The essay falls in two main parts. The first has an expository character. After a brief exposition of Burge's general views on anti-individualism (AI), I turn to his views on perceptual AI and its relation to perceptual psychology, focusing in particular on how Burge thinks vision science underwrites and clarifies perceptual AI. I then go over the explanations given by vision science in some depth. The second part is more critical. I here question the close connection Burge sees between perceptual psychology and philosophical theorizing about perception. First, I argue that vision science seems only to presupposes a very weak, non-standard form of AI. I then argue that it is compatible with quite strong forms of AI, despite Burge's claim to the contrary. In short, the empirical science places fewer constraints on philosophical theorizing about perception than Burge thinks.

1 Anti-Individualism

Anti-individualism (AI), or externalism, as it is also often called, states that the content, and so the nature, of an individual's representational states depends on relations, in particular causal relations, between the individual and her environment. As the familiar Twin-Earth thought experiments make vivid (Putnam 1975/1979), an individual's beliefs will be about the properties and kinds in her environment, not those in potentially different but indistinguishable environments. An individual in an environment containing a liquid that is identical in surface properties and behavior to water but with a different chemical constitution will have a concept for that liquid, not water, even though she may be a physical duplicate of one of us. In fact, her entire linguistic community may be a duplicate of ours – including the dispositions to utter the word 'water'. In other words, AI holds that the merely "internal" states of an individual are insufficient to determine the nature of her representational states; the representational states are what they are because of the individual's interaction with her environment. It is not here necessary to be more specific about the relations between the individual and her environment. Typically, they will be causal relations. In the second part, I look at different ways of construing the relations in virtue of which, specifically, perceptual states have their content. For the present, I will focus on Burge's views about AI in its general form, which he states in terms of his "principle A":

The natures of many mental states constitutively depend on relations between a subject matter beyond the individual and the individual that has the mental states, where relevant relations help determine specific natures of those states. (2010:61)

Burge supplies this characterization of AI with the "closely related" (2010:69) principle that representation must constitutively be associated with a background of veridical representation. This is his "principle B":

For an individual to have any representational state ... as of a subject matter, that state must be associated with some veridical representational states that bear referential, indicative, and attributional representational relations to a suitably related subject matter. (2010:68)

In other words, any representational state must bear some relation to some set of veridical states. As he notes (2010:69n11, 1986:131n4), the principle is related to various versions of Quine's "principle of charity", which also plays a crucial role in Davidson's interpretationist theory.

How exactly Burge thinks of the relation between the two principles – for it is clear that he thinks they are related – is not entirely clear to me. Burge's overall brand of AI seems closer to Putnam's version of AI than to Davidson's; his early and influential work on AI (1979)
employed thought experiments of broadly the same form as Putnam. On the other hand, when Burge in recent works gives two “general grounds” for AI (2010:80–2), he seems closer to Davidson’s “transcendental” argument for a constitutive relation between representation and veridicality or representational success (see, for instance, Davidson 1983/2001). Here I only state Burge’s grounds in the briefest outline: First, the very fact that representational states have veridicality conditions ensures that the states must bear causal relations to what the veridicality conditions are about (2010:80). Second, the function of representational states – to represent veridically – constitutively depends on relations to situations in which the function is exercised successfully, situations which have made the states what they are (2010:81, cf. 308ff).

Burge has written extensively about AI in its general form, but the work I will be considering in the present context is concerned with AI about perceptual states, conceived of as states that, like beliefs, represent the world as being a certain way. In accordance with principle A, AI about perception states that the natures of perceptual states constitutively depend on the environment of the individual. As Burge notes, it is hard to conceive of good thought experiments for perceptual AI; “it is hard to get perceptual cases in which two individuals are behavioral and physical duplicates while differing in their perceptual states” (2010:82n30). This is presumably why in recent works he prefers to endorse AI on the “general grounds” just mentioned. In an earlier work (1986:131–6), Burge gave an example of two environments containing indiscriminable shadows and small cracks respectively, where the individuals had not discriminated them by any other senses (and were not disposed to do so). Burge argued that the difference between the cracks and the shadows would show up in the perceptual states of perceivers just as in Putnam’s original example (1986:131ff). Several authors have doubted Burge’s conclusion, holding that in the case envisaged, the more reasonable thing to say is that the individual merely represent a dark patch – in Segal’s term, a “crackdown” (1989:206). The case seems less convincing or at least harder to assess than the familiar cases about belief.

One might be able to remedy this situation; one can always try to find other examples. Still, Burge is correct that it is harder to devise such cases for perceptual AI than for AI about belief. The difficulties involved in setting up convincing thought experiments for perceptual AI is a potential problem. AI about perception does not seem to be just a straightforward extension of AI about belief. This worry will be pursued further in the second part, where I question Burge’s central contention that perceptual AI is also presupposed – and thus, trivially, supported – by perceptual psychology and vision science. The import of this claim is the topic of the next section.

1.1 Anti-Individualism and Perceptual Psychology
If one casts a glance at perceptual psychology, one might get the impression that it is quite individualistic: Vision science studies how representational states are formed from mere stimulation of the retina, and so one might think that it considers the representational states quite
independently of any environment the individual might happen to be in. In other words, one might think that it ignores or even denies AI.

The basic aim of perceptual psychology, as Burge also describes it himself, “is to explain formation of both veridical visual perception and perceptual illusion, given various kinds of retinal stimulation” (2010:343). More specifically, its aim is to explain how perceptual systems manage to solve what is often referred to as the underdetermination problem, that is, to transform retinal stimulation into a stable representation of the environment that produced the stimulation. The problem is so called because the proximal stimulus underdetermines the environmental situation that gave rise to it: The very same stimulation of the retina could be produced by a wide range of different environmental circumstances. Hence one cannot from the stimulus itself infer what gave rise to it. Yet the problem the visual system has to solve is in effect to draw just that inference. The problem of the visual scientist, in turn, is to explain how the visual system manages this – as it generally does – as well as why it sometimes fails to.

The underdetermination problem is a problem not least because it is in principle insoluble. No stimulus can by itself establish the presence of any particular environment. Moreover, the range of possible environments that would give rise to the same stimulus is in principle infinite (Burge 2005:10, 2010:91). How could one possibly infer any particular environment from the stimulus? The inference could certainly not be deductive. But even a non-deductive inference would seem bound to be extremely shaky at best.

This can be made vivid by an example: The way the light from the three-dimensional environment is projected onto the two-dimensional retina means that all depth is lost: A smaller disk at a small distance will produce the same retinal stimulation as a bigger disk at a greater distance. Given the spatial properties of the environment, we can, from principles of geometry and optics, calculate the geometrical properties of the “image” created by the light projected onto the retina (the retinal image, as it is often called). But we cannot conversely calculate the properties of the environment from the properties of the retinal image, as there simply is no well-defined function of projection from two dimensions to three (cf. Burge 2005:10, Palmer 1999:20–3).

However “impossible” it is in principle, recovering environmental properties is just what is required for us to represent our environment. Since the information on the retina underdetermines the environment that produced it, the visual system must proceed by way of an “inverse optics” to “undo” the “loss of information” caused by the projection of the image onto the retina (Palmer 1999:23). Hence, the system must in effect perform the impossible task of mapping a two-dimensional layout onto a three-dimensional one.

As we will see, many properties other than depth are underdetermined as well. Indeed it seems that any environmental property will be underdetermined. For instance, the stimulus produced by a certain color could equally well be produced by a different color under different lighting conditions. Below, I will use lightness properties as an example: Here as in the case of depth, the perceptual system has to single out one among the (in principle infinitely) many environmental scenarios that would produce the given input.

From this description it can seem unclear why perceptual states are, or indeed could be, anti-individualistically individuated. Apart from other internal (background) information and input from other sense modalities, a given perceptual state is formed merely in response to the retinal stimulus, as Burge states in his “Proximality Principle”:

> Given antecedent psychological states, the formation of perceptual states causally depends on nothing more than proximal input and other contemporaneous internal input into the perceptual system. (2005:22)

It might thus seem that perceptual states are what they are merely in virtue of “internal” factors. What role is there for the environment to play in the formation of perceptual states? Since retinal information is all the system has to “go on”, it can seem that there is none. How, then, can Burge claim that vision science underwrites AI?

Now, elegantly, Burge turns this seeming problem to his advantage: While insisting that the input to the visual system is restricted to mere proximal stimulus, he argues that the way the visual system forms its representations from this proximal stimulus is determined by environmental factors. The anti-individualistic character of perceptual states lies not in some purported direct sensitivity to the environmental entities that bring about retinal stimulation, but rather in the way the system “transforms” these stimuli into fully representational states. More specifically, AI is implicit in the principles that determine how the representational states are formed from the proximal stimulus – the so-called formation principles. The general upshot of this, according to Burge, is that vision science is in fact not just consistent
with AI but committed to it:

It presupposes that perceptual-state kinds are constitutively dependent for being the kinds that they are on patterns of relations to attributes, laws, and other regularities in the physical environment. The science determines specific ways in which kinds and operations in perceptual systems reflect environmental attributes, laws, and other regularities. The science makes anti-individualism about perception specific. (2010:87)

While Burge holds that it can be known a priori (2010:69–70, 310–1, 532–7) – on the “general grounds” mentioned above – that AI is true of representational states, the science shows more specifically what it is about these states that entails AI.7 The answer is that they were formed by formation principles which are what they are because of the individual’s environment.

The formation principles are responsible for “undoing” the loss of information inherent in the projection of light on the retina (2005:12ff, Burge 2010:92ff). Though the result they deliver is fallible, this means that there is after all a kind of “one-way” mapping from retinal stimulus to environmental cause:

There is a many-one mapping from the distal, environmental cause to proximal stimulus, and a many-one mapping from proximal stimulus to the environment. But there is something like a one-one mapping from proximal stimulus to distal environmental cause that is most likely to have generated that proximate stimulus. (2010:345)

Metaphorically put, the system “infers” a solution to the underdetermination problem “based” on proximal stimulation (together with background information and information from other perceptual modes). Staying within the metaphor, the formation principles are the “inference rules” that yield the “conclusion” – the content of the representational state – from the “premises” given by the information in the retinal image (and other internal information).

Now, Burge is clear that this is metaphorical (2005:13, 2010:96–7). So the claim is not that the “content” of the formation principles “concerns” the environment, as if they were real premises. Rather, the claim is that the principles are constitutively dependent on the perceiver’s environment; they are “explicable only by reference to the way in which patterns in the perceptual system’s natural environment have molded the nature of the perceptual system and its perceptual states” (Burge 2010:100, cf. 345).

In the next section, I take a closer look at the formation principles that govern perceptual representation of lightness, with an aim of seeing more clearly whether Burge is right that science underwrites AI.

### 1.2 Case Study: Lightness Constancy

An important feature of perceptual systems is that they exhibit constancy. They can “represent a given property or an object as the same despite significant variations in proximal stimulus” (Burge 2005:10). Palmer similarly defines constancy as “the ability to perceive the properties of environmental objects, which are largely constant over different viewing conditions, rather than the properties of their projected retinal images, which vary greatly with viewing conditions” (1999:125). The successful exercise of a constancy indicates that the perceptual system has come up with a solution to the underdetermination problem. The system has “inferred” the distal cause of the proximal stimulus from the “information” inherent in it, and represents the environment in a stable manner, despite the constantly varying stimulus. This is why constancies are so important, both in vision science and in Burge’s philosophical work.10

The following description by Palmer indicates in broader outline the relation between underdetermination, constancies, and the task of vision science:

> Perhaps the most fundamental and important fact about our conscious experience of object properties ... are more closely correlated with the intrinsic properties of the distal stimulus (objects in the environment) than they are with the properties of the proximal stimulus (the image on the retina). ...

> [T]he first issue that must be addressed in the perception of object properties is how this is possible. After all, the light that is reflected from objects into my eyes as a pair of 2-D images that constitute the starting point for all visual perception. How do people manage to recover the intrinsic properties of environmental objects from these retinal images? ...

> [T]he fact that people veridically perceive the constant, unchanging properties of external objects rather than the more transient properties of their retinal images is called perceptual constancy. (1999:312)

The currently dominant approach to how the visual system achieves this is the computational approach, the outline of which was stated in its essentials by Helmholtz, who understood perception in terms of “unconscious inference”.

The perceptual system has to single out one among the (in principle infinitely) many environmental scenarios that would produce the given input.
As I described at the end of the previous section, the visual system can be seen as “solving” the underdetermination problem by “inferring” the most likely source of the retinal stimulus.

In this section I will narrow in on one kind of constancy: the capacity to perceive achromatic surfaces as having the same lightness (white, grey, black) despite differences in illumination and viewing conditions (Burge 2005:14–6, 2010:351–4, Palmer 1999:122–33). Lightness constancy is in place when a printed page looks the same shades of white and black both in a badly lit room and in sharp sunlight – that is, despite vast variations in luminance, the amount and intensity of light that hits the retina. We see the page as having the same shade of color despite huge differences in proximal stimulation (cf. Palmer 1999:100).

Lightness constancy is well suited to make the underdetermination problem vivid. The proximal factor, luminance, is determined by two distal factors, surface reflectance and illumination:

The problem that the visual system faces in perceiving surface colour is that the light that falls on the retina ... is jointly determined by the reflectance spectrum of the surface and the illumination spectrum of the light that strikes the surface. (Palmer 1999:123)

The task the visual system faces in recovering the surface reflectance is somehow to disentangle the effects of reflectance and illumination so that the invariant property of surface reflectance can be perceived despite differences due to illumination. (124–5)

The perceptual system thus has to “distinguish” two variables responsible for the retinal image. The two variables are illumination and reflectance – in the example, roughly, how much light falls on the page and how much light it reflects. As before, the task of disentangling these variables is in principle “impossible”, since any combination of illumination and reflectance could give rise to the same stimulus luminance. So the system can only form its states – its “conclusion” – with the aid of formation principles – “inference rules” – that yields a choice among the infinite range of possible environmental conditions.

In part, however, the formation principles are relatively simple: For instance, when a page is viewed under different light conditions, the relative luminance between parts of the retinal image will remain largely the same despite the large variations in absolute luminance (Palmer 1999:127). Since surface reflectance remains the same, differences in absolute luminance is due entirely to difference in illumination. This is also what, under such circumstances, the perceptual system will “assume” in the formation of the representational state.

But this is far from the whole story, which is very complex. For instance, in any ordinary environment, lightness constancy depends on perception of spatial layout. Surfaces are seen as having the same lightness despite curves and corners that affect illumination, produce shadows, and so on. This means that “distinguishing” reflectance and illumination becomes very hard. Leaving the details for another occasion (see Palmer 1999:128–30), the main “strategy” the visual system employs is to determine luminance edges: discontinuities in luminance between (larger) areas of the retinal image. Such edges will (normally) stem from abrupt changes either in surface reflectance or illumination, thus providing clues to the solution of the underdetermination problem.

Again, however, the system must distinguish illumination edges from reflectance edges. In order to track achromatic surface reflectance through changes in illumination, edges due to shadows and spotlights must be distinguished from edges due to corners and changes in surface texture. And again, to make a long story short (see Palmer 1999:130–2 for one version of the longer story), the key to resolving this is the various formation principles. While these principles are not infallible, they are fairly reliable in the perceiver’s normal environment. The most basic principles are probably shared by all mammals (Burge 2005:15).

Burge (2005:15–6) and Palmer (1999:132) mention four important formation principles, of which I will describe only the first in any detail.

The first formation principle concerns the sharpness of the edge: Illumination edges tend to be fuzzy or gradual, reflectance edges tend to be sharp. In the absence of contrary information, then, the system will normally “interpret” a sharp luminance edge as a reflectance edge. This principle will be fairly reliable in our normal environment, where shadows and lights are “unfocused”. However, the principle can produce illusions, such as when a sharp-edged spotlight projected on a wall looks like a bright patch.

The second formation principle concerns depth relations among surfaces: Where depth information indicates a corner, the luminance edge is interpreted as an illumination edge. The third principle concerns the luminance ratio: Large ratios (>10:1) are almost always due to chan-

The visual system can be seen as “solving” the underdetermination problem by ‘inferring’ the most likely source of the retinal stimulus.
ges in illumination. The fourth principle concerns information about chromatic color (thus it is a principle of color constancy): Differences in illumination will normally preserve hue and saturation, differences in reflectance will not.¹⁹

Of course, this is just a mere sketch of the explanation given by vision science. The real story is much more complex. The point is to illustrate how the perceptual system depends on properties in the environment in forming perceptual states. The formation principles respond to cues in the proximal stimulus by forming states that represent the likely causes of the proximal stimulation. Thus, we also see how, in explaining these things, “[t]he science makes anti-individualism about perception specific” (Burge 2010:87).

With this in hand, it is time to raise the question explicitly: Is Burge right that vision science presupposes AI in its explication of how the transformation principles allow the visual system to reliably solve the underdetermination problem?

2 Varieties of Perceptual Anti-Individualism
I think the description of the formation principles in the previous section to some extent underwrites Burge’s claim that vision science presupposes AI. The principles are reliable in our environment, as explained in the example. The principles governing lightness constancy conform to general features of our actual environment. So far, Burge may well be right that the science presupposes AI in some form. At any rate, I will not here question that claim. The question I want to raise is how strong the AI presupposed by vision science is (I come to what this means in a moment).

I think that there is reason to doubt that the science presupposes an AI of the strength we know from the “classical” thought experiments of Putnam (1975/1979) and Burge himself (1979). At any rate, I find little in Burge’s own discussion of the science which suggests that it does. Now, it may be that Burge thinks AI about perception is weaker than AI about belief. But the fact that he does not address the issue explicitly gives an at least prima facie reason to think that he thinks them on par. However, my main aim is not to determine whether he really thinks so or not, but to point out the need to discuss which form of AI is supported by vision science, since the differences between those forms are very significant. Finally, underlying my discussion there is of course also a concern about how we ought to think of perceptual AI from a philosophical standpoint.

What do I mean by the “strength” of a variety of AI? AI states that the representational states of an individual are in some way dependent on an environment, in the sense that the states could not be what they are – have the natures that they have – independently of that environment. In that sense, the states are sensitive to the environment, which is certainly something we take our perceptual states to be. Roughly, the strength of a form of AI is a matter of how dependent or sensitive the states are to the environment. One way of bringing this out is to consider cases of what is called “switching” – cases where an individual is transported between various environments, for instance between Earth and Twin Earth. On the standard version of AI, an individual will be able to adjust to a new environment, so that after some time, she will represent the
kinds and objects found there, not (only) those of her old environment. But one can hold on to AI even if one thinks such adjustment is impossible. For instance, one might hold that an individual’s states are fixed by the environment in which it grew up. One might also hold that they depend on the environment of some of her (possibly quite distant) ancestors. Or one might in principle hold that a species’ representational capacities are fixed once and for all by some privileged environment, and that adjustment to a new environment cannot occur (though this would be a strange position to hold if one also believes that perceptual systems have developed through evolution). All these positions are forms of AI, in the sense that they entail Burge’s principles A and B: They all hold that the nature of an individual’s representational state constitutively depends in some way on some environment (cf. 2010:61), and are associated with some veridical representations of that environment (cf. 2010:68). The positions are thus still different from individualism, and entail, for instance, that an individual’s psychology cannot be (exhaustively) studied in isolation from an environment.

The most radical (weakest) form of AI (which holds that no switching is possible) does not seem a relevant option, at least not in the case of evolved beings, so I will leave it aside. The other two non-standard forms of AI, however, are worth considering. It seems a live possibility that science does not support any kind of adjustment beyond these. If so, it only supports a weak AI, one which leaves it open whether an individual will be able to adjust. It may even be that perceptual psychology positively presupposes that individual adjustment is not possible in the case of perception. The question of how an individual will respond to switches seems immediately pressing when discussing perceptual AI. Yet, as I come to below, Burge does not explicitly address it.

Another way for versions of AI to differ in strength is illustrated by currently popular disjunctivist views of perception, which hold that (some) perceptual states involve a particular environment as a constituent: For one to be in such a state, what one represents must exist (and one be suitably related to it). This is a very strong form of dependence on and sensitivity to the environment, for it entails that some states are by nature veridical. Thus, disjunctivism is a stronger version of AI than the one familiar from the classical thought experiments.

This strong form of AI is of interest in our context because Burge claims that vision science presupposes that it is false. This claim is independent of the claims that science presupposes that some weaker form of AI is true. It may also not be readily clear how it relates to what was said about perceptual psychology in the previous sections. However, the claim is in fact implicit in what I said there: In saying that the environment is a constituent of a perceptual state, disjunctivism must reject the Proximity Principle, the claim that a given type of proximal stimulation will (other psychological factors equal) bring about the same kind of representational state. As I have stressed, the same proximal stimulation can be produced by a wide range of different environments. The fact that disjunctivism is inconsistent with the Proximity Principle leads to the second question I raise about (Burge’s claims about) the relation between perceptual psychology and perceptual AI: Is perceptual psychology really committed to the Proximity Principle? Does it really rule out disjunctivism?

Thus, the following discussion involves two independent questions: The first is whether vision science entails standard strength AI about perception (section 2.1). The second question is whether vision science excludes strong AI of a disjunctivist kind (2.2). Both questions concern just how dependent our perceptual states are on our environment and, in that sense, issues that are as old and important as they are hard to state clearly: how “immediate” our relation to our environment is. This will be an underlying theme of the discussion, though it will in the main remain implicit.

To avoid suspense: I will answer both questions in the negative. On the one hand, though perceptual psychology does presuppose some form of AI, it is only a very weak form. On the other hand, it is consistent with quite strong forms. The upshot is that the implications of vision science on the philosophy of perception are much more indirect than Burge thinks. I now turn to the first question.

2.1 Weaker and Stronger Anti-Individualisms
As I suggested in the previous section, while we can accept (at least for the sake of argument) that the formation principles described by vision science do entail some form of AI, that form may be only a very weak one. The formation principles are reliable in our normal environment. Vision science of course concerns itself with our actual perceptual states and our actual environment. But how would the formation principles do in other environments? Would they allow the individual to adjust to a new environment?

I think the classical thought experiments, when they elicit a commitment to AI at all, elicit a rather strong form.
One of the intuitions in Putnam’s example is that if *Oscar* were born on Twin Earth instead of *Toscar*, he would represent the liquid there. Similarly, Twin Earthlings would represent water if they were born here. More to the point, if we were to be placed in a new environment, the content of our beliefs and other propositional attitudes would conform to the properties in that environment. In other words, we would (over time) adjust to the new environment in cases of switching. It is not, of course, that we have clear intuitions of how long it will take for an individual to adjust. The intuition is just that this should be possible for the individual, and presumably within the individual’s lifetime. If not, one would expect responses like this: “How can I judge whether *Toscar* represents twater or something else? I do not know whether his ancestors evolved in that environment!”

While we do of course assume that he did not arrive there just a minute ago, we do not think we need this kind of information about his evolutionary prehistory. At any rate, both Burge and other parties to the debate assume that individual adjustment is possible in the original cases of belief.39

When elicited by the thought experiment, then, the intuition that an individual can adjust to her environment goes hand in hand with the intuition that AI is true at all: that we represent what is to be found in our environment. After an initial period of misrepresentation, we will adjust. If instead we thought that our “internal” constitution would determine whether we would represent twater or water, I think we would thereby also undermine our confidence in AI as such – at least as warranted by the thought experiments.

As I noted at the beginning, it is hard to conceive of good thought experiments eliciting a commitment to perceptual AI. Hence, we cannot readily test whether the intuitions that hold for doxastic states in the classic thought experiments also hold for perceptual states. But we can still ask whether proximal stimulation would lead a perceptual system to respond inflexibly to its environment when it would result in gross misperception, or whether the system would be flexible enough to adjust to a new environment. If perceptual AI is of standard strength, adjustment is possible: Our perceptions will after a while represent the properties of a new environment, just as our beliefs will if we are transported to Twin Earth.

I think we now see that the story vision science *clearly* presupposes is only a much weaker story. The formation principles are reliable in our actual environment. Is it clear that they will adapt to a new environment? If, for instance, the formation principles are wholly *innate*, they will not allow this kind of adaption. The principles would constitute “prior settings” that would lead me to represent what I would have represented in my “normal” environment in response to the given stimulus, even long after switching from that environment.

Here is another way of putting the point: According to standard AI, it is a necessary fact that we (after some time) represent the kinds and entities in our environment, and not some indiscriminable kinds and entities in some other environment. But as far as I can see, for all the story about the formation principles tells us, it might be a contingent fact about us that the formation principles that govern our perceptual systems are reliable in our *actual* environment and not rather in some environment we no longer inhabit. For it is a contingent fact that our species has not undergone a prehistoric switch, a switch which, according to weak AI, could have led it to seriously misrepresent its present environment.39 In the absence of a claim to the

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**Disjunctivism is a stronger version of AI than the one familiar from the classical thought experiments.**

Illustration: Marianne Røthe Arnesen
effect that formation principles are able to adjust to the environment in the lifetime of the *individual*, we have no reason to suppose that it is not a contingent fact that we do not represent properties in some remote environment that we inhabited in our prehistory. Parallel considerations apply in the much less dramatic case that our "settings" are set once and for all during early childhood. Thus, there are important questions to be asked about whether vision science is nativist or empiricist, and also to what extent the formation principles are open to revision after an individual has undergone its formative period. It is unclear to what extent vision science is committed to, say, nativism about the formation principles. My impression is that today's vision science (and cognitive science in general) tends more towards empiricism than it did some decades ago, but I am not sure about this.21

Burge does not say much about these questions, nor does he say much about what perceptual psychology says about them. That might suggest that he thinks science leaves them open; science does not make the strength of AI "specific" (Burge 2010:87, quoted above). Perhaps he would then also regard it as an open issue whether perceptual AI is of standard strength. Some of what Burge says suggest that he is interested merely in the claim that vision science presupposes some reference to an environment. When he motivates AI with reference to the function of representation (the second "general ground"), he explicitly invokes the idea of evolution, such as when he writes that "[p]erceptual systems have developed so that their representational states tend to correlate with the likely causal antecedent" (2010:345) and that "patterns in the natural environment have molded the nature of the perceptual system and its perceptual states" (2010:100). Perhaps he would accept that perceptual systems adjust to the environment only phylogenetically, so that there is no adjustment in individuals, or that the nature of one's perceptual system is fixed by the environment in which one grew up, and so only ontogenetically, if that is all the science is committed to. As I have already mentioned, his official principles A and B are silent on these matters; they simply state a very weak form of AI. So his silence might suggest that, in the case of perception, he simply assumes AI is its barest (weakest) form.22

Nevertheless, I find it strange that Burge never explicitly compares perceptual and doxastic AI with respect to strength, as one would expect if he thought they would differ significantly. From the fact that the thought experiment he once gave for perceptual content (the indiscriminable cracks and shadows) is just a perceptual analog of the classical thought experiments about belief, as well as from the fact that his "general grounds" are supposed to work just as well in the case of perception as in the case of belief, one might reasonably think that he regarded them as on par. Moreover, since Burge holds that standard AI (including the possibility of individual-level adjustment in the case of switching) can generally be established a priori, one would at least prima facie expect that the strength of perceptual AI should be an empirical matter. Again, one would expect that he would mention the difference with respect to their epistemic status.

We are left, then, with three questions: First, what does the science say about the strength of perceptual AI? Second, what does Burge think about the strength of perceptual AI? Third, how ought we to think about perceptual AI? About the first question I do not have much more to say. My aim has not primarily been to find out what the
science says, but rather to point out the need to find out, if one wants an interesting thesis about what vision science presupposes. Beyond that, I can only say that I think it is a serious task to find out what science says, since practicing vision scientists are not very likely to be concerned with this kind of questions. As to the second question, it is after all perhaps not very interesting what Burge thinks, so long as one is aware of the options that are open to him. I hence proceed to the third question: How are we to think of AI about perception?

It may seem that our judgments about AI are less firm with respect to perception than with respect to belief. As I noted in section 1, it is significant that “Putnam style” thought experiments about perception tend to be either artificial or unconvincing (or both). The familiar thought experiments involve objective entities that have the same appearance properties and yet different natures. The lesson of the cases is to induce a judgment that beliefs based on perception are sensitive to the distal conditions despite identical proximal conditions. The problem is to devise similar cases for perception. If we could take it for granted that perception could represent kinds like water and twater, the situation would presumably be straightforward, but many philosophers doubt that perception represents such kinds; presumably, the content of perception is much sparser than that of belief. Philosophers disagree on what properties are instantiated in perception, but one case they do not disagree on is (basic) spatial properties. So we might try to assess the possibility of switching by considering different spatial layouts that give rise to the same proximal stimulation. This seems difficult, however: Perhaps one might abstractly conceive of environments where space itself has different properties, which nevertheless give rise to the same proximal stimulation. But even if we should be able to do this, the problem remains how to assess the cases: Is it really true that we would, in such cases, represent those spatial properties, as distinct from the familiar three-dimensional ones? How to think of such – dizzying – cases is not clear to me. Perhaps in such cases, we would indeed misperceive our environment on a grand scale, due to the constitution of our perceptual system, which of course developed to represent actual space, which is (for all practical purposes) three-dimensional. This would amount to denying the possibility of switching.

We might try to devise less fanciful examples. Burge has given one himself. This case also seemed less convincing than the standard thought experiments, however. In the case of overall spatial properties, the problem was that the envisaged cases were too abstract. In the case of cracks and shadows, the problem is rather that there is no clear intuition whether one determinately represents the one thing or the other, or not rather something less determinate than cracks or shadows – “something dark”, say. Another response might be that it is – as far as the thought experiments goes – an entirely empirical matter whether the contents are the same or not.

The problem of setting up good thought experiments might be taken to suggest that perceptual AI is of a kind much weaker than the standard doxastic AI – or perhaps even that perceptual states are not anti-antivialistsically individuated at all. In fact, though, I also think the considerations just sketched might well provoke the opposite reaction: The suggestion that perceptual AI is only very weak will seem to conflict with our common sense view that perception is somehow “direct”: Can we really be said to be directly sensitive to our environment if our states adjust to it merely by evolutionary adaption? Can we really say that we enjoy direct awareness of the world if our system merely represents what it would also represent in response to a wildly different environment? Admittedly, the concern is inchoate and hard to state clearly. The worry seems palpable enough, though. At least, it seems fair to say that the weakest forms of perceptual AI – those that
individuate our perceptual states relative to environments our ancestors left long ago – only involve a very indirect form of dependence on and sensitivity to the environment we actually inhabit. It also seems worrisome that our perceptual states should be less sensitive to our environment than our beliefs, so that we could undergo switches in belief content that concern perceptually perceived entities if the perceptual states themselves remain unchanged. It seems natural to suppose that our beliefs would be slower in adjusting to the environment that our perceptions, since we naturally need some time to figure out what it is that we encounter perceptually. This should suggest that perceptual adjustment should be at least as quick as adjustment of belief. Whether it is for these or other reasons, many philosophers tend to accept an even stronger AI for perception than the standard AI for belief: In other words, they accept some form of what has become known as disjunctivism. According to Burge, however, such forms of AI are in fact ruled out by perceptual psychology. In the next section, I turn to this claim.

2.2 Anti-Individualism and the Proximality Principle
Disjunctivism is often motivated by a claim to respect an ordinary conception of experience as directly involving the perceived environment: When I look out of the window at the trees outside, the trees shape my experience in a way that entails that no such experience were to be had if the trees had not been there. In this way, the experience constitutively involves the trees. Hence, disjunctivism is often referred to as a relational conception of experience: There could be no experience of this kind if there were no trees there. The trees are simply in view and, as such, are what gives my experience the structure and character it has. To be sure, one might be able to induce in me an experiential state which would be indistinguishable from the one I am now enjoying. One might place me in a qualitatively identical environment, or let a scientist stimulate my retinas in just the way they are now stimulated by the light reflected off the scene in front of me. But the characteristic claim of disjunctivism is to deny that such indiscriminable experiences are of the same kind.

In rejecting the claim that states formed from the same proximal stimulation (and the same background information and inputs from other sensory modalities) must be of the same kind, disjunctivism flat-footedly rejects the Proximality Principle. Since different environmental conditions can give rise to the same proximal stimulation, the principle entails that perceptions of different environments can be of the same kind. Since such stimulation can also be produced artificially, the principle also entails that a perception of that kind could be a mere hallucination. In claiming that a given state constitutively involves entities and properties of a given environment, disjunctivism is a very strong version of AI. It entails that perceptual states are individuated directly by the environment perceived, and in that sense are strongly dependent on and sensitive to it. For instance, it will presumably yield instant switching: When you arrive at Twin Earth and overlook a Twin fjord, the phenomenology of your experience is constituted by twater, not water. Though it is indiscriminable from a perception of water, it is a different state because it is constituted by a different environment, even if your proximal stimulus is the same. In the case of standard-strength perceptual AI, however, such adjustment will take time, and your state can be individuated by kinds which are no longer found in your environment. Thus, standard AI is compatible with the Proximality Principle, whereas disjunctivism is not. However, Burge regards it as clear – scientifically established (2005:1–2) – that visual states are formed merely from proximal stimulus. This is the main claim of his (2005), and it is repeated in later work. Correspondingly, he holds that disjunctivism is ruled out on scientific grounds. Such views, he says, are “commonly propounded without serious understanding” of vision science.
I have already explained the content of the Proximal Principle, but it will be useful to have Burge's own formulation of it on the table:

Holding constant the antecedent psychological set of the perceiver, a given type of proximal stimulation (over the whole body), together with associated internal afferent and efferent input into the perceptual system, will produce a given type of perceptual state, given that there is no malfunctioning in the system and no interference with the system. (2005:22)

Something like this can seem independently plausible. How can the perceptual system "get beyond" what is immediately presented to it? How can states which are caused in the same way from the same proximal causes differ in kind? However, one should note that the "intuitive" appeal of the Proximality Principle is close to an intuitive appeal for individualism: How can a thinker or perceiver "get beyond" her proximal stimulus to form representations of environmental features she cannot discriminate? How can beliefs that are caused in the same ways from the same proximal causes differ in content?

But this intuition is generally overridden by the judgments people make when confronted with the standard thought experiments: The content of the psychological states varies with distal conditions, even if proximal stimulation remains the same. And of course, Burge is otherwise quite clear that this reaction is the right one. The Proximality Principle is consistent with AI, since it is consistent with the claim that the way the perceptual system forms perceptual representational states are dependent on an environment.

I think, then, that the "intuitive" support of the principle should not be particularly convincing to an adherent of AI, at least not without further refinement. The "individualist" intuition for the principle is counterbalanced by an anti-individualist intuition against it. There are other intuitive reasons against the principle. One consideration, noted by John Campbell (2010:203), is simply that the principle conflicts with the ordinary notion of seeing. What one sees is not determined by one's proximal stimulation. For instance, a patch on a wall can look exactly like the moon to me, and vice versa: They would project the same amount of light onto my retina, resulting in indiscernible states. According to the Proximality Principle, the states would thereby be of the same kind. Yet I still see different things. Now, in ordinary cases, background information will ensure that I do not see a patch as the moon or the moon as a patch. But in principle, we can hold such factors constant, and still get different states of seeing. Let us suppose that in either case I believe that I am looking at a patch on the wall, and also see whatever I see "as" a patch on the wall. I still see different things: In the one case, I see a patch (as a patch); in the other, I see the moon (also as a patch).

One reply Burge might give is that when science attempts to explain perception, it is not concerned with what is picked out by our ordinary notions of seeing, hearing, touching, and so on. Mature science is not constrained by ordinary language in this way. Rather, the ordinary notion of seeing can be reconstructed as "veridical visual representation" or the like. But this pill seems a little too bitter to swallow. If the Proximality Principle is true, then the representational content of the two states will be identical, since the proximal stimulation (and background information) is identical. The problem is that we then cannot explain how it is that we see the moon in one case and a patch in the other. Can we simply accept that these ordinary claims carve no joints at all and that the states are identical?

Burge has a second reply, however. It is that, in each case, we represent a singular ‘this’, and that the ‘this’ will refer to whatever in fact suitably causes the state. In his terms, the content of the state will be the same, but the application of the contents will differ, since the referents differ. In other words, in both cases the content is (something like) ‘this is a patch’, but the ‘this’ will have different referents (it could also fail to refer). In this way, we can reconstruct the claim that we see different things, while preserving the claim that the content of the states is the same.

This seems a much better response as it gives us a sense in which the original claims about what we see are right. There is a problem with it, however. It seems that it will either itself be in tension with the Proximality Principle (if this difference of “application” amounts to a difference in the states) or else be ineffective (if it does not amount to a difference in the states). Burge cannot allow the first option. Since states are type-individuated by their content, he cannot allow that the differences between referring to the patch and to the moon amounts to a difference in content. That leaves the second. But that option seems to leave us where we began: If the difference in the “application” does not amount to a difference in the state, how can we respect...
the ordinary distinction between seeing the moon and seeing a patch?

Undoubtedly, Burge will have something to say to this. He has long defended a complex and original story about demonstratives. For the present, I’ll let this exchange end in a standoff. It is time to face the main question: Is Burge right that the science rules out disjunctivism? Is it clear that the Proximality Principle is “scientifically established”?

As Charles Travis points out, the principle does not seem to be an empirical finding:

It is not an empirical result, but rather a methodological assumption with which the science approaches its topic in the first place. (2011:510)

Now, assumptions that guide scientific practice can probably be vindicated if the science itself is successful. But even so, it may not be clear that they are strictly true. The role of idealizations in science is well-known. Writers like Nancy Cartwright (1999) have argued that even many of the laws in physics are really only ceteris paribus laws, holding under idealized, counterfactual situations only. If that is true, then there is certainly no reason to suppose that there is more order in a relatively “messy” subject matter like psychology. Burge needs a notion of “functioning properly” on which the visual system is functioning properly whether it yields perceptions of its environments or mere hallucinations. Again, I do not know that we have a notion of proper functioning on which a visual system generating nothing but hallucinations is “functioning properly”. (Campbell 2010:208)

This relates to the issues about switching discussed in the previous section: How static are the formation principles supposed to be? Already a standard AI – not to mention the very strong AI of Campbell’s (2002) “relational” view – seems to require that formation principles, too, can to some extent adjust to the environment. If not, the result of responding to a non-normal environment could well be massive hallucination. It is far from evident that perceptual psychology would really regard such a system as “functioning properly”.

The other “kludge terms” are also problematic, though I will not rehearse Campbell’s arguments (see his 2010:208–9). What they all suggest is that vision science may be less rigorous than Burge thinks it is. If so, Burge may in the end be left to a familiar habit among philosophers: to give a “metaphysical” construal of science as much more streamlined than it probably is.

I think this kind of response to Burge is good as far as it goes. One possible problem with the response, however, is that it is unclear that one can save disjunctivism merely by “weakening” the principle through, say, a ceteris paribus clause. What seems required is an outright rejection of it. Disjunctivism is committed to holding that proximal stimulus radically underdetermines which perceptual state is formed. The states are generally (if perhaps not without exception) individuated by the objects perceived. This seems incompatible with the Proximality Principle, softened or not. It is not just that identical proximal stimulus now and then or under some conditions gives rise to different states. According to disjunctivism, this is the rule rather than the exception.

Hence, I think the disjunctivist needs a more direct response. Luckily, that response seems not far to seek. As I noted, disjunctivists do not deny that identical proximal stimulation will (generally and under the other conditions stated in the Proximal Principle) give rise to indiscriminable states. Even if the scientist herself may, inconsistent with disjunctivism, think of such states as of the same kind, this does not seem an essential assumption for her pursuit of explaining how they are formed: Instead of explaining how the same states are formed in the case of perception and mere hallucination, she explains how it is that indiscriminable states are formed. In other words, it seems that the Proximality Principle does little real work; it may well be replaced with a weaker principle.

It must be stressed that the disjunctivist will not object to the idea that at some level, mere sameness of proximal stimulation is sufficient for producing a given kind. It is hard to object to the claim that a perception and an etiologically matching indiscriminable hallucination will be physically identical. There may also be shared states at higher organizational levels. But having learnt its lesson from standard AI, disjunctivists will simply reject the assumption that the mental must supervene on the physical structure of the individual considered in isolation. Instead,
she will hold that the supervenience base of the perceptual state includes a bit of the perceiver’s environment. That claim is already familiar for anyone committed to AI.

Whether disjunctivism is true and the indiscriminable states really are distinct, is of course a further claim. But it does not seem to be a claim that is under the scientific pressure Burge endorses. In fact, it may well be a philosophical question whether the principle is true. As I noted above, the principle has a certain “metaphysical” character. I think this is no accident. In fact, it is very close to a conclusion many philosophers have argued for on the basis of the argument from hallucination: If one takes any state of perception, one can, merely by holding the proximal causes constant, ensure that nothing changes “subjectively”. The conclusion is that, since there are neither physiological nor introspective differences, the states cannot differ in kind either. But whether such arguments establish their conclusion seems a philosophical question, not a scientific one.  

**NOTER**

1. A version of principle B is also found in his (2005:1), and related considerations in his (1986:130–1).
2. B alone does not entail AI, according to Burge, since it does not say anything about non-representational relations between an individual and the environments it veridically represents.
3. The assumption that perceptual states are representational states is a standard one in much contemporary theorizing. Recently, the assumption has received critical attention, in particular from disjunctivists like Campbell (2002) and Travis (2004). I myself am highly skeptical of the claim – my (2012) is an extended argument against it and in particular certain motivations for it – but for the present I will not question it. The issues will return, however, when I discuss Burge’s rejection of strong (disjunctivist) forms of perceptual AI in part 2.2.
4. Clearer (if simplified) versions of the example are given by Farkas (2003:156ff) and Fish (2010:73ff).
6. Now, as I have said, Burge in recent work uses more “general grounds” for believing AI. However, due to their abstract character these grounds are less immediately compelling than the traditional thought experiments.
7. Thus, science should also give grounds for AI for someone who did not accept the philosophical arguments for the position. It is unclear, however, whether this can be a reason for Burge to look at the commitments of science, since he holds that there are already a priori sufficient grounds for AI.
8. In the former article, Burge refers to the formation principles under the name of “biasing” principles.
9. However, Burge is also clear that not all talk of (subconscious, sub-individual) contentful states in the visual system is metaphorical, as some philosophers have claimed – for instance, McDowell.
10. Very interestingly, Burge even thinks that constancies mark the starting point of representation as such – though I will not discuss this claim here.
11. For more about lightness (and in particular, a more *virtually* satisfying presentation of it), see Palmer (1999:97–9 and unpaged plates 3.1–3.4).
12. To say that light intensity is responsible for perceived lightness is a simplification. First, all such psychophysical correspondences between light and perceived color are extremely idealized. Second, it is not light intensity as such that determines lightness but “spectral area”. See Palmer (1999:100).
13. Another simple mechanism is mere adaption in the sensory receptors, but though this clearly plays a role in adjustments to different degrees of overall illumination, it cannot account for much of perceived lightness constancies, for reasons given in Palmer (1999:126).
14. In the following, I use “edge” in the way of Palmer (1999) and Burge (2005); later, Burge distinguishes between “edges” and “contours”, where the latter are proximal, the former distal conditions (2010:352n82).
15. For an illustration of how soft and sharp edges give different impressions, see Burge (2010:354): A soft edge looks like a difference in illumination across a planar, evenly colored surface; a sharp edge looks like a line between two differently colored regions, or a corner. Thus, the look of the figure conforms to the first and second formation principles.
16. It does not seem a live option because it is hard to see how an organism could have its representational states fixed by an environment without undergoing evolution. Perhaps it remains possible to choose the case of artificial perceivers, though.
17. That is, they are essentially veridical if they are representational states at all. Often, though, such views deny that perceptual states are representational.
18. These forms of AI also differ in a more familiar, logical notion of strength. If one takes the weakest form of AI to be one that says nothing about the possibility of environmental adjustment, then standard AI will entail it, but not vice versa. Hence, standard AI is logically stronger. In the same way, disjunctivist AI will entail standard AI, but not vice versa. This is also natural in the sense that the stronger versions are ‘more’ dependent on and sensitive to the environment than the weaker ones. However, there are two complications: First, one may want a different notion of “weak” AI, namely one that not only accepts Burge’s principles A and B but also denies disjunctivism or the possibility of some form of adjustment. But while “weaker” in terms of sensitivity to an environment, these forms need not be *logically* weaker than the views they deny. Second, the two ways I have introduced the notion of strength – in terms of the environment’s being a constituent of experience, and in terms of how one thinks of adjustment to the environment – may conflict.
20. Of course, we have sometimes moved to new environments, but not in a way comparable to the switches in the thought experiments.
21. For some historical discussion of the relation between nativist and empiricist approaches, see (Palmer 1999:47f).
22. As Tomas M. Tobiasson brings to my attention, Burge says some things that strongly suggest that he accepts the possibilities I have sketched: For instance, he discusses the possibility that a frog may for its entire life represent illusory bodies of a certain size in response to certain proximal input because its ancestors lived in an environment where such bodies generally gave rise to such input (cf. 2010:69). This is evidence that Burge in fact only intends a very weak notion of AI – even in the case of human perception. Though it does not affect my main points, this undermines my official agnosticism here and in the following. I became aware of this passage too late to rewrite the text accordingly.
23. One might mention color properties too, but these properties are problematic for the different reason that many philosophers have doubted that color is really to be found in the environment and so that they are anti-individually fixed.
24 To illustrate, the reader might compare with (one familiar way of understanding) Kant’s transcendental idealism: Perhaps there are real things in themselves with no spatial properties but which we nevertheless represent to have them. If this is indeed conceivable – it is certainly not visually imaginable, and it may also not be metaphysically possible – then it should also be conceivable that things in themselves really have spatial properties and that these properties are very different from the ones we represent them as having, but yet give rise to proximal stimulation that our visual system interpret in the familiar way!

25 Here I of course set aside the worry, hinted at in the previous note, that the scenarios themselves might not be metaphysically possible, in which case switching would be trivially impossible too.

26 Here is an attempt at setting up a different (and admittedly rather more fanciful) case: On Twin Earth, some of the things that are called “transparent” are actually covered with (intransparent) screens displaying what is behind them in a way indistinguishable from how they would look if they were really transparent. If AI holds, the Twin Earth word “transparent” does not denote transparency. (Presumably it does not denote a property at all, though perhaps it denotes two distinct properties, like our “jade” denotes two distinct kinds. Note that if instead we were to assume that all “transparent” things were screens of this sort, we would run into the problem of conceiving of air and empty space, thus once again running into problems of conceivability.) Again, it is unclear what we would say to this: perhaps our visual system would represent these things as transparent, and hence misrepresenting the properties of all those screens en masse even long after a switch. If so, only weak AI is true.

27 There is a problem with this kind of argument, though: Most philosophers hold that the content of perception is much sparser than the content of belief. For instance, it is not common to suggest that perceptual states represent natural kinds. Thus, neither water nor twater is represented perceptually.

28 It should be said that many philosophers accept disjunctivism about some forms of belief content as well, in particular in the case of singular beliefs.

29 The clearest expression of this kind of motivation – often referred to as defending a version of “naive realism” – is perhaps found in the writings of Michael Martin, for instance, his (2002). Fish (2010:96ff) gives a good introduction to this kind of motivation.

30 One should note that this strong AI about perception will reasonably hold a more standard AI about belief. Even if your visual state has twater as a constituent, most of your beliefs will initially still concern water. This may seem odd, but that impression is softened when one notes that disjunctivists often hold that perceptual states do not have representational content at all: Our experience merely places the environment in view, and our beliefs are formed in response to it. Thus the “delay” in belief content is just natural.

31 As I note below, there are some affinities between the Proximality Principle and the causal argument from hallucination. Perhaps this can reveal a philosophical motivation for the principle.

32 One might object to the example that moons cannot be represented by the visual system anyway. However, one can easily rephrase the case so as to only involve objects and properties that the system can represent. For instance, one could use the standard case of an oval and a circle seen at an angle.

33 At several points, he claims that ordinary language blurs fundamental psychological kinds. See, for instance, (2010:530–1).

34 I will not rehearse arguments about the role of idealizations in science. This is clearly disputed terrain. I also note an additional reason for thinking that the generalization in psychology will not conform to strict laws: Since, as Palmer puts it, all perceptual knowledge has “essential unity” (1999:442), one might think that (higher) perceptual transformation must obey certain normative constraints which rules out strict law-likeness. Again, however, this is highly disputed territory.

35 Campbell’s form of disjunctivism is set out in his (2002); see in particular chapter 6.

36 An analogy which springs to mind is the claim one sometimes hears that scientific explanation requires causal determinism. So perhaps vision science works under the assumption of the Proximal Principle in the way certain scientists may work under the assumption that the subject matter they study is causally determined. But generally, this assumption does not seem to do much real work. Certainly, a subject matter must exhibit some generality in order for explanation and prediction to be successful. But that’s far removed from determinism. Still, the idea that their subject matter is causally determined might be a useful guiding assumption. Perhaps the Proximity Principle might guide vision science in much the same way: The goal of complete causal explanation expresses itself in an adherence to determinism, the goal of explaining any perceptual state as a result of proximal stimulation expresses itself in a commitment Proximal Principle.

37 Thanks to Conrad Bakda and Tomas M. Tobiassen for detailed comments on previous drafts. I thank Tomas in particular for helpful discussions early and (usually) late, and for his healthy skepticism about most of what I say here (and elsewhere). Of course, the remaining faults are all mine.

LITERATURE


