

ARTICLE

Do We Visually Experience Objects' Occluded Parts?

Matt E. M. Bower

Texas State University, San Marcos, TX, USA

Email: membower@gmail.com

Abstract

A number of philosophers have held that we visually experience objects' occluded parts, such as the out-of-view exterior of a voluminous, opaque object. That idea is supposed to be what best explains the fact that we see objects as whole or complete despite having only a part of them in view at any given moment. Yet, the claim doesn't express a phenomenological datum and the reasons for thinking we do experience objects' occluded parts, I argue, aren't compelling. Additionally, I anticipate and reply to attempts to salvage the idea by appeal to perceptual expectation and amodal completion. Lastly, I address potential concerns that the only way to capture the phenomenal character of perceiving voluminous objects is to say experience outstrips what's in view, providing a description of such experience without any implication of that idea.

Keywords: Perception; spatial perception; phenomenology; perceptual expectation; amodal perception; Edmund Husserl; Alva Noë

1. Perceptual presence

Some philosophers think that in perceiving an object you often have a sui generis perceptual sense for more of that object than is exposed to you at a given moment. You're not imagining, remembering, or just thinking about it, they say, but perceiving it in that way. For example, when you look at a book, you have a perceptual and, more specifically, visual sense of its being more than meets the eye, e.g., of its surface including portions not presently in view. Those who hold this view thus accept something like the following claim:

Absence When perceiving an object, you can perceptually experience its occluded or out-of-view parts.

Below I'll argue against that claim. Before evaluating *Absence*, more staging is needed. One prominent group of defenders of the idea that we do perceptually experience out-of-view portions of objects (i.e., *Absence*) advance it as part of a larger explanatory package—as part of their solution to the Problem of Perceptual Presence.¹ In this section, I'll spell out what that problem amounts to. I'll reconstruct the *Absence*-favoring solution to it in section 2, explain why I think no appeal to *Absence* is needed to handle the Problem of Perceptual Presence in section 3, and then reply to some objections in section 4. I'll round out the discussion in section 5 with remarks on the issue of the phenomenal character of the kinds of experience that tempt some philosophers to affirm *Absence* and why it shouldn't.

¹Not everyone addressing the Problem of Perceptual Presence in this way applies that label (*Problem of Perceptual Presence*) to it. I borrow the phrase from Alva Noë. See Noë (2004, 60).

The Problem of Perceptual Presence² (PPP) emerges from the tension between the following two claims (Briscoe 2011; Nanay 2010; Noë 2004, 2012; Leddington 2009).³

<i>Presence</i>	Perceptual experience often presents you with opaque, voluminous objects.
<i>Perspective</i>	Perceptual experience does not present you with opaque, voluminous objects in their entirety.

An example will help foreground what's problematic about entertaining these two assertions as true. Imagine you're looking at a kiwi fruit. If I ask you what you're looking at, you'll no doubt say you see a kiwi. You see a plump, somewhat spherical, brownish, fuzzy-looking object filling up a bit of the space before you. I then remind you that your experience is, causally, largely due to light reflecting off the surface of the kiwi and the remainder isn't causally efficacious at present. You may acknowledge this and observe further that for all you know, you're merely looking at a kiwi façade perceptually indistinguishable from the real thing. PPP has dawned on you. The difficulty consists in understanding how you can perceive an ordinary voluminous object like a kiwi despite the limitations your perspective on the object imposes on that experience.

Two points of clarification. First, it may be that perceptual presence crops up in other sensory modalities, but I'll limit myself to its occurrence in visual perception. Second, perceptual presence shows up in distinct but related forms, only one of which is represented by the example I just gave. That example is a case of self-occlusion. Most of the kiwi is hidden from you by the portion of it that's in view. You seemingly see some of it at the expense of the rest. In other instances, you experience perceptual presence when one object occludes another (or several do). For instance, you perceive a cat standing on the far side of a picket fence even though only scattered parts of it are exposed to view. That involves self-occlusion, too, but it also involves what we could call allo-occlusion, i.e., of the cat by the fence.

Throughout what follows, I'll assume Presence and Perspective are both true. Thus, for present purposes, skepticism about whether we perceive voluminous objects—as opposed to merely their facing surfaces, bundles of perceptible features, or perhaps only nonspatial sense data—is off the table. And, while it would be interesting and worthwhile to know what criteria must be met for an experience to count as a case of object perception, that issue won't detain us here either.⁴ To perceive an object in the relevant sense will mean to experience a concrete particular in the distal environment as an individual, spatially discrete, voluminous item—one that stands out from other objects and fills up space in three dimensions. So, my goal is to assess certain accounts that attempt to reconcile Presence and Perspective. As already noted, I'm less interested in how to reconcile these claims than in understanding the kind of view they're taken to motivate and in evaluating that view. Once the problems facing the view come into relief, the Problem of Perceptual Presence takes care of itself. The problem persists only as long as certain mistaken assumptions are in place.

The understandable response of many philosophers to the puzzle has been to fixate on the occlusion involved in our experience. The idea is that Presence and Perspective seem to clash because Presence means we see a whole, complete object and Perspective means we don't perceive the whole thing. The views that I'll collectively designate as Absence-Based Accounts (ABAs) all

²The phrase *perceptual presence* is sometimes used to refer to other phenomena than the one of interest here, e.g., to the sense that what is perceived is real in some sense. See Dokic (2012), Ferretti (2016), and Matthen (2005) for discussion of other phenomena falling under the heading of *perceptual presence*.

³The precise way I formulate PPP does not appear in any of the accounts that I will discuss. It's my own formulation. I offer it as a reconstruction of the problem implicitly being dealt with by various authors. I hesitate to use the formulation of Noë, even though I'm borrowing his language (see note 1) because I think his characterization is already too theoretically loaded. In section 3, it will become clear why Noë's formulation of the problem in mereological terms is problematic.

⁴See Millar (2017) and Green (2018) for useful discussion.

hold that our mind reaches beyond its perspectival limitations at any given moment to give us a genuinely perceptual experience of occluded portions of the object. As the name I've given them suggests, these accounts endorse Absence. We move next to consider the rationale for ABAs.

2. Absence-Based Accounts

Absence-Based Accounts (ABAs) purport to solve PPP on the basis of the following claim (Husserl 1997, 1989, 1977; Noë 2004, 2012; O'Regan and Noë 2001).

Complexity Perception has phenomenally and intentionally distinct components pertaining to a perceived object insofar as it is in view and insofar as it is out of view.

The idea expressed here is sometimes couched in talk of modal and amodal perception, where, roughly, modal perception enables experience of an object only as it falls within your line of sight and amodal perception enables experience of the object as exceeding what falls in your line of sight.⁵

Edmund Husserl offers an account of PPP that relies crucially on his endorsement of Complexity. Husserl is thus an ABA proponent. This is evident in a distinction he draws that exactly parallels the one between modal and amodal perception. The terminological equivalent is his distinction between “proper perception” which presents the perceiver with, e.g., “the strictly seen front side of a thing,” and the perceptual “appresentation” of (*inter alia*) its “rear aspect” (1999, 139–40/109–10).⁶ Relying on this distinction, Husserl elsewhere writes that perception, and presumably *proper* perception, presents to us “merely [...] one side” or “a mere part” of the perceived thing (1977, 171/131; 1997, 50/42–43). Yet, what is true of proper perception isn't true of perception when fully accounted for.

If I'm looking at a table, for instance, Husserl claims “it is not the mere side of the table that appears [...], it is rather the perceived table as especially seen from this side” (1977, 179/138; 1997, 50–51/43).⁷ That's because in perceiving, proper perception and apperception “reciprocally require one another” (1997, 54/45), functioning together to yield a “total apprehension” or “total appearance,” i.e., the experience of an object over and above its facing portion (1997, 50/43). In short, properly perceiving the facing portion of an object only gives us access to the object (and not, e.g., a façade- or veneerlike entity) because the experience includes a “horizon” (1977, 180–83/138–40) of appresentation pointing the way to the object “as an articulated whole” (1997, 53/45; 1973, 141).⁸ Husserl's view of appresentation clearly entails Absence and, together with what he says about proper perception, it entails Complexity as well.

The elements of Husserl's view that I've just laid out and that commit him to a kind of ABA are anything but outdated. ABAs are alive and well,⁹ as Alva Noë's (2004, 60–65; 2005, 241–43; 2009, 473–76; 2012, 55–58) account of perception attests. His view is entirely consistent with what I've

⁵I'll contest this characterization in section 4.

⁶When citing English translations of Husserl's works that include the page numbers for the German source texts, I cite the page numbers from the German source text first and then the page numbers for the English translation with a slash between the two; Husserl employs the same distinction also in the following passages: (1997, 50–54/42–46; 1970, 157–58; 2001, 3–7/39–43). The idea is widely recognized as central to Husserl's account of perceptual experience by Husserl scholars. For discussion, see, for instance, Bernet, Kern, and Marbach (1993, 115–25), Mulligan (1995, 192–94), Gallagher and Zahavi (2012, 107–8), Christensen (2013, 116–23), and Smith (2016, 56–63).

⁷Husserl extends the analysis to include instances of allo-occlusion as well. See Husserl 1997, 51/43–44.

⁸This is no doubt a simplistic characterization of Husserl's view. There are further elements that go into his story about simple object perception that I make no mention of here. Introducing those complications, however, makes no difference to the point being made, which is that Husserl claims that to make sense of object perception, we must say that perceptual experience involves something analogous to a partitioning of it into what are now called modal and amodal components.

⁹Michael Madary presents a view consistent with the claim I've identified as the core commitment of ABAs, i.e., Complexity, and does so explicitly acknowledging the influence of Husserl on his account. See Madary 2017, especially chapters 2 and 3.

related of Husserl's view (although perhaps not with other details of it). Indeed, the phrase "perceptual presence" that I'm using to frame the problem we're now dealing with is one I borrow from Noë, for whom "the problem of perceptual presence" is that "[w]e have a sense of the presence of that which, strictly speaking, we do not perceive" (2004, 60). The idea is that in cases of self-occlusion or allo-occlusion, "it seems to you as if you are aware, *in a perceptual modality*, of something that is plainly out of view" (2005, 242; emphasis added). With that remark, Noë's commitment to Absence is apparent.

Like Husserl, Noë (2004) holds that our ability to see the kiwi (and not merely its facing surface or unoccluded parts) and the cat behind the fence (rather than just a collection of cat parts, let alone only the unoccluded parts of those cat parts) is explained by the fact that our perceptual experience includes an amodal component that enables us to *experience* (63) in a peculiarly perceptual way the occluded portions of those objects,¹⁰ even though "strictly speaking", i.e., *via* modal perception, we only perceive facing portions (60). He's thus in agreement with the fundamental ABA commitment, i.e., Complexity.

On what grounds do Husserl and Noë settle on a kind of ABA and not some other view, apart from whatever *prima facie* plausibility the idea has?

Their argument relies crucially on phenomenological claims. They appeal to Presence and Perspective as phenomenological evidence and their preferred further explication of those claims. Here's how I understand their reasoning. Your perceptual experience captures, say, the kiwi, not a façadelike entity or just the kiwi's facing surface. That, which conveys the gist of Presence, is taken to mean, further, that you in *some* sense perceive the object as a *whole*. But, if you describe the vivid, sensory givenness of the perceived in-the-flesh, your report would fall short of describing the whole object, as *per* Perspective. What you can report of it, in that sense, corresponds roughly to its facing portion, and would not differ from an analogous report about perceiving a suitably positioned kiwi façade. This is taken to mean that, in *some* sense, you only perceive its facing surface, a mere *part* of the object.

Add to that the observation that no consciously entertained belief or imaginationlike mental state figures (at least, neither necessarily nor in all cases) in the experience, and what seems to follow is that perceptual experience has two distinct features.¹¹ In some sense, you perceive only a part. And that is a deliverance of modal perception. Yet, because the experience is manifestly of the object as whole, and because there is evidently no nonperceptual state that picks up the slack, there must be a supplementary component, an amodal one that grants you further experiential access to the object beyond what is in your line of sight. That last claim, which is tantamount to Absence, combines with the claim about the modal component of perception to yield Complexity. A perceived object is experienced as whole by virtue of modal perception that enables consciousness of its facing surface being combined with amodal perception that enables consciousness of the object's out-of-view remainder.¹²

Evan Thompson, Walter Hopp, and Søren Overgaard have each also integrated a Husserlian version of ABA into their accounts of perceptual experience. (See Thompson 2007, 231–33; Hopp 2011, 161–72; and Overgaard 2012, 84–90.)

¹⁰Curiously, Noë says both that we perceive objects as whole, like our running examples of the kiwi and the cat, but that we don't "represent the whole cat [for instance] in consciousness at once" (2004, 63). I take it that what he means is that there isn't a detailed imagelike awareness of the whole cat. In another place, Noë nearly repeats the phrase, but says "represented or depicted" instead (2005, 243). It is consistent with that to maintain, as I understand him to, that we are in some sense perceptually aware of the cat as whole, such that we are intentionally directed to more of the perceived than it presents *via* modal perception.

¹¹If this rejection of belief and imagination as explanatorily salient for dealing with PPP looks too hasty, Robert Briscoe (2011) has argued convincingly, and not on phenomenological grounds alone, that these alternatives are untenable.

¹²In criticizing ABAs, I will have some skeptical things to say about their appeal to amodal perception. Amodal perception, of course, does exist, and does enrich perceptual experience beyond what modal perception provides. But it doesn't do the work ABAs think it does. I'll return to this issue in section 4.

3. Against ABAs

The root deficiency of ABAs, on my diagnosis, is their mereological interpretation of Presence and Perspective. They take Presence to be equivalent to perceiving (as the outcome of both modal and amodal perception) an object as a *whole* or *complete* object and Perspective is taken to be equivalent to perceiving (as the outcome of modal perception by itself) a *part* of the object, i.e., whatever portion of it has a causal impact on our sensory organs, i.e., its facing surface. There are several good reasons for rejecting this interpretation.

3.a Explanatory failure

For a moment, let's grant that the correct way to understand Presence and Perspective is in mereological terms. If so, then what amodal perception provides is intentional directedness to out-of-view portions of the perceived object and what modal perception provides is intentional directedness to its in-view or facing portion. That is, what modal and amodal perception involve is intentional directedness toward various parts of the object. Yet, on the ABA reading of Presence, we take in the perceived object as a whole or complete object. We don't take in a mere collection of its parts. The experience is not fragmented in that way. Thus, Complexity, by itself, fails to resolve the tension highlighted by PPP on the ABA reading of Presence and Perspective. The problem, for ABAs, was that modal perception falls short of the object as a whole and gives us only part of it. The appeal to amodal perception is supposed to make up for that. But the problem remains if all that amodal perception gives us is perception of more parts.

So, the proposal doesn't achieve its ambition of telling us how we perceive whole or complete objects as such. True, if amodal perception gave a complete characterization of the out-of-view portions of the object, then the problem would be fairly minor. It would only be an instance of a more general issue in understanding perceptual experience, i.e., the binding problem. Just as the sensory modalities of, say, vision and touch can "bind" together enabling a multimodal perceptual experience of an object, the same could also hold for the modal and amodal components of a given sensory modality.

But this response isn't available to ABAs. It's not the case that amodal perception gives us a complete characterization of the out-of-view portions of the object. At most, it could inform us about, in the case of vision, its exterior, the parts available for inspection. This is at least tacitly acknowledged by Husserl when he suggests that amodal perception (apperception) anticipates what the perceived is like indeterminately (1977, 181/139; 1973, 103–5) and by Noë's repeated denial that perceiving an object as a whole means having it "in consciousness all at once" (2004, 63; 2005, 243). Therefore, even if we leave unquestioned the mereological reading of Presence and Perspective, ABAs fail to solve PPP.

3.b The mereological reading of Presence

Now let's give the mereological reading of Presence and Perspective a closer look, beginning with Presence. It's not immediately obvious what motivates the transition from saying that we perceive objects to saying that we perceive complete or whole objects. Of course, if you (veridically) perceive an object and the object is a whole (as opposed to, say, an undetached part), then you perceive a whole object. But that's trivially true. It's also true (again, trivially) that if you perceive a kiwi, and nothing indicates that any parts of it are missing, then you don't perceive it as less than a whole or as incomplete.

What's really at stake, I think, is whether the object is perceived *as* whole or complete. Is the wholeness or completeness of the perceived object somehow reflected in the phenomenal makeup of the experience? The answer to that isn't obvious. Noë sometimes seems to treat it as a phenomenological datum that we experience things that way (2004, 76). Jesse Prinz, on the other

hand, denies that we do (2012, 76), and I would second that, for what it's worth.¹³ At this point, we should step back and ask: Do we *need* to perceive an object as whole to perceive it as an object that is voluminous, filling up space in three dimensions? Are the two ways of registering it somehow equivalent? If not, does some conceptual connection between the two imply that you must register the object as qualified in the first sense in order to do so in the second? I suggest these questions all deserve negative answers.

Suppose perceptual experiences are intentional states, as I've been taking for granted. It is not generally true that for a mental state to pick out, intentionally, a given object that it has to identify it as whole or as a complete object. Additional motivation is needed for the mereological reading of Presence. I suspect that for many ABA proponents a thought like the following makes the mereological reading of Presence attractive. Imagine you're presented with a cube, which is a six-sided figure. Yet all you can make out shapewise regarding the cube in your perceptual experience is, at most, three of its sides. So, it can only be that you perceive the cube as a cube—which I don't want to deny—if you tacitly, amodally register its other sides as well.

But consider that in thinking or speaking, I can intentionally pick out a cube with an expression like "That's a cube!" The proposition I express is about the cube due to its representational content. Yet that content is silent on the matter of the cube's sides. I could also say: "Only one of that cube's sides is exposed to my view right now." That statement also picks out the cube and refers to its sides, but only in a vague way. It may be that I can only identify it as I do in expressions like those if I can also describe it correctly in other ways, e.g., as being three-dimensional, as having six sides, etc. Still, I don't need to have all of that in mind at any given moment to successfully refer to the cube. Something similar may be true of perceptual experience as well, i.e., that recognizing three-dimensional shape requires an ability to discern it in varying perceptual circumstances, e.g., from different vantage points. But that is a much weaker claim than Absence or Complexity.

Things work differently with perception, though, than they do with natural language. Maybe perceiving an object as voluminous requires perceiving it as whole, whereas forming a thought with propositional content about it doesn't require simultaneously deploying concepts like WHOLE or COMPLETE. But if that's true, we need some reason for treating the two cases differently. One possibility in that vein would be to say that the *perspectival* character of perceptual experience is what differentiates it from languagelike thought and that this fact also explains the connection between perceiving an object as whole and perceiving it as voluminously filling up space in three dimensions.

To see the plausibility of this suggestion, let's go back to our kiwi example. The kiwi is, roughly, ovoid in shape. Take its property of being ovoid as a proxy for its being three dimensional and voluminous. Presented perceptually, an ovoid object looks no different from a hemiovoid one oriented so that the entirety of its convex surface is in view. It's also indistinguishable from the similarly oriented convex exterior of a mere façade. You might infer that the perspectival presentation of the kiwi just doesn't tell you enough for you to identify, from its perspectival appearance alone, what shape it has. There's an ambiguity in your experience, and it's not immediately obvious how it might be resolved. Admittedly, you can't tell apart the kiwi from the suitably positioned kiwi half or faux kiwi-façade in *some* circumstances.

As Ekroll and colleagues have shown, however, the ambiguity isn't omnipresent (2013). The point is simple enough to demonstrate for yourself. If you take a kiwi (or whatever spherical or ovoid object you like) and divide it into two hemiovoids, you can take one of the halves and set it on a flat surface. Viewing it from above, what you'll see is a half-kiwi sitting on the flat surface. You might try to see it as a kiwi whose lower half is resting in a hemiovoid concavity in that surface, but you won't have much luck (Ekroll, Sayim, and Wagemans 2013, 514). However, if you raise the kiwi

¹³I'll address the issue of how to describe the phenomenal character of experiencing voluminous objects without taking on the commitment of either Absence or Complexity in section 5.

above the surface while maintaining the same orientation, raising it at least the length of its missing lower half, you'll experience something like a Gestalt shift or aspect switch. It seems to grow as you raise it, and to shrink as you lower it again to the surface. Whether you see it as ovoid or hemiovoid depends on its proximity to the flat surface. So, the ambiguity is circumstantial. It's worth mentioning, too, that what our visual system is tracking here, according to Ekroll and colleagues, in line with the research of Tse (1999), isn't the surface of the object, as *per* ABAs, but its volume. You see it filling out space like an ovoid or hemiovoid, and you don't have an experience of differing surfaces, let alone of differing interiors.

Indeed, some vision scientists claim that the ambiguity of shape is greatly exaggerated and largely an artifact of which objects we choose to examine and in what circumstances. But even in textbook cases of ambiguity, like the cube mentioned earlier and which Noë uses to motivate Absence (2004, 77), objects aren't as ambiguous with respect to three-dimensional shape as they're often said to be. Pizlo and colleagues observe:

Consider the image of [an] opaque cube [...]. Marr pointed out that you can only see half of the six surfaces of this opaque cube (only 50%), but note that you can easily see seven of its eight vertices and nine of its 12 edges. So, if shape is represented by vertices and edges, rather than by (or in addition to) surfaces, we often see 70% or even 87% of the shape, appreciably more than 50% [...]. So, the perception of a 3D shape from its single 2D [retinal] image would be much easier than Marr claimed once shape is defined and represented by points, contours, and surfaces rather than by surfaces alone. In fact, Marr's [...] choice of surfaces for the representation of 3D shape seems to have been the worst possible choice. [...] [R]elying exclusively on surfaces [...] has guaranteed that most of the useful shape information contained in the 2D image would be ignored. (Pizlo et al. 2010, 3)

Pizlo and colleagues have developed a model that "can recover the 3D shape of a complex abstract object from a single 2D image and also recover the 3D shapes of a wide variety of natural objects from a single 2D image" (Pizlo et al. 2010, 2; Li, Pizlo, and Steinman 2009).

The point is that when it comes to three-dimensional shape, things aren't nearly as ambiguous as they may seem. As the immediately preceding quotation indicates, a single viewing may be enough to determine an object's shape. If so, there's no need to anticipate other points of view on an object or to track what its out-of-view parts are like to determine its shape. It's not as if what's in view fails to speak for itself. Notice, further, that, while we of course observe some portion of an object insofar as it can be differentiated, perceiving shape is not primarily a matter of tracking surfaces. The importance of surfaces *per se* gives way to other perceptible properties. This point is not idiosyncratic to Pizlo and colleagues' account. Those studying the perception of three-dimensional shape generally agree that identifying shape requires tracking features of an object like its shading, texture, edges, vertices, as well as more complex ones like symmetry, features that are available from a single vantage point on an object (Todd 2004).¹⁴

Of course, ambiguities remain. Even if we can for the most part accurately discern shape from a single view, there remain cases in which we're liable to misperceive. I presume ABA proponents would agree that not only is the kiwi perceived as ovoid, but so are, illusorily, its look-alikes, e.g., the

¹⁴It's true that we also discern shape by viewing an object from multiple points of view, as research on structure from motion shows (Todd 2004). It's probably also true that we get a more accurate grasp of shape that way, as it leaves less room for ambiguities. Nevertheless, that's just one means in our psychological repertoire for perceiving shape and granting this doesn't detract from the others already mentioned. This seems phenomenologically obvious. In typical structure from motion paradigms, subjects at first see an arrangement of dots with no three-dimensional structure, and only recognize three-dimensional structure once the dots begin moving in a pattern with a certain global order. In that sort of case, three-dimensional structure is indeed first perceptible only from multiple successive viewings. But that's atypical. Ordinarily, we straightaway recognize objects' three-dimensional structure regardless of whether we've taken them in from other points of view. The virtue of the experimental paradigm is that it strips away other means of accessing that structure.

half kiwi (e.g., raised above a flat surface and exposing only its convex surface as viewed from above). So, what should we say about ambiguously shaped objects, like (in some circumstances) the kiwi? Why the preference, e.g., for ovoid over hemiovoid, when what is perceived is in some sense apparently consistent with either? Is there any need to appeal to something like Absence to settle the issue?

Well, suppose our capacity to detect ovoids is shaped by our evolutionary and/or developmental history.¹⁵ Setting aside numerous other details and complications, the emergence of the relevant sensitivity surely depends on both the frequency of exposure to the pertinent property and its practical or even vital salience, whether for the individual in developmental time or for the species in evolutionary time. Given those very general and anodyne assumptions, it's likely we are set up to recognize ovoid objects, but not their nonstandard look-alikes due to the greater likelihood of their presence in our environment, our rich history of interaction with them, and their salience for our everyday activities.¹⁶ Now, our visual system may not be adapted specifically to detect ovoids, but rather to operate by more general shape discrimination principles that favor the typical and the useful. Either way, because time is of the essence, practically and adaptively, it makes sense to think also that we'd need to be able to recognize items with these properties based on incomplete information, our visual system using cues in the stimulus to gauge, e.g., an object's shape, a story that fits nicely with what I've just related from recent work in vision science on shape perception. There is no pressure here to add to our story further details about tracking out-of-view object parts.

Not only is it unnecessary to appeal to perception of out-of-view object parts to make sense of how we perceive the three-dimensional shape of objects (or, more generally, their being voluminous), but at least some such appeals are wrongheaded. Consider Noë's account of shape perception. Noë emphasizes the ambiguity of shape from a single point of view and attempts to resolve that by appeal to anticipation of other possible points of view. Briefly and roughly, his suggestion—a further specification of Complexity—is that perceptual experience consists of both a registration of viewer-relative shape properties, properties that by themselves underdetermine what shape is perceived, and an understanding of the relationship between currently registered viewer-relative shape properties and potentially registered viewer-relative shape properties sufficient to reveal the object's intrinsic shape properties (Noë 2004, 82–86, 133). Crucially, on Noë's account, intrinsic shape properties are in some sense perceived by virtue of viewer-relative shape properties.

There are good empirical grounds for rejecting any account along these lines. Recent work on shape perception in vision science supports the idea that picking out an object's intrinsic, three-dimensional shape is not a matter of first detecting viewer-relative shape properties and then recovering the former from the latter. As Bennett puts it: "It does appear that the representation of some such 'intrinsic,' qualitative surface shape structure is computable from optic array information, and may indeed be a primary target of visual computation" (2012, 503; see also Bennett 2016, 27–35; Green 2017, 376). More bluntly and generally, Bennett claims that "the experiential representation of enduring shape is rarely if ever arrived at by working from recovery of shape appearances, of any kind" (2012, 508). Our visual systems are directly sensitive to both rigid (i.e., highly sensitive to changes in viewpoint), view-defined shape properties (e.g., orientation) and abstract (i.e., relatively stable despite changes in viewpoint), intrinsic shape properties in objects (e.g., quadrilateral, ovoid). Notwithstanding that, it's arguably the case that "the visual system is primarily in the business of producing estimates of more abstract shape properties" (Green 2017, 375). Empirical matters aside, there is a further phenomenological difficulty. It's not clear how to make sense of the suggestion that registering certain viewer-relative shape properties and understanding their interrelation could make an object *look* or *appear* to have a particular intrinsic shape property (Green and Schellenberg 2018, 9).

¹⁵There is some evidence that infants are already able to perceive shape at birth (Bower 1966; Slater and Morison 1985).

¹⁶Leddington (2009) makes a similar point.

The moral is that perceiving objects as whole or as complete is not a necessary condition for perceiving them as voluminous objects. It's sufficient that we can perceive their three-dimensional shape. And this, I've suggested, is something we can do without special attribution of wholeness or experiential interpolation of out-of-view parts. Now, if we abandon the ABA-friendly idea that we perceive objects as whole, then Presence can't be used as argumentative leverage to support Absence and Complexity. The role of these claims in ABAs is to show how our perspective-bound experience of objects is overcome or supplemented to guarantee perception of objects as whole. Having disposed of the mereological reading of Presence, we have one less reason to go that route.

3.c The mereological reading of Perspective

We turn now to the mereological take on Perspective. What Perspective is supposed to convey is that, although, as *per* Presence, we perceive objects as voluminous and three dimensional, in some readily understandable sense we don't perceive them in their entirety. Our perspective constrains what we take in of perceived objects. On ABAs' mereological rendering, that means, in a sense, when we perceive an object, we only perceive part of it, namely, its facing surface. That qualifier, "in a sense," is important. While in another sense, through the joint work of modal and amodal perception, we encounter the object as whole, what *modal* perception, by itself, puts us in contact with is only the perceived object's facing surface. This is the issue I want to focus on now, because if modal perception is not limited in that way, then ABAs' claim that amodal perception overcomes this limitation by giving us access to objects' occluded parts is unfounded.

Let's suppose, for the sake of argument, that modal perception by itself only accounts for experience of part of the perceived object, i.e., its facing surface. (Set aside for a moment the issue of how to understand amodal perception. I'll come back to that in [section 4](#)). When you perceive the kiwi, then, you only take in its facing surface through modal perception. One response to that would be, with ABAs, to say that modal perception thus limits our access to objects. Another response is to say that, as a matter of fact, what the object's facing surface does is precisely give us access to it. Following Frank Jackson's analysis, we could say it's by means of or by virtue of its facing surface that you perceive the kiwi (1977, 15–20). We may have to add that you only perceive the kiwi itself indirectly, but nothing rules out a priori that we perceive objects indirectly.

Nevertheless, courting an indirect theory of object perception will be too high a price to pay for many. Consider, then, Scott Campbell's argument that it's possible to affirm that we perceive an object by perceiving its facing surface while denying that perceiving the object in that way is indirect (2004, 396–97). Campbell has us turn our attention away from vision and toward touch to get the point. Suppose you touch the kiwi with a single finger. You touch the kiwi. Yet you come in contact, physically and experientially, with even less of it than vision affords. Still, you touch the kiwi directly, not indirectly. The point generalizes. It's just not correct to say that the "in virtue of" relation involves mediation or indirectness. Adapting Campbell's apt example, I live in the United States by (virtue of) living in Texas, but it makes no sense to say that the former is mediated by the latter.

So far, I have taken for granted that modal perception affords us only experience of part of the perceived object and argued that doing so doesn't prevent us from saying that we experience objects rather than merely their facing surfaces. But we should question the very idea that we perceive objects' facing surfaces or, if we do, that perceiving them plays any role in granting us access to the objects to which they belong, following William McNeill's reasoning (2016). To begin with, let's make the sensible assumption that either (a) to perceive an object's facing surface at all requires perceptually differentiating its facing surface or (b) to perceive an object by means of its facing surface (that is, for perception of its facing surface to explain perception of it) requires perceptually differentiating its facing surface.

On McNeill's (2016) argument, which I'll only incompletely sketch, the requirement of either conjunct fails to be met. We do not perceptually differentiate objects' facing surfaces. Doing that

would amount to differentiating them from their perceptual surrounding. While we do differentiate, say, the kiwi from its surrounding (it stands out, perhaps, due to its color), the same is not true of its facing surface (415–19). That is because, thanks to their co-occupancy of a certain region of space, the kiwi is part of the background of the facing surface yet can't be differentiated from it. It is not as if the visible boundary separating the kiwi from its surroundings is perceived as an edge, a perceptually salient feature marking off what is in view from the out-of-view remainder of the object's surface. It doesn't look like an edge, and work in vision science suggests our visual systems don't respond to such boundaries as they do to edges (Tse 1999; Koenderick 1990).¹⁷

If that's right, then the kiwi's facing surface is no obstacle to perceiving it because its facing surface is not perceptually registered. Let's relax the requirement of (a) and move to (b). We thus allow that the facing surface is perceived, on the assumption that a thing can be perceived without being perceptually differentiated. Nevertheless, because it can't be perceptually differentiated for the reason just given, perceiving it does not explain how you perceive the kiwi to which it belongs. Therefore, you perceive the facing surface and the kiwi, but not the latter by (virtue of) the former (McNeill 2016, 420–25). Again, the object's facing surface doesn't get in the way of your perception of it.

In sum, then, we should both be wary of how ABAs explicate Perspective and of the explanatory role they give it. Conceding ABAs' assumption that Perspective should be understood mereologically, i.e., to mean that we perceive (due to modal perception alone) only the facing surface of an object, lends no support to Complexity or Absence if objects can be (indirectly or directly) perceived by perceiving their parts. But, following McNeill, we shouldn't make that concession, because the facing surface of an object can't be perceptually differentiated from the object to which it belongs, so that either we don't perceive the facing surface at all or we do, but don't perceive the object by means of it. Either way, the object's facing surface presents no barrier to perceiving it and amodal perception is not needed to supplement modal perception to guarantee experience of the object, pulling the dialectical rug out from under Complexity and Absence.

4. Objections and replies

I'll now consider two possible responses on behalf of ABAs to the arguments of the preceding section. Those arguments, if successful, show that we do not need to accept Absence or Complexity to solve PPP. There may be other reasons to accept them. One reason to do that is to explain the phenomenon of perceptual surprise. A second reason is to account for amodal perception, which my argument has only characterized negatively or as ABAs describe the phenomenon. Until a positive characterization is offered, it's reasonable to think the default conception of amodal perception is along the lines proposed by ABAs. I'll handle those objections in turn.

4.a Perceptual surprise

Some ABA proponents have appealed to the phenomenon of perceptual surprise or frustration as further evidence for Absence and Complexity (Husserl 2001, 63–66; Madary 2017, 41–47). To see what's at issue here, consider an example. At t_1 , you are looking at a ball, one that looks, from what you can see of it right now, uniformly spherical in shape and also uniformly patterned. You experience surprise at t_2 when the ball rotates 90 degrees and reveals more of its surface, which turns out to be differently patterned. The surprise would, presumably, be amplified if at t_2 the ball also displayed irregularities in shape and a different color. A natural way to understand what's happening in this case is to say that when you perceive the ball at t_1 , you form a perceptual anticipation (not necessarily future-directed)¹⁸ about the out-of-view surface of the ball that winds

¹⁷I'll return to this point in section 5.

¹⁸See Judge (2017) for an argument focusing on music perception that future-directed expectations aren't necessary for explaining perceptual surprise. Gregory (2015) makes essentially the same point about visual experience.

up being disappointed at t_2 , when that portion of the ball falls into your line of sight. That disappointment is what your surprise registers.

The appeal to perceptual surprise is unconvincing for a few reasons.

First, let me sketch an explanation that makes no appeal to anything like Absence. When you perceive the ball at t_1 , you perceive an object with such and such a shape and surface pattern. Given what I've already said (section 3.b), there is no reason to restrict the attribution of perceptible properties, e.g., shape and surface pattern, merely to the portion of the ball that lies in view. To assume otherwise would beg the question. So, you perceive a ball as a ball (i.e., as spherical) and as patterned in some way. Then, at t_2 , the ball has rotated and presents a different pattern and irregularities in its spherical shape. There is a conflict between your two perceptual experiences. One attributed certain properties to the object that it turned out not to have, at least, not without qualification. There is no need to posit visual expectations to explain this. It's enough that you have the conflicting experiences and are in a position to recognize the conflict between them.

What's needed for that recognition, for starters, is working memory. In some sense you retain awareness of the prior experience of the ball. It may be that working memory itself interacts with your current perceptual experience to make you aware of the conflict. It may also be that some further metacognitive capacity is needed, some form of global reflective or prereflective self-awareness that takes the experiences at t_1 and t_2 into its purview and makes apparent to you the conflict between them. Either way, positing visual expectations would be superfluous here. It's simpler and at least as plausible to suppose that you attribute certain properties to the object, retain cognizance of that attribution while subsequently experiencing the object to not have those properties (without qualification), and are capable of recognizing the disparity between the two experiences. The example therefore fails to motivate any form of ABA.

The objection could be pressed with a little nuancing of the example. Imagine the case somewhat differently. You have a favorite shirt—a shirt you've owned and worn for years, being intimately aware of its features. Maybe it shows wear, and thus irregularity, in some spots. Maybe it's taken on a stain or a hole here and there, too. In any event, you know just where these irregularities lie. When you're presented with the shirt from any particular point of view on it, you anticipate its further "surface" features, even when they aren't already in view. It is tempting to think that this anticipation is visual in nature. This obviously isn't yet an argument, but a hypothesis of sorts with an example to motivate its plausibility.

Normally when you vary your viewpoint on the shirt, your expectations are confirmed. Now suppose that someone replaces your favorite shirt with a doppelganger that's just like it, only minus the imperfections. It's been placed in your shirt drawer with you unaware of that happening. When you take it out of the drawer and hold it up, you're surprised as you turn it and your expectations are systematically frustrated. No wear, no stains, no holes. As much as you may appreciate this (or not, as the case may be), the interesting aspect of all this is the surprise you display. You weren't thinking about those features. And even as your expectations were being frustrated, you might not even then have realized immediately what was off about the shirt. It is not wildly implausible to think that you had a visual experience in which certain visual expectations—expectations about out-of-view features and, thus, parts of the shirt—were violated.

The ABA-favoring interpretation of this type of case is far from compulsory. On the one hand, your current experience of the doppelganger shirt may generate surprise by interacting with your beliefs even if you're not consciously entertaining those beliefs. It may be, too, that some form of visual imagination plays a role here. Further, it's not essential to surprise or frustration of expectations that the conflict you register be between a present, consciously occurring mental state and an immediately preceding conscious mental state. Indeed, it isn't clear that you had to have previously consciously or unconsciously entertained a conflicting mental state at all if, for one reason or another, you previously would have been disposed to think of things being otherwise than they now appear. So, if after picking up and viewing the doppelganger shirt at t_1 with none of its differences yet in view, you experience surprise or frustrated expectations when you view its

divergences from your old shirt at t_2 , that doesn't necessarily reveal anything about your visual experience of the shirt at t_1 .

There is also reason to doubt the ABA-friendly interpretation of this case. It doesn't appear that our visual system attributes properties to objects in the way the ABA-friendly interpretation requires. We've already come across a phenomenon that nicely illustrates the point. Return to the case of the half-kiwi discussed earlier. In most circumstances (i.e., excepting the sort of scenario described by Ekroll and colleagues [2013]), when you are viewing an object like the half-kiwi oriented so that only its convex facing surface is in view, the object looks ovoid and not hemiovoid. Even if you know the kiwi is a half-kiwi, it will continue to look as if it had the shape of a normal kiwi. Habituation won't alter that.

What this illustrates is that the way we perceive properties like three-dimensional shape is insulated from beliefs (Keane et al. 2012; Keane 2018) and constrained by principles along the lines of simplicity, symmetry, what Gestalt psychologists called "good continuation," and the like (van Lier and Gerbino 2015; Gerbino and Zabai 2003; Tse 1999; van Lier 1999), a point that hasn't gone totally unobserved by philosophers commenting on this issue (Briscoe 2011; Phillips 2017).¹⁹ Gaetano Kanizsa emphasized—specifically with regard to cases of allo-occlusion—that the perceived spatial organization of a scene pays no heed to our expectation from prior experience, maintaining that the latter "cannot change at all the relationship before/behind [of occluding/occluded objects, respectively] which is imposed by the conditions of the field and by the powerful forces of organization, on which the empirical factor [i.e., prior experience] is unable to exert any influence" (1969, 72; my interjections).²⁰

We may have some sort of experience, a form of visual imagination, that is sensitive to past interactions with particular objects or types of object and their idiosyncrasies or, more minimally, that gives us awareness of objects' out-of-view features (Briscoe 2011; Gregory 2018), but, at least with respect to volumetric properties, visual experience itself isn't like this. The nuanced version of the case involving surprise and violation of expectations therefore provides no support for Absence.

4.b Amodal perception

The second objection I'd like to address is that any account of amodal perception will entail the truth of Absence and perhaps even Complexity and thus provide a basis for some form of ABA. Amodal perception occurs when your perception of an object tells you something about that object (and here I'm being deliberately vague) despite the fact that this something isn't playing any immediate causal role in producing the perceptual episode in question. (I don't offer that as a proper conceptual analysis, only as a first-pass description.) Characteristic instances include cases of perceived self-occlusion (e.g., perceiving the kiwi and nothing less) and allo-occlusion (e.g., perceiving the cat behind the fence and nothing less).

It isn't difficult to see why this phenomenon, sometimes referred to as perceptual completion or amodal completion, might be taken to support ABAs when you consider a typical gloss on the idea. This one is given by Rob van Lier and Walter Gerbino in a recent survey of the topic:

Perceptual completions demonstrate that organizational principles predict not only the belongingness of stimulus-specified *parts* to functional *wholes* but also the production of

¹⁹Sekuler and Murray (2001, 283–84) note that prior experience does affect attribution of shape. The way it influences shape perception appears to be by favoring one over another basic principle, e.g., shape attribution will differ depending on whether global contours or local features (so-called T-junctions, where an occluding contour meets an occluded contour) are the leading stimulus cues. Clearly, this doesn't predict that familiarity with idiosyncratic features of an object will enable you to perceive the object as having those features when you can see the object but not those features. Such idiosyncrasies are highly irregular, whereas the influences Sekuler and Murray highlight bear on which simple principle of regularity is employed by the visual system.

²⁰Kanizsa's claim is likely an overstatement. See note 19 above.

parts devoid of local stimulus counterparts. In vision, completions overcome gaps in the optic input and reveal the creative side of perception. (van Lier and Gerbino 2015, 294; emphasis added)

Allison Sekuler and Richard Murray, similarly, state:

One of the most common obstacles the visual system must overcome in order to recognize objects accurately is the partial occlusion of object contours and surfaces: Because most objects are opaque, they frequently occlude *parts* of themselves and parts of neighboring objects. Somehow, though, the visual systems seems to fill in missing information, so that we can interact appropriately with *complete*, meaningful objects. (Sekuler and Murray 2001, 265; emphasis added)

If that is what amodal perception is, then it looks like Absence follows immediately. The “stimulus-specified parts” mentioned by van Lier and Gerbino include, for instance, all of the in-view portions of the kiwi, i.e., its facing surface. And the parts that the phrase “production of parts” picks out include the kiwi’s out-of-view portions, e.g., its nonfacing surface. Since the perception in question is conscious perception, it follows that amodal perception affords us experience of out-of-view parts of the perceived object, as Absence asserts. If it could be shown, in addition, that there is a corresponding phenomenal difference between how the in-view and out-of-view parts are experienced, which seems plausible, that would secure Complexity as well.

As an initial reply, it is worth noting that, while use of mereological language is common to such glosses,²¹ it’s not universal. Peter Ulric Tse in a landmark survey introduces the phenomenon like this:

How is the percept of a 3-D scene constructed from the 2-D retinal image projection? Because many states of the world could project to the same image, the image is inherently ambiguous. To overcome this ambiguity the visual system must make assumptions about the relationship between image information and the structure of the world, and it must infer or “add” information about the world that is “missing” from the image. For decades the study of completion phenomena has been at the center of attempts to understand such constructive processes. (1999, 37)

But set that point aside and let’s focus on the common mereological construal of the phenomenon à la the two passages quoted above. An argument for Absence based on that construal gives too much weight to an initial gloss without seeing how the details of the theory deepen—or fail to deepen—it. While the initial gloss adopts mereological, part-whole language, it is not the case that the explanatory elaboration of the phenomenon makes any significant reference to perception of parts and wholes. Rather, what the theory focuses on are features and (nonmereological) properties.

For instance, in describing how certain typical instances of amodal perception work, van Lier and Gerbino write that “the shape completed behind the occluder depends on the properties of the [...] partly occluded contours” (van Lier and Gerbino 2015, 296). This is not a story about perceiving a mereologically complex object by tracking its parts, but rather one about perceiving one property, the object’s shape, by virtue of perceiving another, the partly occluded contours. Even if the properties and features are, and are necessarily, properties and features of parts, that doesn’t entail that perceiving them requires perceiving the parts as such. They are, and this seems consistent with

²¹It is typical for philosophers to adopt mereological language as well. Here is Tyler Burge: “Amodal completion is a capacity to perceptually represent an entity as whole or completed, even though less than the whole entity causally affects the sensory apparatus” (2010, 417).

the phenomenal character of the experience, properties perceived as characterizing the perceived object.

The details laid out by van Lier and Gerbino about other typical instances of completion follow suit, referring to features and properties, but not parts. Likewise, the leading paradigms used to study amodal perception described by Sekuler and Murray involve experimental subjects making judgments about shape and related properties (Sekuler and Murray 2001, 269–72). This is, moreover, in keeping with other surveys of work in vision science on amodal perception (e.g., Tse 1999; van Lier 1999). The focus is squarely on properties and features, and not insofar as these belong to parts, in particular—although do they in fact belong, some of them, anyway, to parts—but insofar as they characterize the perceived object.

The way amodal perception is understood in vision science, then, doesn't force our hand and compel us to accept that ABAs are right to commit to Absence. While mereological language is typical of the literature in vision science on the topic, I take it to be a *façon de parler*, an effective way of calling attention to the phenomenon in question. From the outside, from a sideways-on view, carving up the perceived object into out-of-view and in-view parts is helpful in at least two ways.

First, it allows us to identify domains of what does and doesn't impinge on the visual system, which is fundamental for perceptual psychology, whose task it is to determine how we have such a rich, well-rounded experience of objects despite the limitations of our perspective on them. Second, mereological language is useful in describing what we *don't* experience. For instance, in cases of allo-occlusion like the cat behind the fence, it has to be stressed that we *don't* perceive a set of scattered, noncontinuous cat bits. Nor, in allo-occlusion, is an object's facing surface salient as such, let alone as in any way independent or discontinuous from its remainder. Neither of those points, however, amount to or lend any direct support to the crucial ABA claims, i.e., Absence and Complexity.

5. Conclusion

In place of ABAs, I've suggested that in cases of self-occlusion and allo-occlusion, our experience, rather than carving objects up into parts, presents objects to us as having certain properties. The kiwi is perceived as ovoid, as filling out space in a certain way. That no doubt entails that the kiwi has out-of-view parts, but not that we experience those parts in any way. And the cat behind the fence is seen as one continuous item located behind and appearing at various points through the fence. What about the phenomenology, though? What can I say to someone like Noë or Husserl who claims to experience occluded object parts? My account may not appear to have addressed the phenomenal character sufficiently, and so I'll conclude by assuaging potentially lingering concerns on that front. Of course, I think what Noë and Husserl offer are misdescriptions of the same experience we share by virtue of our fundamentally similar visual systems. They report that the out-of-view remainder of the kiwi and the parts of the cat blocked by the fence are perceptually present in visual experience. Although that is not what's going on, it is an understandable way of giving voice to the experience.

Part of the story is that edges and occluding contours are phenomenally distinct. What manifestly shows up in experience is that, when viewing the kiwi, you register its occluding boundary as such, as continuing on out of view, rather than as an edge. It represents a phenomenally salient boundary between the kiwi and the rest of the visible scene, but not a line of demarcation for the kiwi itself. And when you look at the cat behind the fence, you see the portion of the cat that visually intersects with the occluding edge of the fence as having an occluded contour rather than an edge. That is, the phenomenal boundary separating what's visible of the cat and the fence looks not like the intersecting of two objects, where one ends and the other begins, but like the edge of one (i.e., the fence slat) standing before another that, thanks to the cat's also appearing through between other slats, belongs to one continuous item running behind the fence. So, supposing the cat is standing parallel to the fence, the upper and lower bounds of its body look like occluded contours where they visually meet the slats of the fence. That's not the entire story, however. I've already

helped myself to the second part somewhat, which has to do with the phenomenal salience of perceived relative spatial positions of visible objects.

For the kiwi, it matters how it is situated in relation to other objects. We saw this in the example from Ekroll and colleagues discussed several times already. A half kiwi oriented to the viewer to expose only its convex surface and situated a few inches above a flat surface looks indistinguishable from a whole kiwi. What is in fact an edge is experienced as an occluding contour. But things change when you let the kiwi rest on the flat surface and maintain the same vantage point on the kiwi. Now the edge looks like an edge. The point I want to make at present is that before you let the half kiwi rest on the flat surface, when it appears simply to be a kiwi, i.e., an ovoid object, you experience it as filling out space in relation to the surface below it, a space that you experience magically diminishing, as if the kiwi were deflating, when you lower it to rest on the surface. That is, although you don't see the whole kiwi, you nevertheless *experience* it as ovoid, as having an occluding contour, and as standing in a certain spatial relation of proximity to what is beneath it. The phenomenal salience of relative position is equally apparent in the case of the cat occluded by a fence. You experience occluded contours of the cat's body (i.e., along its back and undercarriage) as continuous with other visible occluded contours belonging to a single item and at the same time you experience that single item as positioned behind the fence.

My response to the concern that ABAs have some advantage until a better description of the phenomenal character of experiences of self-occlusion and allo-occlusion is provided is this. As the example from Ekroll and colleagues shows, there's a phenomenally salient difference between perceiving an ovoid and a hemi-ovoid. So, not only is the three-dimensional shape phenomenally salient, as all parties agree, but along with that, so are features like edges and occluding or occluded contours as well as properties like relative spatial position in depth. You visually experience the kiwi, and not only its facing surface, not because you also perceive its out of view parts, but because you experience it as having a certain three-dimensional shape, having occluding contours at its visual boundary, and being at least a certain distance from other objects in its surround.

Matt Bower is senior lecturer at Texas State University. His area of specialization is post-Kantian philosophy, especially phenomenology. His research has largely consisted in explicating Husserl's genetic phenomenology and finding points of contact between the theories of perception of Husserl, Merleau-Ponty, and Levinas and embodied/enactive and naive realist accounts of perceptual experience.

References

- Bennett, David J. 2012. "Seeing Shape: Shape Appearances and Shape Constancy." *British Journal for the Philosophy of Science* 63: 487–518.
- Bennett, David J. 2016. "The Role of Spatial Appearances in Achieving Spatial-Geometric Perceptual Constancy." *Philosophical Topics* 44 (2): 1–41.
- Bernet, Rudolf, Iso Kern, and Eduard Marbach. 1993. *An Introduction to Husserlian Phenomenology*. Evanston, IL: Northwestern University Press.
- Burge, Tyler. 2010. *Origins of Objectivity*. Oxford: Oxford University Press.
- Bower, T. G. R. 1966. "Slant Perception and Shape Constancy in Infants." *Science* 151 (3712): 832–34.
- Briscoe, Robert. 2011. "Mental Imagery and the Varieties of Amodal Perception." *Pacific Philosophical Quarterly* 92: 153–73.
- Campbell, Scott. 2004. "Seeing Objects and Surfaces, and the 'in Virtue of Relation.'" *Philosophy* 79 (3): 393–402.
- Christensen, Carleton B. 2013. "The Horizontal Structure of Perceptual Experience." *Logical Analysis and History of Philosophy*, vol 16. *The Philosophy of Edmund Husserl*, edited by Uwe Meixner and Albert Newen, 109–41. Muenster, Ger.: Brill Mentis.
- Dokic, Jérôme. 2012. "Pictures in the Flesh: Presence and Appearance in Pictorial Experience." *British Journal of Aesthetics* 52 (4): 391–405.
- Ekroll, Vebjørn, Bilge Sayim, and Johan Wagemans. 2013. "Against Better Knowledge: The Magical Force of Amodal Volume Completion." *i-Perception* 4: 511–15.
- Ferretti, Gabriele. 2016. "Visual Feeling of Presence." *Pacific Philosophical Quarterly* 99 (S1): 112–36. <https://doi.org/10.1111/papq.12170>.
- Gallagher, Shaun, and Dan Zahavi. 2012. *The Phenomenological Mind*. 2nd ed. London: Routledge.
- Gerbino, Walter, and Cristina Zabai. 2003. "The Joint." *Acta Psychologica* 114: 331–53.
- Green, E. J. 2017. "A Layered View of Shape Perception." *British Journal for the Philosophy of Science* 68 (2): 355–87.

- Green, E. J. 2018. "A Theory of Perceptual Objects." *Philosophy and Phenomenological Research* 99 (3): 663–93. <https://doi.org/10.1111/phpr.12521>.
- Green, E. J., and Susanna Schellenberg. 2018. "Spatial Perception: The Perspectival Aspect of Perception." *Philosophy Compass* 13 (2): e12472. <https://doi.org/10.1111/phc3.12472>.
- Gregory, Dominic. 2015. "Visual Content, Expectations, and the Outside World." *Proceedings of the Aristotelian Society* 115 (2): 109–30.
- Gregory, Dominic. 2018. "Visual Expectations and Visual Imagination." *Philosophical Perspectives* 31 (1): 187–206. <https://doi.org/10.1111/phpe.12094>.
- Hopp, Walter. 2011. *Perception and Knowledge*. Cambridge: Cambridge University Press.
- Husserl, Edmund. 1970. *The Crisis of European Sciences and Transcendental Phenomenology*. Translated by David Carr. Evanston, IL: Northwestern University Press.
- Husserl, Edmund. 1973. *Experience and Judgment: Investigations in a Genealogy of Logic*. Translated by James S. Churchill and Karl Ameriks. Evanston, IL: Northwestern University Press.
- Husserl, Edmund. 1977. *Phenomenological Psychology. Lectures, Summer Semester 1925*. Translated by J. Scanlon. The Hague: Martinus Nijhoff.
- Husserl, Edmund. 1989. *Ideas Pertaining to a Pure Phenomenology and to a Phenomenological Philosophy, Second Book*. Translated by R. Rojcewicz and A. Schuwer. Dordrecht, Nether.: Kluwer.
- Husserl, Edmund. 1997. *Thing and Space: Lectures of 1907*. Translated by R. Rojcewicz. Dordrecht, Nether.: Kluwer.
- Husserl, Edmund. 1999. *Cartesian Meditations*. Translated by D. Cairns. Dordrecht Nether.: Kluwer.
- Husserl, Edmund. 2001. *Analyses Concerning Passive and Active Synthesis*. Translated by A. Steinbock. Dordrecht Nether.: Kluwer.
- Jackson, Frank. 1977. *Perception: A Representative Theory*. Cambridge: Cambridge University Press.
- Judge, Jenny. 2017. "The Surprising Thing about Musical Surprise." *Analysis* 78 (2): 225–34. <https://doi.org/10.1093/analysis/anx139>.
- Kanizsa, Gaetang. 1969. "Perception, Past Experience, and the 'Impossible Experiment.'" *Acta Psychologica* 31: 66–96.
- Keane, Brian P. 2018. "Contour Interpolation: A Case Study in Modularity of Mind." *Cognition* 174: 1–18.
- Keane, Brian P., Hongjing Lu, Thomas V. Papathomas, Steven M. Silverstein, and Philip J. Kellman. 2012. "Is Interpolation Cognitively Encapsulated?" *Cognition* 123 (3): 404–18.
- Koenderick, Jan J. 1990. *Solid Shape*. Cambridge, MA: MIT Press.
- Leddington, Jason. 2009. "Perceptual Presence." *Pacific Philosophical Quarterly* 90: 482–502.
- Li, Yunfeng, Zygmunt Pizlo, and Robert M. Steinman. 2009. "A Computational Model That Recovers 3D Shape of an Object from a Single 2D Retinal Representation." *Vision Research* 49 (9): 979–91.
- Madary, Michael. 2017. *Visual Phenomenology*. Cambridge, MA: MIT Press.
- Matthen, Mohan. 2005. *Seeing, Doing, and Knowing*. Oxford: Oxford University Press.
- McNeill, William. 2016. "The Visual Role of Objects' Facing Surfaces." *Philosophy and Phenomenological Research* 92 (2): 411–31.
- Millar, Becky. 2017. "Smelling Objects." *Synthese*. <https://doi.org/10.1007/s11229-017-1657-8>.
- Mulligan, Kevin. 1995. "Perception." *Cambridge Companion to Husserl*, edited by Barry Smith and David Woodruff Smith, 168–238. Cambridge: Cambridge University Press.
- Nanay, Bence. 2010. "Perception and Imagination: Amodal Perception as Mental Imagery." *Philosophical Studies* 150: 239–54.
- Noë, Alva. 2004. *Action in Perception*. Cambridge, MA: MIT Press.
- Noë, Alva. 2005. "Real Presence." *Philosophical Topics* 33: 235–64.
- Noë, Alva. 2009. "Conscious Reference." *The Philosophical Quarterly* 59 (236): 470–82.
- Noë, Alva. 2012. *Varieties of Presence*. Cambridge, MA: Harvard University Press.
- O'Regan, J. Kevin, and Alva Noë. 2001. "A Sensorimotor Account of Vision and Visual Consciousness." *Behavioral and Brain Consciousness* 24: 939–1031.
- Overgaard, Soren. 2012. "Visual Perception and Self-Movement: Another Look." *Moving Ourselves, Moving Others*, edited by Ad Foolen, Ulrike M. Lüdtke, Timothy P. Racine, and Jordan Zlatev, 81–104. Philadelphia: John Benjamins.
- Phillips, Ben. 2017. "Inscrutability and Visual Objects." *Synthese* 194: 2949–71.
- Pizlo, Zygmunt, Tadamasawa Sawada, Yunfeng Li, Walter G. Kropatsch, and Robert M. Steinman. 2010. "New Approach to the Perception of 3d Shape Based on Veridicality, Complexity, Symmetry, and Volume." *Vision Research* 50: 1–11.
- Prinz, Jesse J. 2012. *The Conscious Brain*. Oxford: Oxford University Press.
- Sekuler, Allison B., and Richard F. Murray. 2001. "Amodal Completion: A Case Study in Perceptual Grouping." *From Fragments to Objects*, edited by Thomas F. Shipley and Phillip J. Kellman, 265–94. Amsterdam: Elsevier.
- Slater, Alan, and Victoria Morison. 1985. "Shape Constancy and Slant Perception at Birth." *Perception* 14: 337–44.
- Smith, Joel Alexander. 2016. *Experiencing Phenomenology*. London: Routledge.
- Thompson, Evan. 2007. *Mind in Life*. Cambridge, MA: Harvard University Press.
- Todd, James T. 2004. "The Visual Perception of 3D Shape." *Trends in Cognitive Science* 8 (3): 115–21.
- Tse, Peter Ulric. 1999. "Volume Completion." *Cognitive Psychology* 39: 37–68.

- van Lier, Rob. 1999. "Investigating Global Effects in Visual Occlusion: From a Partly Occluded Square to the Back of a Tree-trunk." *Acta Psychologica* 102: 203–20.
- van Lier, Rob, and Walter Gerbino. 2015. "Perceptual Completions." *The Oxford Handbook of Perceptual Organization*, edited by Johan Wagemans, 294–320. Oxford: Oxford University Press.