Burge's Defense of Perceptual Content

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1. Introduction

A central question, if not *the* central question, of philosophy of perception is whether perceptual

states have a nature similar to thoughts about the world, whether they are *essentially*

representational. According to the *content view*, perceptual states are, at their core,

representations with contents that are either accurate or inaccurate.[1] Opponents of the content

view typically embrace some version or other of a *relational view*, the view that perception is, by

its nature, a matter of standing in a relation to mind-independent items in the world.[2] Since this

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[1] The term "content view" has been used by Siegel (2010a) and Brewer (2011). Schellenberg (2011) speaks instead of the *content thesis*. Siegel's characterization of the content view is too weak for our purposes here. The content view she defends is neutral with regard to the nature of sensory states, and Burge is explicitly defending a claim about what certain sensory states *are*. Siegel suggests that the deeper issue at stake in disputes with naïve realists over the content view is whether perceptions ought to be individuated by reference to the particular things perceived. Our understanding of the debate is different. Burge is not at odds with the naïve realist claim that perceptions are individuated by reference to particulars in the environment. He allows that perceptual states are individuated by their contents and that the representational content of perception constitutively possesses a singular element (2010a, pp.379-381). In defending the content view, Burge is opposed to those, like naïve realists, who identify perception with something other than sensory representation.

[2] For a survey of recent attempts to defend and develop this kind of approach to perception, see Nudds 2009. Other opponents of the content view grant that there is a factor common to the normal case and the hallucinatory case, and insist that that common factor is something other than a representational state with associated accuracy conditions. For example, Thomas Reid argues that the good case and the bad case both involve a non-intentional mental state. For a defense of this reading of Reid, see Ganson 2008.

kind of relation is absent in episodes of hallucination, proponents of a relational view are committed to disjunctivism, the view that there is no perceptual-state kind common to normal and hallucinatory states—no state that is either accurate or inaccurate.

Once Travis (2004) called attention to the surprising dearth of arguments in favor of the content view, proponents of the view got busy defending it.[3] The most sustained and sophisticated defense of the content view to date is Tyler Burge's *Origins of Objectivity*. On Burge's terminology, "perception" is a name for "the most primitive kind of (non-deflated) representation" (2010a, p. 316). Perceptions are supposed to be *non-deflated* representations in the sense that they possess contents with associated accuracy conditions "as an aspect of the fundamental explanation-grounding kinds that they instantiate" (2010b, p. 2). Burge argues that there are successful explanations in mainstream perceptual psychology whose success depends crucially on taking perceptual states to be content-bearing representational states. That is, empirical psychology supports the content view over a relational view.

After we provide a sketch of his reasoning in favor of the content view, we argue that Burge has misrepresented mainstream psychology on several key points. The upshot is that Burge's central argument for the content view is unsuccessful.

2. Burge's Argument for the Content View

Burge's argument appeals to commonplace views in perceptual psychology. In this section we survey the views in question and explain how they relate to the content view.

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[3] See Byrne 2009, Pautz 2010, Schellenberg 2011, and Siegel 2010a and 2010b.

Apart from some Gibsonians, perceptual psychologists are generally at home with talk about sensory representations. The following remarks by Ken Nakayama capture the standard view on these matters among psychologists today:

> Gibson and especially his followers have scrupulously avoided reference to any form of internal representation. Whether this reflects a defensible ideological position as articulated by his followers, a pragmatic ordering of research priorities as indicated by Gibson himself, or a fundamental naïveté as suggested by Marr, this almost blatant disinterest in the face of steady and often brilliant progress in the fields of neuroscience and psychophysics strikes me as a major limitation, particularly now.
> (1994, p. 334)

Marr and his followers have argued that commitment to sensory representations is unavoidable for any adequate account of our sensory capacities. Their argument begins from the familiar observation that the stimuli for our sensory states are routinely impoverished relative to our perceptual accomplishments. Consider, for example, the remarkable discriminatory feats of the human visual system. The input to the visual system is essentially a two-dimensional projection of light registered at the retina, and yet the visual system affords discrimination of the shape, size, and distance of objects in three-dimensional space. Here the visual system must overcome an *inverse projection* (or *underdetermination*) problem: infinitely many three-dimensional scenes—each containing objects of different sizes and shapes at various distances—could have produced a given two-dimensional projection. According to constructivists like Marr, positing sensory representations of the environment is the best way to account for these impressive discriminatory abilities. By way of computational principles, the visual system is able to go

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beyond its paltry data and construct an internal representation of the environment, something that is either accurate or inaccurate.

Consider Palmer's familiar version of constructivism, according to which accuracy conditions are specifically tied to the presence of *heuristic processes* in the visual system designed to overcome inverse-projection problems:

> ...the visual system transcends the available optical information by implicitly making a number of highly plausible assumptions about the nature of the environment and the conditions under which it is viewed. When these assumptions are coupled with the sensory data in the incoming image, they result in a *heuristic interpretation process* in which the visual system makes inferences about the most likely environmental condition that could have produced the image. The process is heuristic because it makes use of probabilistic rules of thumb that are usually, but not always, true. If these underlying assumptions are false, they will lead to erroneous conclusions in the form of visual illusions.
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> (Palmer 1999, p. 58)

Palmer calls these probabilistic rules of thumb *heuristic assumptions*. On a plausible reading of Palmer, these principles of the visual system are supposed to be both *ampliative* and *substantive*. They are *ampliative* in the sense that they supplement the input to visual processing, allowing the visual system to overcome its impoverished data. The assumptions are *substantive* in the sense that they can be true or false, depending on the context. Accordingly, commitment to heuristic processes goes hand-in-hand with commitment to accuracy conditions: when heuristic assumptions are false in the context, the constructed output can be non-veridical.[4]

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[4] Of course, the veridicality conditions of the constructed sensory states are to be distinguished from the veridicality conditions of the assumptions implicit in the heuristic process.

This dual role of heuristic assumptions is worth emphasizing. Heuristic assumptions must explain successes *and* failures. Talk of heuristic assumptions is out of place unless the assumptions serve to make intelligible a kind of success in sensory discrimination that is otherwise unaccountable (given how impoverished the stimuli are). And success in accounting for our discriminatory capacities must be coupled with success in explaining failures of discrimination (including cases we pretheoretically regard as illusions and hallucination). Otherwise we have not succeeded in identifying heuristic assumptions. But once these conditions have been met, we seem to have evidence that the conditions for sensory *representation* have been met.

As an illustration of the dual role of heuristic assumptions, consider the celebrated anchoring theory of lightness developed by Gilchrist et al. (1999), a theory of perception of achromatic surface colors. The problem of lightness perception is a deep one. The proximal stimulus deriving from a given surface (the luminance value of the light reflected from that surface) is highly ambiguous. Luminance values conflate the contributions of illumination and reflectance. Indeed, any given luminance value can yield perception of any shade of gray from white to black, if we skillfully alter the context (Wallach 1948). To achieve a correct interpretation of surface lightness, the visual system has to exploit information about the local and global contexts of any given luminance value. There is broad agreement that the visual system computes surface lightness from *relative* luminance values across the scene. Notice, though, that relative luminance values by themselves seem at best to yield relative lightness. But, of course, we do not perceive mere relative lightness—we perceive specific shades. One important component of the anchoring theory of lightness is its anchoring rule: the highest

luminance is taken to be white. This heuristic not only allows the visual system to overcome an

inherent shortcoming of the stimulus; it also gives rise to a wide range of illusions.[5]

Gilchrist himself does not speak of heuristic assumptions. He prefers to speak, as we did

above, of anchoring *rules*. Another term commonly employed to express the same idea is

"constraints." As Poggio, Torre, and Koch explain, the visual system needs constraints to avoid

ambiguity:

> ...vision is confronted with the inverse problem of recovering surfaces from images. As
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> so much information is lost during the imaging process that projects the three-
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> dimensional world into the two-dimensional images, vision must rely on natural
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> constraints, assumptions about the physical world, to derive unambiguous output.
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> (1985, p. 314)

This phrase "natural constraints" is apt to confuse because it can also be used to refer to

regularities in the environment which place constraints on how retinal images get formed. To

avoid this ambiguity, the phrase "internalized constraints" has been widely adopted to refer to

the perceptual system's assumptions about the environment.[6] When we speak of *constraints* in

what follows, we are talking about internalized constraints.[7]

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[5] There are still significant obstacles to achieving a comprehensive and fully satisfying theory of lightness perception. For some recent alternatives to the anchoring theory, see Bressan 2006 and Purves and Lotto 2011. Although we are treating Gilchrist as an ally of the computational approach to vision associated with Marr, it is worth noting that Gilchrist regards his more recent theoretical stance as closely allied to Gestalt theories.

[6] For a review article on internalized constraints, see Proffitt and Kaiser 1998. There is a metatheoretical question about whether or not internalized constraints should be thought of as rules explicitly represented and deployed in the construction of perceptual outputs. One possibility is that the system acts in accordance with the rules without using the rules as premises. For discussion see Epstein and Rogers 1995, ch. 1, and Kubovy and Epstein 2001.

[7] Burge refers to constraints as *formation principles* and to the problems they address as *underdetermination problems*.

These remarks suggest that perceptual psychology may well afford a principled basis for

attributing non-deflated representations to sensory systems. A constructivist might argue that,

wherever we have constraints at work, the constructed outputs have accuracy conditions shaped

by the constraints in question.[8] Burge pursues this line of thought in a distinctive way. He

suggests that *constancy mechanisms* are the means by which sensory systems overcome

problems posed by impoverished data. Accordingly, perception exists when and only when

constancy mechanisms are in play.[9]

By "constancy mechanisms" we mean mechanisms that underwrite perceptual

constancies like shape constancy, lightness constancy, and the rest. Size constancy serves as a

useful illustration of perceptual constancy. Size constancy is, roughly, stability in visual

perception of an object's size through changes in distance which affect the size of the object's

retinal projection. Since this effect on the retinal image is akin to the effect that a change in

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[8] This line of argument is not enough, by itself, to establish the content view. One can accept that perceptual psychology gives a principled basis for attributing representations to sensory systems and yet deny that *perception* is representational. Some (e.g., McDowell 2010) claim that sensory representations are subindividual states in a sensory system, while perceptions are states of the whole individual. Representations, on this view, may enable perception, but they are not themselves perceptual states.

Any successful defense of the content view must address this worry. Burge's own efforts to do so focus on the methodology and explanatory success of perceptual psychology. First, he claims that psychological "theories of animal perception and action take [representational] states, as described in the science, to be ordinary states of animal perception more clearly specified and more rigorously explained" (2010a, pp. 369-70, note 3). If psychologists insist that they are offering accounts of perception, not just its enabling conditions, we should take them at their word. Second, the experimental methods of psychology presuppose that some sensory representations are conscious states that are available for verbal report, and so are presumably perceptions of the individual. Psychologists test their accounts of representational states against verbal reports from subjects. This practice makes sense only if those representations are perceptions of the individual (ibid.). (For further discussion of these issues, see Burge 2011.)

Whether this part of Burge's argument succeeds is unimportant for our purposes. We will offer independent grounds for doubting Burge's argument for the content view.

[9] For a closely related view of perception, see Smith 2002.

object size would have on the image, a visual system that achieves size constancy will need mechanisms for distinguishing these distal events (i.e. change in distance from change in object size).[10]

How does perceptual constancy relate to constructivism? Historically, constructivists have taken a special interest in the constancies, and it is not difficult to see why. Constructivist views have their origins in machine vision, where researchers seek to devise veridical outputs—accurate representations of physical properties in the environment—that allow a robot to function properly. Marr was thinking of the human visual system on this model. He took the task of vision to be "that of recovering from sensory information 'valid' properties of the external world," a task which the system performs admirably: "usually our perceptual processing... delivers a true description of what is there" (1982, pp. 29-30). This machine analogy derived much of its force from the fact that the constancies are such a pervasive aspect of human visual perception. As Gilchrist notes, "machine vision's emphasis on veridicality resonated with the traditional theme of constancy in psychology, bringing this issue back to the foreground" (2006, p. 126). To describe adequately the operation of a constancy mechanism, we have to identify a specific attribute that is stably attributed by the sensory system to the environment despite changing conditions of proximal stimulation, and this notion of sensory *attribution* would seem to carry with it the supposition that attributions are either accurate or inaccurate. That is, wherever constancy mechanisms are at work, sensory systems seem to be in the business of constructing veridical representations of environmental stimuli.[11]

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[10] For an excellent introduction to the notion of perceptual constancy, see Cohen (forthcoming).

[11] Here is a typical passage from Burge on the importance of constancies: "Perception requires systematic transformations from sensory registrations to representational states that are distinctive to *specific* environmental conditions. Perception requires that law-like patterns in these transformations lead systematically from very different arrays of sensory registration to a range of representational sensory states all

Of course, not all sensory states meet the demands Burge places on genuine perception. When appeal to accuracy conditions is explanatorily dispensable, we are dealing with mere *sensory information registration* rather than *perception*.[12] Sensory states fall short of perception whenever they are not products of constancy mechanisms, or whenever there is no underdetermination problem that the sensory system must overcome using constraints. For example, olfactory states in humans are sensory information registrations. Our olfactory system has the selected-for function of registering information about airborne chemicals at our nostrils, so there is some point to speaking of our olfactory states as representational. But they are representational in a deflated sense only. There are no perceptual constancies associated with olfaction; nor is there an underdetermination problem that our olfactory system must overcome using constraints. Burge insists that any appeal to representational content is explanatorily idle.

Our aim is to show that Burge's appropriation of constructivist ideas is problematic on two levels. First, Burge is wrong to claim that perception *via* internalized constraints correlates with the deployment of constancy mechanisms (sections 3 and 4). Second, he is mistaken in thinking that there is any deep connection between operation of constraints or constancy mechanisms and non-deflated sensory representation (sections 5 and 6). In other words, we not only reject Burge's appeal to the constancies in his constructivist argument for the content view; we reject the general constructivist strategy for defending the content view.

3. Constraints without Constancy

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of which are representations as of a given environmental attribute. Perception requires perceptual constancies" (2010a, p. 399).

[12] For a closely related distinction, see Fodor (2008), pp. 186-7.

Is Burge right that perception is possible only when constancy mechanisms are in play? Consider one of the most straightforward cases where constructivists are inclined to posit constraints yielding an internal representation with accuracy conditions: the case of seeing distance. The capacities humans and many other animals display in tasks of visually discriminating distance are truly remarkable when one considers the fact that the retinal images which serve as input are, in effect, 2D patterns of light. This case poses a problem for Burge because the central mechanisms responsible for distance perception—e.g. mechanisms that exploit stereoscopic information like retinal disparity—are not themselves constancy mechanisms, and their operation is in principle independent of constancy mechanisms. We evidently have perception involving constraints without perceptual constancy.

Burge recognizes that his view of perception commits him to positing *distance constancy* as a constancy additional to the more familiar constancies like size constancy, shape constancy, and lightness constancy. He defines distance constancy as "a capacity to represent a perceived entity as at a given distance, under various types of stimulation deriving from various types of entities perceived" (2010a, p. 410-11), and offers perception of distance *via* convergence as an illustration of this form of constancy:

> A given location hence distance can be determined for many textures, shapes, kinds of entity, all of which produce very different proximal stimulations. A red circle, blue square, and moving rough textured black body—each producing different proximal stimulations—can each be attributed the same distance and direction (location). Convergence is one of the simplest constancy capacities. It yields location and hence distance constancy...
> (2010a, p. 349)

Burge does not cite any experimental evidence that this form of constancy is present in humans or other animals, but there is little reason to doubt that perception of distance typically remains stable through these kinds of changes.

What we find objectionable here is Burge's suggestion that this sort of stability amounts to *perceptual constancy* as psychologists understand it. Burge is attempting to find a basis within perceptual psychology for establishing the existence of perception understood as non-deflated representation. He takes for granted that the constancies constitute "a natural psychological kind" (2010b, p. 12-13) and he attempts to show that this natural kind is what sets perception apart from other sensory states. His assumption that the constancies form a natural psychological kind is dubious, however, if distance constancy is to be included among the constancies. Distance constancy is not a kind that figures in psychological explanations.

Psychologists do not posit constancy mechanisms to account for stability in perception through just any sort of change in the proximal stimulus. Although the perceived lightness of a two-dimensional surface remains stable through a wide range of changes in the shape of that surface, this stability is not a matter of lightness constancy. Lightness constancy is, roughly, stability in perception of surface color in spite of variation in luminance, the amount or intensity of the light reflected to the eyes. Lightness constancy is an interesting psychological kind because a visual system that accomplishes lightness constancy needs to be able to separate out differences in luminance due to changes in illumination from differences in luminance due to changes in reflectance. The problem with recognizing distance constancy is that there is nothing analogous to luminance in the case of the proximal stimulus for distance perception. It is

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difficult to see what specific problems facing the visual system would require us to posit distance constancy mechanisms.[13]

Although distance constancy is not a kind that is of interest to psychologists, one might insist that there is still some point to speaking of constancy here. No doubt there is measurable stability in distance perception through the kinds of changes in proximal stimulation that Burge mentions. But loosening the notion of constancy in this manner would sever the connection between constancy and constructed representation. On the constructivist view that Burge is defending, we need to posit sensory representations when a sensory system affords discriminatory accomplishments that outstrip the information available in the proximal stimulus. Were we to move to the loose notion of constancy as just any sort of measurable stability through changes in proximal stimulation, constancy would readily extend to chemoreception, thermoreception, nociception, and other cases where constraints are unnecessary. (Think, for example, of stability in detecting the contribution of juniper berries to a gin through just noticeable dilutions of the spirit or stability in the burning quality of a pain through just noticeable differences in intensity of stimulation.[14]) Moving to a loose notion of constancy would involve abandoning the idea that constancy is sufficient for sensory representation.

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[13] For an excellent discussion of the constancies (loosely) associated with depth perception, see Howard and Rogers 2002. One needs to distinguish Burge's so-called *distance constancy* from what is sometimes referred to as *depth constancy*. The latter has to do with constancy in the perceived depth of an object's form through changes in distance from the perceiver. Another constancy that is not relevant here is constancy of relative distance: the ability to maintain a constant perception of the distance between two objects through changes in absolute distance from the perceiver.

[14] Burge insists that "not all selectivity with respect to proximal stimulation marks a perceptual constancy" (2010b, p. 11). On the other hand, he is happy to speak of distance constancy through changes in surface shape and color. But once Burge allows the latter cases to count as instances of constancy, he has no obvious means of distinguishing mere "selectivity with respect to proximal stimulation" and genuine constancy. Burge might suggest that any stability in chemoreception, thermoreception, and nociception exists at the level of

In addition to the fact that distance constancy does not figure in psychological explanations, we have another (less decisive) reason to doubt Burge's claim that so-called distance constancy and the other constancies form a natural psychological kind. Consider the ways that familiar constancy mechanisms reveal themselves through introspection, those noticeable ways perception of object properties can remain stable through changes in appearance. The tilted coin has a different shape-related appearance without looking to be different in shape. The part of a white surface that lies in a mild shadow has a different color-related appearance without looking to be other in color. The problem is that there is no analogue of this sort of thing in the case of distance perception. Having a different distance appearance just is appearing to be at a different distance. In this respect distance perception is akin to gustatory and olfactory states, which seem not to be produced by constancy mechanisms.

Burge wants to say that we have perception only when we have constancy mechanisms at work. He could, in principle, hold on to this claim and deny that the mechanisms involved in seeing distance, operating in isolation from the constancies, would yield distance *perception*. It is unclear, however, how Burge can coherently adopt this strategy. Burge's original reason for positing an internal representation of distance is unaffected by the conclusion that there is no such thing as distance constancy. The proximal stimulus for distance perception is impoverished relative to our perceptual accomplishments. According to Burge, the best account of our perceptual accomplishments posits a constructed model of distance, something that is either accurate or inaccurate. Noting that there is no such thing as distance constancy does nothing to counter his constructivist argument for the existence of representations of distance.

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judgment and is not genuine *sensory* stability, but this suggestion is implausible. Our gin and pain examples are hardly exceptional: measurable stability is easy to come by—even in creatures incapable of judgment.

4. Constancy without Constraints

Burge (2010a, p. 413) takes it to be obvious that the constancies are sufficient for perception (cf. Smith 2002, p. 172). This confidence is somewhat puzzling, however. Surely it is a substantive empirical matter whether this view is correct. And on careful inspection one finds Burge acknowledging that his view is in tension with empirical evidence that direction constancy is a genuine constancy. In this section we explore this tension, explaining why Burge seems to be committed to an unorthodox view about what constancies there are.

> Consider a kind of problem that is commonly faced by visual systems:
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> Fruit flies produce a so-called "optokinetic reaction," which means that they turn in the direction of world movements. A moment's reflection tells us that if the fly had no mechanism for distinguishing between changes in the visual flow caused by its own movements and changes caused by movements in the world, it would be paralyzed every time it produced the optokinetic reaction. If, for example, the world moves to the fly's left, the fly's head moves to the left, but this leftward movement will cause the world to (apparently) move to the right, and so this in turn should cause a rightward movement, which in turn… In other words, if every apparent movement of the world were taken as a real movement, the creature would be as paralyzed as Buridan's ass.
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> (Russell 1995, p. 131)

The fruit fly's own movement can, in principle, produce exactly the same type of change in visual stimulation as a movement in the scene. What we have here is a problem that needs to be solved in order for the fruit fly to function properly. The problem is roughly analogous to one faced—and solved—by the human visual system. Our visual system needs to avoid confounding changes in stimulation due to real-world movements in a given retinocentrically defined

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direction with movements of the eyes in the opposite direction. Otherwise visually guided

movement would be a chaotic mess!

Does the successful behavior of the fruit fly show that this creature enjoys visual

perception? Not if we follow Burge in supposing that perception arises only when sensory

systems supplement paltry data. On the plausible assumption that the fly's visual system can

exploit non-visual information about the creature's own efferent impulses, the fly's visual system

is not confronted with a problem of impoverished data like the inverse-projection problems.

Burge would likely say, as he does about similar cases: "Here we have computation *without*

representation." (2010a, p. 424) There is no need for the visual system to supplement the

available data. No need for constraints. What is needed is simply a transformation on the visual

system's input.[15]

Burge will surely concede that direction constancy does not, as a general rule, require

constraints understood as ampliative principles that supplement the input to visual processing.

Accordingly, direction constancy poses a straightforward difficulty for Burge's claim that

constancies are sufficient for perception (understood as a product of sensory processes that

utilize constraints). Evidently Burge favors a response according to which some instances of

direction constancy are not genuine cases of constancy (see 2010a, pp. 424-5, note 73). Burge

does nothing, however, to justify or even clarify what looks like an *ad hoc* maneuver intended to

save his claim that the operation of constancy mechanisms is sufficient for perception.

Our take on the case of direction constancy is quite different. We doubt that overcoming

impoverished data marks out a deep difference in kind among sensory states. Psychologists do

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[15] This distinction between mere computational transformation on input and supplementation of paltry input
figures centrally in *Origins of Objectivity*. Especially noteworthy is the way Burge exploits this distinction in
his fascinating discussion of navigational capacities of arthropods (see pp. 492-518).

not treat visual discrimination of direction as some sort of illegitimate type of perception. Nor do they have any good reason to. Burge's constructivist line of thought which ties perception specifically to overcoming impoverished data is ill motivated. We will develop this point in the following section.

5. Perception without Constancies and Constraints

Burge takes seeing distance *via* convergence as a paradigm instance of perception (as opposed to mere sensory information registration). We agree that, if there are perceptions in Burge's sense, seeing distance *via* convergence is as good an example as any. The problem for Burge is that convergence does not involve constancy mechanisms or constraints. We have already talked about how distance perception in us is independent of exercise of constancy mechanisms. We will focus here on the absence of constraints.

The role of convergence is to yield information about distance to the fixation point. The inputs to convergence are not impoverished relative to that goal.[16] Convergence exploits proprioceptive information which functionally correlates with the orientation of the eyes in order to determine two angles, the *vergence* and *version* angles. From these two angles, the visual system can compute distance to the fixation point. A visual system that relied entirely on two-dimensional retinal images to calculate distance to the fixation point would indeed need to apply constraints, but we should hesitate to think that anything like constraints are at work in convergence. Convergence supplements paltry sensory data at the retina by bringing in additional data, and this additional data suffices to determine distance to the fixation point.

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[16] This is not to deny that distance perception more generally presents an underdetermination problem. It does. Convergence cannot help account for visual perception of the distance of objects more than approximately six meters away. For a recent discussion of stereoscopic perception of greater distances see Palmisano et al. 2010.

Internalized constraints are not needed to explain this discriminatory capacity; the inputs to convergence, and geometric computations over them, suffice.

Burge does not acknowledge this difficulty for his view, but he evidently attempts to grapple with it. In the following passage he strains to find underdetermination at work in convergence:

> ...none of this geometrical computation determines, by itself, that anything is seen at the relevant fixated location. Proximal stimulation underdetermines distal objects *seen* at that location. Proximal stimulation may be abnormal, and illusions may occur. So the location, hence distance, of *perceived objects*, relative to the viewer, are underdetermined by proximal stimulation itself.
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> (2010a, p. 349)

It is difficult to find any plausible argument here. Burge is right to claim that convergence cannot guarantee that an object exists at the fixation point. When the eyes fixate some point in space, they may fail to fixate an object. But this point does not suggest that *distance* to the fixation point is underdetermined by proximal stimulation. On the assumption that convergence is concerned with computing the distance to the fixation point, Burge's remarks do nothing to show that convergence must solve an underdetermination problem using internalized constraints.

Burge might concede that there is no need for constraints and suggest that convergence is an example of computation without representation. But this way of saving the theory misses the deeper point of the example. Seeing distance *via* convergence—or seeing direction for that

matter—is supposed to be a paradigm instance of sensory representation (if indeed there is such a thing).[17] To insist otherwise would be *a priori* revisionary psychology at its worst.

6. Constancies and Constraints without Perception

According to Burge, explanatorily indispensable representation first bursts upon the scene with the emergence of constancy mechanisms designed to overcome problems posed by paltry proximal data. In offering this account of where non-deflationary representation first emerges, Burge is attempting to improve on Dretske's (1988) view about the origins of the psychological. We begin with a statement of Dretske's view before turning to Burge's alternative.

Psychological explanation of behavior is distinctive, in part, because it appeals to meaningful states *as such*. Suppose an opera singer belts out "coffee please" in a café. Psychological explanation is out of place in accounting for the behavior of the glass which shatters as a result of the opera singer's vocalization, but it is indispensable in accounting for the waiter's accommodating behavior. Before turning to cases where appeal to meanings as such is indispensable, we want to look at two cases where a meaningful state's meaning is *not* doing any causal work, two cases of *deflationary* representation.

Consider first the behavior of a bimetallic thermostat. Thanks to its bimetallic strip, the thermostat registers information about the temperature of the immediately surrounding air. This sensitivity to changes in the air's temperature figures in an explanation of why the thermostat turns the furnace on when it does. Information about the temperature of the immediately surrounding air is registered insofar as the curvature/height of the thermostat's bimetallic strip is

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[17] Although we follow Burge in taking perception of distance *via* convergence as an exemplar of sensory representation, it is worth noting that a few psychologists have voiced skepticism about whether convergence plays a role in human distance perception. For a recent discussion of the issue see Logvinenko et al. 2001.

causally sensitive to changes in the air's temperature, and this curvature (together with the set point) determines whether the furnace turns on. Since the thermostat has the *function* of registering information about the surrounding air, it is natural to say that this curvature of the bimetallic strip *represents* the temperature of the surrounding air. And there is no harm in speaking this way provided we keep in mind that we are dealing with merely *deflationary* representation. The thermostat does not do what it does *because of the meaning of the strip's curvature*. It does what it does (turn on the furnace) *because of the curvature of the strip*.

Meaning is similarly irrelevant to explanation of the thermotaxic behavior of the bacterium *E. coli*. The bacterium migrates to areas of appropriate temperature thanks to the thermal sensitivity of its membrane-bound receptors. The sensory states[18] resulting from stimulation of these receptors can be said to represent temperature insofar as these states functionally correlate with the temperature of the surrounding environment. We can thus say that certain states of the *E. coli* mean that the environment is (too) cold and other states mean that the environment is (too) warm. Notice, though, that any such meaning has nothing to do with why a given *E. coli* moves towards or away from a heat source. Temperature-induced changes in receptor conformation trigger chemical cascades that affect the direction of flagella rotation so that the bacterium is more likely to change swimming direction if it is in a region that is too warm or too cold (Bray 2012). Even without filling out the details of such an explanation, we can see that what is causally relevant is the power of sensory states to induce certain chemical cascades and ultimately directional changes rather than the meaning of those sensory states.

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[18] These states are *sensory* states, on Burge's plausible view, insofar as they are states of a capacity that (i) is possessed by an entity capable of behavior, (ii) is causally controlled by present stimulation, (iii) serves a biological function, and (iv) serves that function by discriminating among causal impacts of stimuli of a particular stimulus modality (2010a, pp. 376-378). Burge prefers the terms "sensory state" or "sensory information registration" over "sensation" because, on one prominent use of the latter, sensations must be conscious states (ibid, p. 374, note 9).

Why, exactly, is meaning irrelevant in these cases? Not because there are underlying chemical or mechanical explanations of the behaviors in question—the same is presumably true of all behavior. Rather, the behaviors do not possess the right sort of *dependence* on the meanings of the states that trigger the behaviors. The kineses and taxes of bacteria, like the behavior of the thermostat, are inflexible behavior patterns. Accordingly, taxes and kineses of a given bacterium are insensitive to what its triggering sensory states indicate—insensitive, for example, to potential changes in what those states indicate. We can bring this point out by reflection on various counterfactual scenarios. For example, suppose some dramatic change in the environment were to alter what an *E. coli's* sensory states indicate. The *E. coli* would continue to respond as it did before to the sensory states in question (Dretske 1988).

Dretske suggests that the situation alters dramatically as we turn to the flexible behaviors of creatures capable of learning. Suppose a rat stuck in a maze with two types of walls—white and grey—discovers a strong correlation between tasty treats and white walls, and subsequently comes to pursue corridors and rooms with white walls. The rat's behavioral response (pursuit) to its sensory state (seeing white) is evidently sensitive to what the state means (its indicating a tasty treat). This dependence is brought out through reflection on counterfactual scenarios. For example, the rat would abandon its pursuit of white walls were the correlation to end and white walls ceased to indicate tasty treats, and it would not currently be pursuing white walls had they not previously correlated with tasty treats.

Burge worries that this account of the origins of the psychological cannot be reconciled with our best theories of learning because the relevant forms of learning, on these accounts, *presuppose* robust representational capacities and so cannot serve as their origin (Burge 2010a,

306). Burge's alternative suggestion, of course, is that causally efficacious meaning is present as soon as you have a sensory system implementing constraints and constancy mechanisms.

The problem with Burge's suggestion is that it fails to address Dretske's intuitive point that the meanings of sensory states are explanatorily idle in cases of inflexible fixed-action patterns. Consider instinctual behaviors triggered by states that implement constraints or constancy mechanisms.[19] We will not yet have meanings playing an explanatorily indispensable role because these types of behavior do not have the right kind of dependence on the triggering states' meanings. We can grant that the involvement of constraints and constancy mechanisms helps to explain why the creature's discriminatory behaviors are able to transcend its impoverished data. We can even grant that the sensory states in question have meanings.[20] The point remains that these meanings are not doing any explanatory work. (This lack of dependence of the behavior on meaning is, once again, brought out by various counterfactual considerations.) We conclude that constraints and constancies are not sufficient for the presence of explanatorily indispensable meanings.[21]

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[19] Burge acknowledges the reality of such behaviors in his rich discussion of primitive agency (see 2010a, 337). In this discussion Burge tells us that action triggered by perception "reaches a new level of sophistication" as compared with action triggered by sensory information registration, even when the actions in question are inflexible. Curiously, however, he does not consider the worry that the meaning of the perceptual state will remain explanatorily idle in cases where the behavior is inflexible.

[20] We assume that the vast majority of perceptual psychologists who speak of sensory states as *representational* have in mind a deflated sense of the term that readily extends to thermostats and other systems with functional sensitivity and responsiveness to stimuli. We are not questioning the legitimacy of this usage.

[21] These remarks bring into focus another fundamental point of disagreement between Burge and ourselves. Not only do we reject Burge's constructivist argument for the content view; we also reject his attempt to identify the defining feature of the psychological, his view that the genuinely psychological first emerges with constraints and constancies. For a competing account, see Carruthers 2006, ch. 2. It is unfortunate that Burge fails to engage with Carruthers' plausible alternative.

We want to emphasize, in closing, that our disagreement with Burge is not over methodology. We agree that the best means available for discovering the natures of sensory states is to look towards successful explanations in empirical psychology. We allow that introspection on experience together with armchair reflection (e.g. on the role of perception in justifying perceptual beliefs) might, in principle, reveal important truths about sensory states. We deny, however, that these sources of evidence have any special authority, and we are doubtful that they will take us very far by themselves.

Our disagreement with Burge concerns the commitments of contemporary perceptual psychology. We reject Burge's attempt to show that current mainstream psychology favors the content view over rival theories, including relational views. There is no clear connection between constraints or constancies, on the one hand, and causally efficacious sensory content, on the other.[22]

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