Decoupling Accuracy from Fitness

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Abstract

Tyler Burge (2010) provided a scathing critique of all programs for naturalizing concepts of representation, especially teleological naturalizing programs. He intended to demonstrate that "representational content" is a concept that cannot be reduced to more fundamental biological or physical ideas. According to him, since the 1970s, the concept of representational content has been firmly established in cognitive psychology as a mature science and utilized in adequate explanations. Since Dretske's program is Burge's primary objective, this paper concentrates on Dretske's perspective. Following Burge's criticisms, I concur that Dretske's naturalizing program trivializes the complex concept of representational content in cognitive science by applying it to bacteria, protozoa, etc. There is a superior explanation, namely Burge's alternative idea of "registering information". I do not believe, however, that this spells the end of naturalization programs. There is no reason to deny that at least some biological functions entail representational capacities with perceptual constancy, if not all. Cases of genuine perception, representing the accurate distal causes of proximal stimuli under various conditions, contribute to fitness. It is not by accident that representational content plays a role in cases of genuine perception. Consequently, I will argue that accuracy and biological fitness cannot be separated.

Keywords: Representational content, Registering of information, Indicator function.

1. Introduction

In this paper, I will accept as given Campbell's "content view" of sensory experience.[1] When I see a yellow ball directly in front of me, I perceive the world in a particular manner, namely as containing a yellow ball now in front of me. My sensory experience is subject to the accuracy or satisfaction conditions (Searle 1983). The appropriate direction of fit is mind-to-world. If there is a yellow orb in front of me, my sensory experience accurately represents the world, i.e., the representational

[1] See Campbell 2002. Versions of the "content view" have become popular since the seminal works of Armstrong in 1961, 1967, and 1997. See also Block 1990, 1996, 2003; Boghossian and Velleman 1989; Brogaard 2010; Burge 1991; Byrne A 2001a, 2001b, 2005, 2009, 2016; Chalmers 2002, 2004, 2006; Dretske 1969, 1988, 1995, 2003; Schellenberg 2010, 2011; Siegel 2004, 2006a, 2006b, 2010a, 2010b, 2014; Tye 1995, 2000, 2009.

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content is accurate. Thus, when I see a yellow ball directly in front of me, the representational content of my sensory experience is accurate only when there is a yellow ball where I am gazing; otherwise, it is inaccurate.

Notably, the label "content view" is an umbrella term covering quite different views on the alleged content of sensory experience (see Chalmers 2004). Yet, my only concern in this paper is with Dretske's teleological naturalizing program on the representational content of sensory experience (perception). In general terms, naturalization is the name of projects that aim to account for experience content in non-semantic, non-mental, and non-normative terms. Teleological naturalizing programs are attempts to explain the content of sensory experience in terms of the standard conditions for the fulfillment of biological functions.[2]

Teleological naturalizing programs face several challenges. My concern is with Burge's (2010) most basic charge: we cannot reduce the content of sensory representations to biological functions (with or without information-theoretical notions). Sensory representations are not reducible to what Burge calls "registering of information". Burge argues that "perceptual constancies" are essential to genuine perceptions. His argument is based on the belief that only perceptual constants can convey objective importance to perception. Without perceptual constancies, we are left with only sensations ("registering of information") with no objective relevance or genuine representation of the external world. Teleological naturalizing programs trivialize the rich notion of representation by letting it sweepingly to bacteria, protozoa, amoebae, etc., i.e., by reducing the rich notion of representation to the mere "registration of information" or sensations. Burge wanted to show that "representation" is a primitive concept that cannot be reduced to more basic biological or physical notions (such as the notions of indicator function or fitness). According to him, the concept of representation has been firmly anchored in psychology as a mature science since the 1970s and has been used for successful explanations. The concept of representation makes no explanatory contribution beyond the concept of the registration of information. Second, there is incommensurability between the accuracy of representations and biological fitness. It would be better if we decoupled accuracy from biological fitness.

Some teleosemanticists, e.g., Neander (2017), bite the bullet here by taking the proximal stimulus as the content without giving up on teleosemantics.[3] In contrast, Shea (2007) holds that the teleosemantic approach to content should be modified but not abandoned.[4] I hold that none of those reactions are promising. Nonetheless, I cannot consider all the quite different teleosemantic programs for the question of space. This would take me far, requiring a book rather than a simple paper. Thus, since Burge (2010) explicitly targets Dretske's teleological naturalizing program, my focus is on Dretske's position.

I argue for the following claims: following Burge, I endorse the general complaint that teleological naturalizing programs trivialize the concept of representation when there is a better explanation available, namely the assumption that primitive organisms are merely reacting to proximal stimulation. Using the same technical term, one blurs key distinctions between psychological and non-psychological

[2] The main exponents are Dretske 1981, 1986, 1988, 1995; Millikan 1984, 1989, 1990, 2007; Papineau 1984, 1998, 2016; Neander 2012.

[3] Although he agrees with Burge on almost all relevant points, Block (2023: 138) doubts that "constancies" are involved in cases of genuine perception.

[4] For a reply to Shea, see Millikan 2007.

explanations. Yet, I do not believe that this means an insurmountable obstacle for Dretske's program (at least when we have genuine perceptions in mind). If not all biological functions involve representational capacities with perceptual constancies, there is no reason to deny that at least some of them do. Cases of genuine perception—the representation of the accurate distal causes of proximal stimuli under different circumstances—play a fitness role. So, accuracy cannot be decoupled from biological fitness, or so I shall argue in this paper.

The paper is conceived as follows: the next section is devoted to presenting Dretske's teleological naturalizing program. In the following section, I address the main charge of trivializing the rich notion of content. The subsequent section is the decisive one. It is devoted to responding to the incommensurability charge. After that, I argue that we can still reduce sensory representations to biological functions when the concept of perception is not trivialized. The subsequent section addresses the methodological charge. In the final section, I make my concluding remarks.

2. Dretske's Naturalizing Program

The source of inspiration for Dretske's teleological naturalizing programs in the philosophy of mind is what Grice calls "natural meaning" (see Grice 1989; Dretske 1986). A particular state of type *T* naturally means a state instance or property instance *G* if there is some relatively reliable counterfactual supporting the relation between instances of *T* and instances of *G* that cause instances of *T*. Dretske took up the idea again when he introduced the technical notion of a flow of information (see Dretske 1981). Roughly, a signal conveys information about the probability of the occurrence of a source when there is a nomic co-variation between the signal and the source in a way that supports the following counterfactual idea: the signal would not occur without the source occurring.[5]

However, nearly everyone agrees that registering information is not enough to account for the concept of sensory representation. The fundamental reason is that information-theoretical accounts do not make room for non-accuracy or error in the critical notions associated with representation. As Dretske claimed, there can only be sensory representation where sensory misrepresentation is possible (see Dretske 1986). He says talking about misinformation in Dretske's sense makes no sense. Failure is not extractable from causal, statistical, or law-like notions that underlie both natural meaning and information-theoretical notions. Abnormality and interference with regular processes are not errors or failures. Representational systems that rely only on natural signals do not constitute genuine sensory representation because they lack the power of misrepresentation.[6]

Here is where the appeal of teleology appears to be attractive. To acquire proper content, a signal that already conveys information about a source must also be selected to indicate the source. Dretske calls this indicator function "systemic" in the case of perception (Dretske 1995: 12-13). Brain states are phylogenetically "selected" with some indicator function in virtue of the fitness of the individual to his environment. For example, suppose that a specific neuronal state in my secondary visual cortex covariates with the presence of red; that is, it

[5] Several contemporary theorists of natural information call Dretske's position into question. See, for instance, Piccinini and Scarantino 2011; Shea, Godfrey-Smith, and Cao 2018; Stegmann 2009.

[6] Skyrms (2010), however, conceives the possibility of misinformation.

provides information about an instance of red. Since the representation of red was of paramount importance for the fitness of my species, the assumption is that the neuronal states that convey this information about the instance of red have been phylogenetically selected to represent that instance of red. That same neuronal state misrepresents the color red when it indicates or conveys information about something else it is not supposed to indicate.

Even so, misrepresentations raise the so-called disjunction problem. A system with a genuine meaning must have more than one stimulus sufficient to cause the token "x". However, a circumstance in which the token "x" can be caused by non-x, say y, forces the crude, causal, and informational theorists to the unacceptable conclusion that "x" means x or y. The disjunction problem is usually illustrated using the bacterium example. The bacterium's only sensory faculty is its "magnetosome", a sensor that reliably determines the magnetic north and whose evolutionary function is to direct the bacterium toward the nearest geomagnetic pole. That enables the bacterium to swim downward, away from the toxic, oxygen-rich surface of the water. The problem is that the bacterium can be "fooled" into coming to the surface by placing a magnet near the water's surface. Is the bacterium now misrepresenting? Not according to Dretske. In this case, we have a breakdown in the average correlations upon which the bacterium's mechanisms depend.

For one thing, even though it is pretty evident that, in this case, something went wrong, "there is no reason to say that it is not performing its function" (Dretske 1986: 157-73). We can only assess the accuracy of perception by considering the creature's natural environment under normal conditions. Frogs in a lab that snap at black dots are not misrepresenting insects because they do not represent anything in the first place and do not represent because they did not evolve in the lab.

However, if for nearly everyone, the notion of carrying information is not enough, for others, it is not even necessary. For one thing, the notion of information carrying requires representation to have a high likelihood of corresponding to its object, at least in normal circumstances, which can, in principle, be quite unreliable, even in normal circumstances.[7] Phenomena counted as representational by naturalists are often unreliable but still fulfill biological functions. This problem has led several naturalists to jettison strictly informational elements and any appeal to reliability by separating informational factors from functional factors.[8]

Let me return to the previous bacterium example. It has a "magnetosome" that responds to magnetic fields. Under certain conditions, moving in response to those magnetic fields leads the bacterium to beneficial areas in the pond because the areas have less oxygen. The function of sensory registration and movement is to enable the bacterium to move toward oxygen-poor locales.

Yet, the bacterium is not causally sensitive to oxygen poverty but rather to magnetic fields (north). Given this, the bacterium's states and movements are more reliably and causally correlated with magnetic forces than oxygen or oxygen poverty (see Millikan 1984). The pressing question is: with or without information-

[7] This is Dretske's position, but it is the view of several contemporary theorists of natural information. Regarding this, see Shea 2007 and Stegmann 2009, among many others.
[8] See Millikan 1984. In this regard, see also Abrams 2005, Nanay 2014, and Hundertmark 2018. I do not take sides in this debate.

theoretical notions, is it reasonable to say that an anaerobic bacterium represents the north? Is it reasonable to claim that the dog's saliva represents food?

3. Trivialization

According to Dretske's teleological naturalization of sensory content, nearly any state can have accuracy conditions. Representation can be applied to the sensitivities of simple organisms (bacteria, amoeba, protozoa, etc.) and sometimes even to plants and non-living artifacts, such as thermostats. Consider this:

> To illustrate the way Mf is supposed to work, consider simple organism with obvious biological needs. […] Some marine bacteria have internal magnets (called magnetosomes) that function like compass needles, aligning themselves (and, as a result, the bacteria) parallel to earth's magnific fields. […] If a bar magnet oriented in the opposite direction to earth's magnific fields is held near these bacteria, they can be lured into a deadly environment […] this appears to be a plausible instance of misrepresentation (Dretske 1986: 26-27).

According to Dretske, the bacterium represents oxygen poverty. But this raises fundamental questions. Are those creatures representing the distal properties of their environment? (That is Burge's charge.) In the same vein, Sterelny (1995: 252) wonders: "When does representation begin?". Is there no difference between "organisms that represent their environment and those that merely react to it" (Sterelny 1995: 252)? To be sure, the bacterium has a "magnetosome" that makes it move toward oxygen-poor locales. Yet, as this response is directed to magnetic fields rather than oxygen-poor locales, does it make sense to state that the bacterium represents oxygen-poor locales?

The bacterium is not directly connected to oxygen poverty but to magnetic fields. But what's the big deal? This is what Dretske used to call a fact about a representation rather than a representational fact. Suppose that we have a simple speedometer mechanism whose function is to represent vehicle speed. However, as the most straightforward device on the market, it represents vehicle speed by registering the rotation of the axle. This simple device is designed to be used in cars equipped with different-sized tires. If I use the instrument in a car with standard tires, I calibrate the dial one way. If you use larger tires, you calibrate them differently. The point is that it does not matter whether the speedometer represents vehicle speed by registering the rotation of the axle or by directly registering the speed of the tires. Dretske claims the speedometer was designed to represent vehicle speed; the fact that it uses the rotation of the axle is a fact about representation rather than representational. Yet Dretske's answer is far from convincing when a simpler account is available.

The critical point is that the rich notion of representational content makes no explanatory contribution over and above information registration. The reasonable view here is to assume that the bacterium only reacts to proximal stimuli, namely the electromagnetic field, using its magnetosome rather than representing oxygen poverty as the distal constant cause of such stimulation. According to Burge,

> In the cases of some sensory states—non-perceptual ones—saying that the states have accuracy conditions would add nothing explanatory to what is known about

> discriminative sensitivity and the biological function of the sensitivity. [...] Accuracy conditions can be imposed. But invoking them gains no empirical traction and yields no empirical illumination. In such cases, there is no reason to believe that there are representational states (Burge 2010: 395).

Let us take stock. Burge claims, first, that non-perceptual sensory states can be explained in non-representational terms, e.g., by appealing to the notion of "registering of information". Second, he argues that the claim that these states are representations does not make any significant explanatory contribution. Since representational ascriptions must play some beneficial explanatory role, the imposing conclusion seems to be that these non-perceptual states are not representations.

4. Incommensurability

It has been claimed that there is incommensurability between intentional properties of cognitive psychology and extensional properties selected biologically. Any association between the accuracy conditions of sensory experience and biological fitness for evolutionary success is a mistake. Biological fitness for evolutionary success has a practical value that benefits the species' survival. In contrast, the accuracy conditions of representations have none. The idea is that psychological explanations employing accuracy conditions have no practical end. To my knowledge, Plantinga was the first to raise this charge, followed by Wagner, Davies, Fodor, and finally Burge.[9] The avoidance mechanism of prey usually illustrates the incommensurability charge between accuracy and fitness in reaction to its predator:

> The biological function contributes to a fit response to the predator, which entails contributing to avoiding predators. *Failure of accuracy need not be a failure to realize any biological function. Interacting successfully concerning a beneficial or detrimental distal condition is not the same as accurately detecting the condition*—attempts to explain failures of representational accuracy as failures in realizing a biological function face this problem. The problem is another aspect of their conflating representational issues with the practical issues that underlie biological functions (Burge 2010: 302; emphasis added).

The leading idea is that the failure of the prey's representation is not a failure of any biological function. Indeed, the empirical fact that the prey often misrepresents the presence of the predator shows that the accuracy of the representational content does not contribute to the prey's biological fitness.

Millikan (1984) addresses this challenge by decoupling accuracy from biological fitness once and for all. Her point is that, in several cases, the misrepresentation of the presence of a predator contributes to biological fitness. For example, the function of the monkey's alarm is not to be reliable, but even so, it protects the prey from predators. That said, the "normal condition" for fulfilling this biological function is the presence of a predator. "Normal" here does not mean "statistically normal".

Millikan's way of getting around the challenge, however, is far from convincing. For one thing, it is not clear that signals and sensory states are representative

[9] See Plantinga 1993, Wagner 1996, Davies 2001, Fodor and Piattelli-Palmarini 2010, and Burge 2010.

in the same way. For example, it is not clear that the vervet monkey's call signaling the presence of the eagle has to do with perceptual constancies as opposed to "registration of information". However, I do not have space to discuss Millikan's position since the paper focuses on Dretske's position, which is the only one that Burge explicitly targets.[10]

5. Genuine Perceptions

But now we come to the critical questions of the paper: What about the genuine perceptual contents that represent the exact distal cause under different proximal stimuli (perceptual constancy)? Is it true that accuracy failure need not be a failure to realize any biological function? Is there any future for Dretske's teleological naturalizing program? Can we not account for genuine perceptual contents in terms of biological functions?

One may wonder why predators' accuracy of perception contributes to the biological fitness of the organism to its environment. Our first assumption is that perceptual constants are capacities to track given environmental attributes under different environmental conditions that yield very different types of proximal stimulation. In that case, this is what we have in the case of predators. Predators need to sensibly represent their prey by tracking them down using objectification. The question is what their representational states are for. The only reasonable answer is this: through natural selection, complex sensory states are formed through objectification, with the non-basic function not of indicating proximal stimulation but rather of tracking the distal causes of stimulation (the prey). In those cases, there is a match between the accuracy and the fulfillment of a biological function. Hardly any hunt would be successful if the predator did not accurately or veridically represent its prey.

Suppose a tiger is after a deer. He spots the deer from a distance and determines her exact location relative to his. He then begins his approaching behavior by creeping into the woods, and as he moves, he tracks the deer's every movement. Note that the tiger is not merely reacting to proximal stimulation (Burge calls it "registering information"). Instead, all perceptual constants are involved in this case: the prey's size regardless of distance, the prey's color regardless of light, etc. For sure, the tiger, as a solitary hunter, only succeeds once every five attempts to catch the deer. By contrast, a wildcat (*Felis nigripes*) kills between 10 and 14 prey (usually rodents or small birds) at an average of one kill every 50 minutes. Even more interesting is that he has an astonishing 60% success rate in his attacks against his prey. Yet, the question is: Even if the tiger's success is relatively low when compared to other cats, would the tiger succeed in his hunt if he were not accurately representing the deer as a distal cause of his proximal stimuli? Is the tiger's fitness for his environment independent of veridically representing his prey as a distal cause of his proximal stimuli? Finally, do the accuracy conditions of perception add no practical value, in this case, to the tiger's fitness? I believe that case speaks for itself. We cannot decouple accuracy from biological fitness.

Given this, there is no obstacle to reducing the predator's sensory representation to biological functions (with or without information-theoretical notions). Genuine perception is not a primitive notion, as Burge claims, but one that can

[10] I would like to thank an anonymous reviewer for drawing my attention to this point.

be accounted for in terms of biological functions and fitness. First, it is fair enough to say that tigers sensibly represent their prey because they have evolved a biological mechanism to track prey. Second, when the tiger gets older and gradually loses his natural ability to represent accurately, he becomes an unsuccessful predator and dies. However, this only happens after his reproductive function has ceased. In this case, the accuracy of the predator's sensory representation has undeniable practical value.

To be sure, Dretske's claim is counterintuitive: the bacterium does not represent oxygen-poor environments. But what about the prey? Does it represent its predator? That depends on different kinds of predators, different ways these predators can approach, etc.[11] When we consider the deer or the Thompson gazelle, perhaps the most plausible hypothesis is to claim that they are reacting to proximal stimulation before they see and represent the leopard. But why is it so? They do not have the same time to flee from their predator. They have to react as fast as possible to proximal stimuli to increase strength and their ability to avoid predators.

Be that as it may, it is counterintuitive to claim (i) that the tiger is not representing its prey (the deer) or that the eagle is not representing the vervet monkeys with accuracy conditions, and (ii) that the accuracy of the tiger's perception of the deer (or of the eagle's perception of the monkeys) adds no practical value to the tiger's (or the eagle's) fitness. Thus, to circumvent the second objection, we all need to recognize that not all biological functions of organisms involve representations; in several cases, the fitness of organisms to the environment depends much more narrowly on reactions to proximal stimulation. To be sure, simple creatures such as bacteria, protozoa, etc. do not represent. In all those cases, the concept of representation is idle. However, that does not mean some biological functions do not involve representation. All we need is to introduce a new function.

In contrast, the sensory states of complex creatures possess two different indicator functions. In several cases, their sensory states have acquired the simple function of indicating proximal stimulation: sensitivity to the environment, sensory discrimination, or registration of information, just like simple creatures such as bacteria, amoeba, protozoa, etc. A plausible conjecture is that complex organisms have inherited that simple indicator function phylogenetically from their ancestors. Yet, more complex organisms have a more complex indicator function, indicating or tracking down the distal cause of their proximal stimulation. However, this indicator function relies on what cognitive psychologists have called the subliminal process of "objectification", that is, the transformation of information carried by proximal stimulation into a perceptual state that genuinely represents the world, beyond the individual's local, idiosyncratic, or subjective features (see Burge 2010: 397).

Nobody doubts that, through sight, creatures of the most different species represent the distal causes of their proximal stimulation. The fundamental question that arises is: Why do creatures that evolved in the presence of light have eyes while creatures that evolved in the abyssal regions of the oceans, in the absence of light, are devoid of eyes? If the visual representation of distal causes has no adaptive role in the species' fitness, how can we explain the origin of vision?

[11] See Cheney and Seyfarth 1988. I am grateful to one of my anonymous reviewers for reminding me of the original contribution of Cheney and Seyfarth.

Likewise, why do predators that evolved in oceans (sharks, whales, and dolphins) possess the ability to represent their prey by disturbances of magnetic fields, while terrestrial predators have evolved without such representational capacity? By all reasonable accounts, the ability of predators to veridically represent their prey has a biological function.

6. The Methodological Charge

Teleological naturalizing programs also raise a methodological charge. According to critics, naturalizing projects are driven by misconceptions about the relationship between philosophy and science (Burge 2010: 296). It is a mistake to assume that sensory representation is not a scientifically respected notion. Hence, it can only be made respectable by reducing it to some scientifically respectable notion, such as biological function (with or without information-theoretical notions). Since the 1970s, the notion of sensory representation has been entrenched in psychology as a mature science. It has been employed in successful explanations. There is nothing unnatural or supernatural about such psychological explanations.

There are successful reductions in the domain of mature science itself. For all we know, heat is molecular motion, water is H_2O, etc. Yet, the bottom line is that it is not up to metaphysicians to propose any reduction, but only to natural science itself. The philosopher should only determine the place of representational states in the broader natural order by finding systematic connections in which they are involved. Progress can only be achieved by clarifying employed notions and exploring and connecting representations with the broader natural order (see Burge 2010: 298).

It is important to note that there is no consensus within cognitive psychology on the use of the concept of representation. While figures like Marr, focusing on vision, consider representation a fundamental and indispensable concept, ecological psychologists such as Gibson and her followers reject the "content view" altogether. According to the latter perspective, perception is not about representation but about direct interaction with objects that elicit sensory stimulation. These objects are regarded as "affordances" for potential actions. Nevertheless, as expected, Burge dismisses such non-content approaches as "non-mainstream", deeming the likelihood of completely dispensing with representational contents in the psychology of perception as remote (Burge 2010: 110, fn. 53). However, let us assume, for the sake of argument, that the concept of representation is indeed fundamental to cognitive psychology as a mature science. The questions that then arise are as follows: Does the mere fact that perceptual psychology uses this concept as a primitive concept offer a conclusive argument against the philosophical discourse on the nature of representation? Does a reductionist stance commit a methodological error by denying the primitive status of representation?

On reflection, we must distinguish at least reductionism from eliminativism. The first just aims to explain the notion of representation in terms of biological functions, motivated by different reasons, as we shall see below. The second aims to eliminate or replace the notion of representation with the notion of biological function. Burge's criticism targets reductionism. In his own words:

> Notions like representation earn their keep in science [...] by figuring in successful explanations. The successful explanation is marked in the usual ways by yielding

> agreement, opening new questions, making questions testable and precise, and engendering progressive improvement in theory and experimentation. Mainstream work in perceptual psychology displays these features. [...] One could hardly have a better epistemic ground to rely on a notion than that it figures centrally in a successful science (Burge 2010: 298).

Burge is tacitly assuming here Quine's famous criterion on what there is, namely the so-called "bound variables of our successful global scientific theory". Suppose psychology, as a mature science, takes the notion of representation as primitive. In that case, claiming that we can eliminate "representations" in favor of more fundamental notions makes little sense. After all, as Burge argues, we cannot have a better reason to rely on a notion than that it figures centrally in a successful mature science such as cognitive psychology. Since our successful psychological explanations posit representational states to explain intentional behavior, eliminating representation is out of the question. But is it elimination that teleosemantics has in mind? According to Papineau:

> In defense of this biologically reductionist view, it can be observed that teleosemantics aims to offer an *explicit account* of representational properties by appealing to a notion of function that is used in biological theorizing. On the other hand, it is unclear whether the facts to which teleosemanticists reduce representational properties *should qualify as biological facts*, given that they standardly involve cognitive mechanisms that would normally be *counted as in psychology rather than biology*. In the end, we do not think that much hangs on whether we think of teleosemantics as a type of reduction to biological properties. *The more important point is that teleosemantics offers a naturalistically acceptable explanation of representation, whether or not we also count this as a biological reduction* (Macdonald and Papineau 2006: 3; emphasis added).

Papineau did not doubt that teleosemantics aims not to qualify psychological facts as biological facts (elimination of psychological facts) but to provide an explanation. When an explanatory reduction is in question, the idea of "primitiveness" is relative to a scientific domain or the level of explanation. For psychological purposes, the notion of representation is "primitive" because psychologists do not have to care about its underlying nature. The psychologist's only concern is explaining cognitive mechanisms and intentional animal behavior. But this is not an obstacle to looking for a further account for "representation" at another level of explanation, the metaphysical. In this case, what is at stake is not the psychological explanation of intentional behavior but rather the very nature of the notion of "mental representation". Let me explain by way of analogy. In physics, "time" is taken as a primitive notion. No one cares to explain the very nature of time. Once, I asked a professor of physics about the nature of time, and he answered: "Oh, my friend, I can only tell you that at this university, we have one of the most precise instruments to measure time. I leave the answer for you, philosophers".

Let me formulate my methodological point of view as follows. In the context of the program of teleosemantics, it is important to clarify that the methodological issue does not revolve around ontological reductionism, wherein one scientific domain or type of entity is reduced to another perceived as more fundamental. Historically, ontological reductionism has been a guiding principle in empiricist traditions. Instead, the central methodological concern is with the continuity between the metaphysical underpinnings of sensory experience and the realm of

cognitive science, a point that Burge himself repeatedly emphasizes. Just as the metaphysical exploration of sensory experience cannot disregard the accomplishments of cognitive science, cognitive science must be receptive to philosophical perspectives on representational content and related matters. Consequently, irrespective of whether the concept of "representation" is primitive to the well-known explanatory aims of psychology as a mature science, there is no inherent methodological impediment to engaging in a philosophical inquiry into the underlying nature of representation in metaphysics and endeavoring to elucidate it within the framework of biological concepts such as biological functions.[12]

7. Conclusion

In the nineties of the last century, Dretske carried out an ambitious program of naturalizing the mind by appealing to indicator function and information-theoretical notions, specifically of naturalizing sensory representation. This is nothing but brain states recruited by natural selection to indicate the presence of specific properties (with which the brain states covariate). Burge harshly criticized Dretske's teleological naturalizing program for trivializing the concept of representation and overlooking that psychology is primitive. Indeed, according to the original proposal, we have to assume that bacteria, protozoa, ameba, etc. represent distal properties of their environment. But Burge's criticism goes deeper than this. He also claimed that we could decouple the accuracy conditions of sensory representation from biological fitness.

First, I have conceded that Dretske's teleological naturalizing program entails a trivialization of the rich psychological concept of representation. Indeed, sensory representations cannot be reduced to "registering information", discriminations, and so on. Perceptions represent distal causes rather than discriminating proximal stimuli.

Yet, I have also argued that this does not mean an insurmountable obstacle for Dretske's teleological naturalizing program. To be sure, not all biological functions of organisms involve representations. Some of them only involve what Burge calls registering of information. Through evolution, simple creatures have acquired the function of indicating proximal stimulation. The same is valid for some (but not all) prey: to increase their strength and ability to avoid predators, they have acquired the function of reacting to proximal stimuli. In all those cases, the concept of representation is idle. Still, that does not rule out the highly plausible hypothesis that at least some quite complex biological functions involve representations. All we need is to introduce a new complex indicator function at the very level of sensibility.

Given this, what matters are not the cases where the concept of sensory representations is trivialized but the cases in which we can speak of genuine representations. The example we chose is that of predators chasing their prey. In those cases, there are no obstacles to the explanatory reduction. The sensory capacities of the predator have not acquired through evolution the function of indicating proximal stimulation. Instead, they have acquired the function of detecting the distal causes of proximal stimulation, that is, of tracking prey. In those cases, there is a match between the accuracy and fulfillment of a complex biological function.

[12] I would like to thank an anonymous reviewer for drawing my attention here. She or he saw more clearly than I did what I was trying to say in this section.

References

Abrams, M. 2005, "Teleosemantics Without Natural Selection", *Biology and Philosophy*, 20, 1, 97-116.

Armstrong, D.M. 1961, *Perception and the Physical World*, London: Routledge and Kegan Paul.

Armstrong, D.M. 1967, *A Materialist Theory of Mind*, London: Routledge and Kegan Paul.

Armstrong, D.M. 1997, *A World of States of Affairs*, Cambridge: Cambridge University Press.

Block, N. 1990, "Inverted Earth", *Philosophical Perspectives*, 4, 53-79.

Block, N. 1996, "Mental Paint and Mental Latex", in Villanueva, E. (ed.), *Philosophical Issues*, 7, Atascadero: Ridgeview, 19-49.

Block, N. 2003, "Mental Paint", in Hahn, M. and Ramberg, B. (eds.), *Reflections and Replies: 10 Essays with Responses from Tyler Burge*, Cambridge, MA: MIT Press, 165-200.

Block, N. 2023, *The Border Between Seeing and Thinking*, New York: Oxford University Press.

Boghossian, P. and Velleman, J.D. 1989, "Color as a Secondary Quality," *Mind*, xcviii, 389, 81-103.

Brogaard, B. 2010, "Strong Representationalism and Centered Content", *Philosophical Studies*, 151, 3, 373-92.

Burge, T. 1991, "Vision and Intentional Content", in Lepore, E. and Van Gulick, R. (eds.), *John Searle and his Critics*, Oxford: Blackwell, 195-214.

Burge, T. 2010, *Origins of Objectivity*, Oxford: Oxford University Press.

Byrne, A. 2001a, "Intentionalism Defended", *Philosophical Review* 110, 2, 199-240.

Byrne, A. 2001b, "Do Colors Look Like Dispositions? Reply to Langsam and Others", *Philosophical Quarterly*, 51, 203, 238-45.

Byrne, A. 2005, "Perception and Conceptual Content", in Sosa, E. and Steup, M. (eds.), *Contemporary Debates in Epistemology*, Oxford: Blackwell, 231-50.

Byrne, A. 2009, "Experience and Content", *Philosophical Quarterly*, 59, 236, 429-51.

Byrne, A. 2016, "The Epistemic Significance of Experience", *Philosophical Studies*, 173, 4, 947-67.

Campbell, J. 2002, *Reference and Consciousness*, Oxford: Oxford University Press.

Chalmers, D.J. 2002, "The Components of Content", in Chalmers, D.J. (ed.), *Philosophy of Mind: Classical and Contemporary Readings*, Oxford: Oxford University Press, 608-33.

Chalmers, D.J. 2004, "The Representational Character of Experience", in Leiter, B. (ed.), *The Future for Philosophy*, Oxford: Oxford University Press, 153-81.

Chalmers, D.J. 2006, "Perception and the Fall from Eden", in Gendler Szabo, T. and Hawthorne, J. (eds.), *Perceptual Experience*, Oxford: Oxford University Press, 49-125.

Cheney, D. and Seyfarth, R. 1988, "Another "Just So" Story: How the Leopardguaders Spot", *Behavioral and Brain Sciences*, 11, 3, 506-507.

Davies, P.S. 2001, "The Excesses of Teleosemantics", *Canadian Journal of Philosophy*, 31, 117-37.

Dretske, F. 1969, *Seeing and Knowing*, London: Routledge.

Dretske, F. 1981, *Knowledge and the Flow of Information*, Cambridge, MA: MIT Press.

Dretske, F. 1986, "Misrepresentation", in Bogdan, R. (ed.), *Belief: Form, Content, and Function*, Oxford: Oxford University Press, 17-36.

Dretske, F. 1988, *Explaining Behaviour: Reasons in a World of Causes*, Cambridge, MA: MIT Press.

Dretske, F. 1995, *Naturalizing the Mind*, Cambridge, MA: MIT Press.

Dretske, F. 2003, "Experience as Representation", *Philosophical Issues*, 13, 1, 67-82.

Fodor, J. and Piattelli-Palmarini, M. 2010, *What Darwin Got Wrong*, London: Picador.

Grice, H. 1989, *Studies in the Way of Words*, Cambridge, MA: Harvard University Press.

Hundertmark, F. 2018, *Mind and Function – Teleosemantics Beyond Selected Effects*, Dissertation, Universität Bielefeld.

Macdonald, G. and Papineau, D. (eds.) 2006, *Teleosemantics: New Philosophical Essays,* Oxford: Clarendon Press.

Millikan, R.G. 1984, *Language, Thought and Other Biological Categories*, Cambridge, MA: MIT Press.

Millikan, R.G. 1989, "In Defense of Proper Functions", *Philosophy of Science*, 56, 2, 288-302.

Millikan, R.G. 1990, "Compare and Contrast Dretske, Fodor, and Millikan on Teleosemantics", *Philosophical Topics*, 18, 2, 151-61.

Millikan, R.G. 2007, "An Input Condition for Teleosemantics? Reply to Shea (and Godfrey-Smith)", *Philosophy and Phenomenological Research*, 75, 2, 436-55.

Nanay, B. 2014, "Teleosemantics Without Etiology", *Philosophy of Science*, 81, 5, 798-810.

Neander, K. 2012, "Toward an Informational Teleosemantics", in Ryder, D., Kingsbury, J., and Williford, K. (eds.), *Millikan and Her Critics*, New York: Wiley, 21-40.

Neander, K. 2017, *A Mark of the Mental: A Defence of Informational Teleosemantics*, Cambridge, MA: MIT Press.

Papineau, D. 1984, "Representation and Explanation", *Philosophy of Science*, 51, 4, 550-72.

Papineau, D. 1998, "Teleosemantics and Indeterminacy", *Australasian Journal of Philosophy*, 76, 1, 1-14.

Papineau, D. 2016, "Teleosemantics", in Smith, D.L. (ed.), *How Biology Shapes Philosophy: New Foundations for Naturalism*, Cambridge: Cambridge University Press, 95-120.

Piccinini, G. and Scarantino, A. 2011, "Information Processing, Computation, and Cognition", *Journal of Biological Physics*, 37, 1, 1-38.

Schellenberg, S. 2010, "The Particularity and Phenomenology of Visual Perception", *Philosophical Studies*, 149, 1, 19-48.

Schellenberg, S. 2011, "Perceptual Content Defended", *Noús*, 45, 4, 714-50.

Searle, J. 1983, *Intentionality: An Essay in the Philosophy of Mind*, Cambridge: Cambridge University Press.

Shea, N. 2007, "Consumers Need Information: Supplementing Teleosemantics with an Input Condition", *Philosophy and Phenomenological Research*, 75, 2, 404-35.

Shea, N., Godfrey-Smith, P., and Cao, R. 2018, "Content in Simple Signalling Systems", *British Journal for the Philosophy of Science*, 69, 4, 1009-1035.

Siegel, S. 2004, "Indiscriminability and the Phenomenal", *Philosophical Studies*, 120, 90-112.

Siegel, S. 2006a, "Which Properties are Represented in Perception?", in Gendler Szabo, T. and Hawthorne (eds.), *Perceptual Experience*, Oxford: Oxford University Press, 481-503.

Siegel, S. 2006b, "Subject and Object in the Contents of Visual Experience", *Philosophical Review*, 115, 3, 355-88.

Siegel, S. 2010a, "Do Experiences Have Contents?" in Nanay, B. (ed.), *Perceiving the World*, New York: Oxford University Press, 333-68.

Siegel, S. 2010b, *The Contents of Visual Experience*, New York: Oxford University Press.

Siegel, S. 2014, "Affordances and the Contents of Perception", in Brogaard, B. (ed.), *Does Perception Have Content?* Oxford: Oxford University Press, 39-76.

Skyrms, B. 2010, *Signals: Evolution, Learning, and Information*, Oxford: Oxford University Press.

Stegmann, U.E. 2009, "A Consumer-Based Teleosemantics for Animal Signals", *Philosophy of Science*, 76, 5, 864-75.

Sterelny, K. 1995, "Basic Minds", *Philosophical Perspectives*, 9, 251-70.

Tye, M. 1995, *Ten Problems of Consciousness: A Representational Theory of the Phenomenal Mind*, Cambridge, MA: MIT Press.

Tye, M. 2000, *Consciousness, Color, and Content*, Cambridge, MA: MIT Press.

Tye, M. 2009, *Consciousness Revisited: Materialism Without Phenomenal Concepts*, Cambridge, MA: MIT Press.

Wagner, S.J. 1996, "Teleosemantics and the Troubles of Naturalism", *Philosophical Studies*, 82, 1, 81-110.