noë 2001. See also Noë 2002 and Noë, in press.

different things we need to do to attain those features, and the different sensorimotor skills we need to deploy.

Now it is true that we have access to more than we take ourselves to experience perceptually. Not everything that is accessible is perceptually present. The room next door feels present, for example, but it doesn't feel perceptually present (as discussed in O'Regan and Noë 2001). I can't see it through the wall. The room next door is merely thought to be present. That it is not felt to be present perceptually comes out in such facts as that I know that I can jump up and down, turn around, turn the lights on and off, blink, and so on, and it makes no difference whatsoever to my sense of the presence of the room next door. My relationship to the room next door — however strongly I believe or know or assume or feel that it is present — is not a perceptual relation. My relation to hidden parts of the cat, or to the far side of the tomato, in contrast, *is* perceptual, even though I don't actually see these items. For my relation to them is mediated by patterns of sensorimotor dependence. My relation to them is affected by bodily movements.

You may wonder whether this account can be quite right. First, you might object, my visual relation to the room next door is no less mediated by patterns of sensorimotor dependence than my relation to the tomato is. *What* I need to do to produce the relevant sensory change may differ (e.g. I would need to walk out into the hall and through the door of the room next door); nevertheless, in both cases my relation is mediated by patterns of sensorimotor dependence. Second, you might question whether it is really true that I am perceptually linked to the unseen bits of the tomato or cat.

To reply to these worries: In general, sensorimotor dependencies can be characterized as having two important features. The first of these, which I have been emphasizing, is that they are *movement*-dependent. The slightest movements of the body modulate my sensory relation to the object of perception. But they are also *object*-dependent. Suppose I am looking at you and someone off to the side gets up to leave. In normal circumstances I will notice the movement and turn my eyes to it. Part of what my sense of the perceptual presence of the periphery of my visual field consists in is just this fact that movements there grab my attention. (Indeed, this in part explains our sense of the unboundedness of the visual field.)<sup>13</sup>

It is true, then, then there are movements of my body that will bring me into visual contact with the room next door, but it is generally not the case that movements or changes in the room next door will produce sensory changes in me. The sensorimotor contingencies mediating me and the room next door are not object-dependent (in the sense described here).

Now consider the tomato in front of me. True, I am unlikely to notice an ant crawling on its far side. After all, the ant is hidden by the tomato. On the other hand, the slightest movement of the tomato will grab my attention and may bring me into contact

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<sup>13</sup> This distinction between movement- and object-dependence corresponds to the distinction between bodiliness and grabbiness first presented in O'Regan and Noë 2001 (and developed in a series of unpublished papers by O'Regan, Myin, and Noë). There are differences, however, between the distinction as presented here in the text and that presented in this other work.

with its now occluded parts. Crucially, there is no sense in which the occluded part feels perceptually present.

For the relation to an object to be perceptual, it must be mediated by patterns of sensorimotor dependence which are both movement-dependent and object-dependent. In this way, then, the enactive approach allows us to say that the experience of the tomato (and its backside), but not that of the room next door, is perceptual. (Or rather, our relation to the room next door is not visual, whereas our relation to the hidden bits of the tomato is, at least to some extent.)

An objection to this proposal starts from the thought that what explains the sense of presence of the tomato as a whole, on the basis of its visible parts, is the fact that the hidden and visible parts are united by their inherence in a single object. Just as one can kick a whole table merely by kicking its leg, so one can see a whole tomato just by seeing its facing side. By the same token, so the objection goes, we ought to say that one does see the room next door by seeing the larger object (the building) of which it is a part.<sup>14</sup>

In reply, note that this objection is a version of the appeal to inference and knowledge considered above in Section 2. I am happy to believe that the concept of objecthood shapes and constrains our appreciation of what is seen. However, I insist, as I did earlier, that this can't be the whole story. For what is needed is an account that does justice to the phenomenology itself, and phenomenologically at least some of the unseen parts of the tomato are *perceptually* present, not merely present insofar as we understand that they belong to the object we are looking at.

I grant that there is a sense in which the room next door *feels* present. And perhaps its felt presence has in part to do with our understanding that it belongs to the building of which we are perceptually aware. However, it is not present with the same liveliness, vividness and immediacy with which some of the strictly *unseen* parts of the tomato are present. This difference corresponds precisely to the differences in the ways in which our relation to the tomato (and its unseen parts), but not our relation to room next door, is governed by patterns of sensorimotor dependence.

This account of perceptual presence provides the basic elements of a more full-blooded account of perceptual content.<sup>15</sup> For the question in what does my sense of the unseen part of the tomato consist is equivalent to the question in what does my experience of the tomato's shape consist.

Consider a simple case of shape perception:

A cube has six sides; there are twelve edges and eight vertices. You can never see more than three sides from a single point of view. As you move with respect to a cube, its aspect changes dramatically. Sides come into view while others disappear. Any

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<sup>14</sup> This objection has been raised by Edward Harcourt, Michael Martin, and the editors of this book.

<sup>15</sup> I offer such an account in Noë [2004].

movement determines a set of changes in perceived aspect; any set of changes in perceived aspects determines equivalence classes of possible movements.<sup>16</sup>

When you see the cube from a particular vantage point, you encounter its aspect from that vantage point. When you experience an object as cubical on the basis merely of its aspect, you do so because you bring to bear, in this experience, your sensorimotor knowledge of the relation between changes in cube aspects and actual and possible movement. To experience the figure as a cube, on the basis of how it looks, is to understand *how* its look changes as you move.

Similar points, *mutatis mutandis* go for different shapes and different perceptible properties.

This idea was anticipated by Merleau-Ponty [1945/1962: 82], who wrote:

I know that objects have several facets because I could make a tour of inspection of them, and in that sense I am conscious of the world through the medium of my body.

Experiencing the ovoid character of the tomato depends on one's implicit grasp of the complicated sensory effects of movement in relation to the tomato. To experience the tomato as voluminously ovoid is to experience it as providing the possibility of a range of movement-induced sensory changes.

## 6. Enactive externalism and virtual presence

With this account of perceptual presence on the table, let's return to the question of externalism and the vehicles of content. Are the vehicles of perceptual experience in the head?

It might have seemed that this question requires a positive answer. We are now in a position, however, to appreciate the possibility that perceptual experience need not supervene on neural states. The content of a perceptual experience is not given all at once the way the content of a picture is given in the picture all at once. What we experience *now* goes beyond what we represent *now* in consciousness. Detail, three-dimensionality, color, are present in experience not *as represented*, but rather *as available*. In this sense, experience has this content at a moment in time only as a potentiality. The content may be enacted; it is accessible, thanks to the perceiver's embedding in the world, and the perceiver's possession of the skills – sensorimotor, perhaps also conceptual – needed to assemble it. Perceptual experience is a temporally extended activity of skillful probing. The world makes itself available to our reach, given our skill. The experience itself comprises mind and world. It has content only thanks to the established dynamics of interaction between perceiver and world. This is the first suggestion I want to make in support of the idea that the body and the world may enter into the making of experience. There is a sense in which the content of the experience is not *in the head*. But nor is it *in the world*. Experience isn't something that happens in us. It is something we do.

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<sup>16</sup> Koenderink [1984] discusses this case in detail.

In defense of this idea, I propose that the world is present in experience *virtually*, the way information from a remote server is present on your desktop. The world is present virtually thanks to the way we are bound to it, in bodies with the right sort of connectivities. Moving the eye, turning the head, repositioning the body, brings us the detail we need as we implicitly know that it will. The world is present in experience virtually thanks to our online, dynamic access to it.

This metaphor invites an objection. All that is present in your computer, *really*, is what is already downloaded. Information on the network is accessible, but it is not present. The *illusion* of presence (that's what it is, after all) depends only on the current state of your local machine. Isn't the same true of perception? The content of your current experience is determined by your current brain state. Crucially, this brain state includes all the needed information about the sensory effects of movement. Anyone whose brain is in a state identical to yours would have the sense of presence of the same variety of features, even if their environment were radically different!

I respond to this challenge directly in the next section. For now, two basic ideas need to be laid out.

First, phenomenologically speaking, virtual presence is a kind of presence, not a kind of non-presence or illusory presence. Recall, it doesn't seem (for example) as if you can actually *see* the partially occluded bits of the cat. It only seems as if they are present in that by movements we can bring them into view. Virtual presence is all the presence we need, phenomenologically. Crucially, virtual presence can be explained given a conception of the perceiver as embodied and as situated in and coupled with an environment that affords possibilities of exploratory movement.

Second, and this may be the most important idea in this paper, experiential presence is virtual *all the way in*. This is an important disanalogy with the computer case. Consider the tomato again. You see the facing side. You can't see the far side, but you have a perceptual sense of its presence thanks to your practical grasp of sensorimotor patterns mediating your relation to it. The rear side is present virtually, but the facing side is present *simpliciter*. Notice, however, that you do not, as a matter of fact, have the *whole* of the facing side of the tomato in consciousness all at once. The facing side has extent, and shape, and color, and you can't embrace all this detail in consciousness all at once, anymore than you can embrace the whole detailed scene. This is clear to careful consideration. Take a tomato out. Look at it. Yes, you have a sense that the facing side of the tomato is all there, all at once. But if you are careful you will admit that you don't actually experience even every part of its visible surface all at once. Your eyes scan across the surface and you direct your attention to this or that. Further evidence is provided by change blindness. As mentioned above, the very color of the object you are staring at can change right before your eyes without your noticing it, so long as you are not attending to the color itself!

What this shows is that you cannot factor experience into an occurrent and a merely potential part. Pick any candidate for the occurrent factor. Now consider it. It is structured too; it has hidden facets or aspects too. It is present only in potential.

The point here is not that one can only attend to a small number of features at an instant in time, although this is widely agreed to be true [Pylyshyn 1994; Sperling 1960].

The point rather is this: a perceptual experience doesn't analyze or break down into experiences of atomic elements, or simple features. Experience is always a field, with structure; you can never comprehend the whole field in a single act of consciousness. Something always remains present, but out of view. All you can do is serially run through features. But the moment you stop and try to make a single feature the sole object of your consideration – *this shade of red*, for example – it exceeds your grasp. This is true even of a *Ganzfeld*. Suppose you are in a grey fog. Nothing visually distinguishes here from there. And yet, you are not given the greyness around you as a simple property. There's the color, which is spread out in space, but there's also the texture.

Qualities are available in experience as possibilities, as potentialities, but not as completed givens. Experience is a dynamic process of navigating the pathways of these possibilities. Experience depends on the skills needed to make one's way.

The upshot of this is that there is no basis, in phenomenology, for thinking that what is given now, to me, as present in my consciousness, is ever enough to account for the character of my current conscious experience. My phenomenal experience expands my immediate horizons and takes me beyond myself to the world. This sounds paradoxical, but it is not. Presence in absence, I have tried to show, is a pervasive feature of our perceptual lives.

### **7. Does experience supervene on internal states of the brain?**

The correct answer to this ought to be: “maybe”.<sup>17</sup> I have argued that the content of perceptual experience depends on the possession and exercise of sensorimotor skill. The objector is right to push the thought that how things are with one perceptually at a given moment is controlled by one's current sensorimotor expectations, and, thus, by one's current state. However, to concede this – how could I not concede this? – is not to grant that perceptual experience supervenes on internal neural states. For it is an open question, an empirical question, whether the content and character of the sorts of perceptual experiences we actually enjoy is controlled by our sensorimotor expectations *alone*. It could be, as there is now reason to suspect, that *our* experience (as opposed to some more primitive kind of experience) requires dynamic interaction with the environment. *It is an empirical question whether our brains can do the work needed to enable us to enact our virtual worlds*. It is a mistake – a prejudice really – to think this question has already been settled.

Recall the significance of the earlier discussion of the perceptual presence of detail. Change blindness shows that we do not, at a moment in time, have access to an internal representation of the visual detail. Some scientists (e.g. O'Regan 1992) have proposed that the visual system can go without such detailed internal representations since the environment can serve as a repository of information about itself. Why represent what is immediately accessible? The thought here is that an *external*

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<sup>17</sup> In this section I draw on joint work with Susan Hurley. My own thinking about externalism has been shaped by engagement with her work and by our collaboration.

representation would be just as good as an internal one. This is an important insight, one that takes the first step to demoting the significance of *internal* representations in the theory of perception. The implication is that internal representations of experienced detail are not necessary for experience.

What if they are not sufficient either? As noted at the outset, it is an uncontroversial fact about our current epistemic predicament that we don't have any understanding of what it is about the action of neural states (representational or otherwise) that gives rise to consciousness. How could internal representations of the environment be the ground of the perceiver's phenomenal experience of that environment? This explanatory cul-de-sac stands in contrast with the avenues of explanation made available on the enactive approach. For example, we have considered how the perceiver's implicit grasp of the sensory effects of movement can make the shape of an object available in perceptual experience.

We are considering the thought that detailed internal models of the environment are neither necessary nor sufficient for perceptual experience. What if, as a matter of empirical fact, they are not even possible? Change blindness raises this question. Perhaps, as a result of our phylogenetic history, we are just *bad* at storing detail, at representing. If this is how things are, then our sense of the presence of environmental detail could not consist in the fact that we have access to an internal representation, but would have to consist in our *access to the detailed environment itself*, thanks to our possession of the requisite sensorimotor knowledge and to the fact that we are *coupled* with the world. Our current experience of detail would depend on our current access to unrepresented detail.

We have already disarmed one objection to this possibility based on phenomenology: it seems to us as if the detail is represented in our consciousness all at once. This is the wrongheaded, snapshot conception of experience that I targeted earlier in this paper. It does not seem to us, when we see, that we have all the present detail in consciousness at once. The world is present -- not in our minds, but as available to our inspection.

Upshot: it is an open empirical possibility that our experience depends not only on what is represented in our brains, but on dynamic interreaction between brain, body and environment. The substrate of experience may include the non-brain body, and the world.

## 8. Modal intuitions

“Wouldn't my neural duplicate have the same experiences as me?”

Perhaps, but your neural duplicate would almost certainly be embedded in and interacting with a duplicate of your environment. What else could explain the neural identity? (This point has been discussed by Hurley 1998; see also Hurley and Noë 2003.)

“But wouldn't my neural duplicate have the same experiences as me *whatever differences there might be between its environment and mine*? This is the force of the claim that experience supervenes on the brain.”

We can follow Hurley in challenging this *duplication assumption* (1998, chapter 8): who knows what would be the case in a world in which there could be neural duplicates in radically different environments? How could one decide?

It's worth recalling that arguments for *content* externalism – such as Putnam's original discussions of Twin Earth – make the assumption that physical duplicates are also phenomenal duplications, but what motivates this assumption is the supposition that they occupy qualitatively identical (if physically dissimilar) environments. In the absence of this sort of consideration, how can we even make sense of the proposal that creatures in different environments could be neural (and so phenomenal) duplicates? One strategy would be to appeal to “virtual reality”. This is certainly an intelligible possibility, but not one that lends much support to the “consciousness is in the head” doctrine. First, what explains the phenomenal identity in a virtual reality scenario is not neural identity, but the environmental sameness (at some level of characterization) that drives that neural identity. What is doing the explanatory heavy lifting is idea that the virtual environment presents the same face, as it were, to the subject. Second, in the virtual reality scenario, it is not the brain alone, but the brain as coupled to the system (perhaps including the system's designer) that suffices for experience.

I have urged that experience is a temporally extended phenomenon; it is an activity of skillful probing. If this is right, then a neural duplicate of me now, at a moment in time, won't, by dint of being my duplicate now, have any experience at all.<sup>18</sup> If the duplicate does have experience, it will be thanks to its dynamic, temporally extended interaction with the environment. But then again we must note that there is little reason to think that its experience would or could be like mine unless its environment were also like mine.

The internalist may be tempted to refer to dreaming as evidence that experiential states can be produced by the brain alone. But this appeal only succeeds in demonstrating (given additional assumptions) that *dream experiences* depend on neural states alone. It has been reported by the psychologist Stephen LaBerge (personal communication) that dreaming may differ from non-dream perceptual experience precisely in respect of the stability and richness of represented detail. For example, when you read a sign in a dream, and then look away and then look back, the sign almost always says something different. What explains this qualitative difference between dreaming perception and real perception may be precisely the fact that dream experiences, but not genuine perceptual experiences, do depend only on neural activity for their basis. Normal perceptual experience, in contrast, is anchored by our dynamic coupling to the world.

I have not sought to demonstrate vehicle externalism. My point has not been that the mind *must* extend beyond the limits of the head, but rather that there is no deep theoretical obstacle to thinking that (as regards experience) it might do so (at least for some range of aspects of experience).

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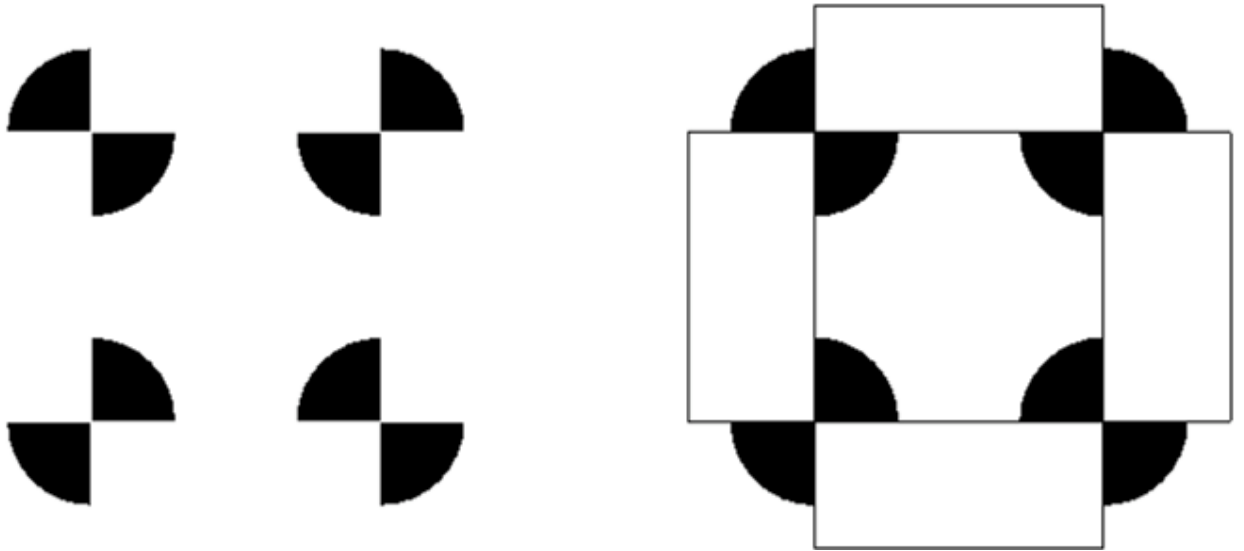
<sup>18</sup> As Mark Rowlands has emphasized in correspondence.

It has always seemed that there were obstacles to thinking that consciousness could so extend beyond the limits of the skull. “Gosh darn it, experience just feels like it’s in the head.” But this is bad phenomenology, I have argued, and it is probably bad science. As we have seen, detail may be present in consciousness only virtually. We thus open up the possibility of an account of (for example) the perceptual experience of detail that is consistent with its not being the case that that detail is represented at once in the head. Although of course it *could* be. The upshot is not that experience is without the head, but that it might be. The world is safe for an externalism that allows that we enact perceptual content by the exercise of sensorimotor skills over time.

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**Figure 1**



**Figure 2**



**Figure 1 Caption**

**Due to Kanizsa**

**Figure 2 Caption**

*Filling in at the blind spot*

Shut your right eye and fixate the cross with your left eye. Adjust the distance of the book from your eye. At one point the gap in the line on the right falls within the blind spot. What do you experience when that happens?

## Works Cited

- Angelone, B.L., Levin, D.T., & Simons, D.J. (2003). The roles of representation and comparison failures in change blindness. *Perception*. 32: 947-962.
- Brooks, R. A. (1991) Intelligence without reason. *Proceedings of the 1991 International Joint Conference on Artificial Intelligence*: 569-595. Clark, A. 1999
- Clark, A. and Chalmers, D. J. [1998] The extended mind. *Analysis* 58, 1: 7-19.
- Clarke, T. [1965] Seeing surfaces and physical objects. In M. Black (ed.) *Philosophy in America*. Ithaca: Cornell University Press.
- Davidson, D. [1987] Knowing one's own mind. *Proceedings and Addresses of the American Philosophical Association* 60: 441-458.
- Dennett, D. C. [1987] Error, evolution and intentionality in *The Intentional Stance*. Cambridge: MIT.
- Dennett, D. C. [1991] *Consciousness and Explained*. New York: Little Brown.
- Dennett, D. C. [2001] Surprise, surprise. [Commentary on O'Regan and Noë]. *Behavioral and Brain Sciences* 24, 5.
- Dennett, D. C. [2002] How could I be wrong? How wrong could I be? *Journal of Consciousness Studies* 9, 5-6: 13-16.
- Dreyfus, H. L. [1972/1999] *What Computers Still Can't Do: A Critique of Artificial Reason*. Cambridge, MA: The MIT Press.
- Dretske, F. [1995] *Naturalizing the Mind*. Cambridge, MA: The MIT Press.
- Durgin, F. H., Tripathy, S. P., & Levi, D. M. (1995). On the filling in of the visual blind spot: Some rules of thumb. *Perception*, 24(7), 827-840.
- Hurley, S. L. [1998] *Consciousness in Action*. Cambridge, MA: Harvard.
- Hurley, S. and Noë, A. [2003] Neural plasticity and consciousness. *Biology and Philosophy*, 18: 131-168.
- Kelly, S. D. [2001]. The non-conceptual content of perceptual experience: situation-dependence and fineness of grain *Philosophy and Phenomenological Research* lxii, no. 3: 601-608.
- Koch, C. [2004] *The Quest for Consciousness*. Colorado: Roberts & Company Publishers.
- Koenderink, J. J. [1984]. The internal representation of solid shape and visual exploration. In L. Spillmann & B. R. Wooten (Eds.), *Sensory experience, adaptation, and perception. Festschrift for Ivo Kohler* (pp. 123-142). Hillsdale, New Jersey: Lawrence Erlbaum.
- Levin, D.T., Simons, D.J., Angelone, B.L., & Chabris, C.F. (2002). Memory for centrally attended changing objects in an incidental real-world change detection paradigm. *British Journal of Psychology*, 93: 289-302.

- Merleau-Ponty, M. (1945/1962) *The phenomenology of perception*. Trans. Colin Smith. London: Routledge Press, 1962. [French original: 1945.]
- Minsky, M. (1985) *The Society of Mind*. New York: Simon & Schuster.
- Mitroff, S.R., Simons, D.J., & Levin, D.T. (in press). Nothing compares 2 views: Change blindness can result from failures to compare retained information. *Perception and Psychophysics*.
- Noë, A. [2002] Is the visual world a grand illusion. *Journal of Consciousness Studies*. 9:5/6: 1-12.
- Noë, A. [2002a] *Is the Visual World a Grand Illusion?* Thorverton: Imprint Academic.
- Noë, A. [2004] *Action in Perception*. Cambridge, MA: The MIT Press.
- Noë, A. Pessoa, L., Thompson, E. [2000]. Beyond the grand illusion: what change blindness really teaches us about vision.
- O'Regan, J.K. [1992] On the real mysteries of visual perception.
- O'Regan, J. K. [in press] Change blindness in *Encyclopedia of cognitive science*, Nature Publishing Group.
- O'Regan, J. K. and Noë, A. (2001) A sensorimotor approach to vision and visual consciousness. *Behavioral and Brain Sciences* 24/5: 883-975.
- Merleau-Ponty, M. (1945/1962) *The phenomenology of perception*. Trans. Colin Smith. London: Routledge Press, 1962. [French original: 1945.]
- Palmer, S. (1999) *Vision: From Photons to Phenomenology*. Cambridge, MA: The MIT Press.
- Peacocke, C. [1983] *Sense and Content*. Oxford: Oxford University Press.
- Pessoa, L, Thompson, E. and Noë, A. [1998] Finding out about filling in: a guide to perceptual completion for visual science and the philosophy of perception. *Behavioral and Brain Sciences* 21/6: 723-802.
- Poincaré
- Pylyshyn, Z.W. (1994). Some primitive mechanisms of spatial attention. *Cognition* , 50, 363-384.
- Ramachandran, V. S. and Gregory, R. L. [1991] Perceptual filling in of artificially induced scotomas in human vision. *Nature* 350, 6320: 699- 702.
- Rowlands, M. (2002) Two dogmas of consciousness. *Journal of Consciousness Studies* 9/5-6: 158-180.
- Simon, D. S. [2000] Current approaches to change blindness. *Visual Cognition* 7: 1-15.
- Simons, D. S. and Levin, D. T. Change blindness. *Trends in Cognitive Science* 1/7: 261-267
- Simons, D.J., Chabris, C.F., Schnur, T. T., & Levin, D.T. (2002). Evidence for preserved representations in change blindness. *Consciousness and Cognition*, 11, 78-97..

Sperling, G. [1960] The information available in brief visual presentations. *Psychological Monographs*, 74.

Strawson, P. F. (1979) Perception and its objects. In G. F. MacDonald (ed.) *Perception and Identity: Essays Presented to A. J. Ayer with His Replies*. Ithaca: Cornell University Press. Reprinted in Noë, A. and Thompson, E. (eds) *Vision and Mind: Selected Readings in the Philosophy of Perception*. Cambridge, MA: The MIT Press.

Wilson, R. A. [1997] *Cartesian Psychology and Physical Minds: Individualism and the Science of the Mind*. Cambridge: Cambridge University Press.