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THE RADICAL ENACTIVIST AND ECOLOGICAL ENTERPRISE OF GETTING RID OF (OR TAMING) PERCEPTUAL ILLUSIONS

La empresa enactivista radical y ecológica de deshacerse de las ilusiones perceptuales (o domarlas)

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Abstract

Some anti-representational approaches to cognition have become increasingly popular, and many of their proponents see them as promising a new paradigm for cognitive science. In this paper, I focus on two of those approaches to argue that they do not contain a proper explanation of perceptual illusions—and that perhaps they cannot provide it. My claim will be that, without an adequate treatment of such a common perceptual phenomenon, they can hardly be seen as part of a new paradigm. I begin by describing the context in which these approaches arose and developed, while in the second part I present three treatments of perceptual illusions coming from the approaches at issue. The third part makes a detour about the notion of perceptual illusion, as the assessment of these explanations of illusions seems to require it. Then, the fourth part is devoted to evaluating these explanations of illusions, discussing the introduction of normative language, appeal to notions as "situation-dependent" property, and whether a proposed definition of illusion fits our current comprehension of them, as well as the rejection of inferences from unfitting behavior that seem abductively legitimate. There I argue that those accounts of perceptual illusions fail to achieve their aim.

Key words: Perceptual Illusions; Anti-Representationalism; Radical Enactivism; Ecological Approach.

Resumen

Algunos enfoques antirrepresentacionalistas sobre la cognición se han hecho cada vez más populares, y muchos de sus defensores los consideran prometedores de un nuevo paradigma para la ciencia cognitiva. En este manuscrito, me centro en dos de esos enfoques para argumentar que no contienen una explicación adecuada de las ilusiones perceptuales, y que quizá no puedan proporcionarla. Sostendré que, sin un tratamiento adecuado de un fenómeno perceptual tan común, difícilmente pueden considerarse parte de un nuevo paradigma. Empiezo describiendo el contexto en el que surgieron y se han desarrollado estos

enfoques, mientras que en la segunda parte presento tres tratamientos de las ilusiones perceptuales procedentes de los enfoques en cuestión. La tercera parte hace una digresión sobre la noción de ilusión perceptual, ya que la evaluación de estas explicaciones de las ilusiones parece requerirlo. A continuación, la cuarta parte se dedica a evaluar estas explicaciones de las ilusiones, discutiendo la introducción de lenguaje normativo, la apelación a nociones como propiedad "dependiente de la situación", y si una definición propuesta de ilusión se ajusta a nuestra comprensión actual de estas, así como el rechazo de inferencias que parecen abductivamente legítimas a partir de conductas no apropiadas. Allí sostengo que esas explicaciones de las ilusiones perceptuales no logran su objetivo.

Palabras clave: Ilusiones perceptuales; Antirrepresentacionalismo; Enactivismo Radical; Enfoque Ecológico.

1. Introduction

Over the past two decades, some anti-representational approaches have become increasingly popular views of cognition—after years of preeminence of representational cognitivism. Some of their advocates claim that those approaches announce a new paradigm for cognitive science and that it is time to abandon representational cognitivism (Stewart et al., 2010). In this paper, I focus on two recent and influential nonrepresentational accounts to argue that they do not contain a proper explanation of the kind of perceptual experience usually called perceptual illusions. Moreover, I cast doubt on the possibility of those particular views to account for such perceptual experiences. My conclusion will be that if they are unable to account for this part of perceptual experience, their chances of becoming part of a new theoretical paradigm are dim, at best.

I begin by describing the context in which those two anti-representational approaches are located, as well as the main arguments of those views against representationalism. Doing justice to this aim requires beginning with a few words on cognitivism and anti-representationalism.

The second part largely builds on the first to present a couple of ways in which those two views could deal with perceptual illusions. It is worth noting that, despite being considered a major challenge to those views, anti-representationalist treatments of perceptual illusions are rare. Although explicit treatments can be found in the two views discussed, they are quite sparse. Thus, even though there is not much to draw from, it is necessary to do the best with what is at hand. Remarkably, those ways of dealing with illusions are rather different from each other in terms of their aims and method.

One reason why anti-representationalist views rarely deal with perceptual illusions is that they consider the notion to be theoretically

loaded, tipping the scale in favor of representationalism (Favela & Chemero, 2016, p. 71). Together with the fact that the explanations of illusions from the two views discussed seem to aim at different targets, this makes it necessary to address the very notion of perceptual illusion. Assessing both explanations of illusions and whether the notion of an illusion belongs to the representational framework, no doubt requires pinpointing the notion's content and adherences. In the third section, I will cast doubt on the claim that the notion of perceptual illusion is infiltrated by representationalism.

Then, I proceed to evaluate those two accounts of illusions by carefully dissecting each of their parts. In that section, I discuss the possibility of their introducing normative language, the need for such language in dealing with what is usually called illusion, and the explanatory character of non-normative accounts, as well as topics like ecological validity. I also discuss issues concerning a proposed definition of illusion and abductive reasons going against the anti-representationalist treatment.

Rather than a defence of representationalism, what I intend to show is that crucial pieces are missing in those two anti-representationalist accounts of perception/cognition, without which it cannot even be said that they are part of a clear *prospect* of a change of paradigm (let alone a new paradigm). Representationalism is used as a point of contrast allowing to enhance the seriousness of these gaps in the anti-representationalist explanations at issue. Thus, I conclude that those two views lack an adequate account of a common perceptual phenomenon. Even more, I suggest that it is unclear whether they are in principle able to provide such an explanation—it might be that their conceptual tools prevent them from doing so and from ever becoming part of a new paradigm in cognitive science.

2. Enactivism

During the second half of the twentieth century, cognitivism became the privileged explanation of mentality and cognition (Bechtel, 2013). The representational theory of mind was the backbone of cognitive psychology: behavior was driven by inner processes that involved elements coding, among other things, information about the environment (Pitt, 2022). Cognitivism also proved fruitful in the study of perception. It provided a straightforward account of illusions, namely as some kind of error in the development of perceptual representation.

However, there is a family of views endorsing the thesis that representations are not required to explain cognition (in a broad sense that includes perception). There is a multitude of versions of this claim, which

differ in what is supposed to be explained, the kind of explanans that is rejected, and the implications of such a rejection. This multitude includes traditions as diverse as phenomenology (Merleau-Ponty, 1945), pragmatism (Dewey, 1896, 1930; Rorty, 1979), behaviorism (Skinner, 1938), ecological psychology, and eliminative materialism. Merleau-Ponty, for example, points out that the notion of body representation misconstrues the way we experience our body (1945, p. 108). Rorty criticizes representationalism's background assumption that knowledge is the mirroring of a mind-external world, while Dewey rejects the division between an inner, subjective representation and an outer, represented object. For their part, it is well known that behaviorists rejected the postulation of inner, subjective items that were effects of external stimuli and cause of behavior.[1]

Inspired by some of these traditions, in recent years several influential antirepresentational approaches have emerged that are sometimes grouped under the label "enactivism". Ward et al. (2017) have distinguished three distinct forms of enactivism in circulation: autopoietic, sensorimotor, and radical. Autopoietic enactivists consider that any living system has cognition (Di Paolo, 2005; Varela et al., 1991). At its most basic, they claim, cognition comes from the organism being autopoietic, that is, a closed, autonomous system able to maintain itself and reproduce (Maturana & Varela, 1980). Drawing from phenomenology, autopoietic enactivism challenges the realist assumptions of representationalism (the idea of a pre-given reality to which the organism has access, to which autopoietic enactivism opposes the thesis that the organism and the environment are co-constituted). Sensorimotor enactivism (Noë, 2004; O'Regan & Noë, 2001) aims to explain the intentionality and phenomenology of perception. According to this view, perception requires implicit knowledge of the systematic relationships between sensation and bodily activity ("sensorimotor contingencies"). We will now focus on the third form of enactivism distinguished by Ward et al. (2017), considering their main anti-representationalist arguments. Next, we will present another recent anti-representationalist approach, inspired by ecological psychology.

[1] There is also relationalism, though it is a view limited to perception rather than cognition (Brewer, 2013; Soteriou, 2000; Travis, 2004). Very roughly, according to this view, perception is a relation between the subject and the perceived object, so that perceived objects are constituents of our perceptual states rather than their contents—as a consequence, perceptual states are not representations. These theorists have advanced complex (though controversial) approaches to perceptual illusions. Given the goal of this paper, I will leave them for another time.

2.1. Radical enactivism

Radical enactivism resembles sensorimotor enactivism in that it does not adopt the theses from phenomenology nor the views on the biology of autopoietic enactivism (hence, for instance, they do not problematize any realist assumptions). Rather, it commits to the broad project of rejecting representationalist explanations and favoring non-representational explanations of cognition (Hutto & Myin, 2013, 2017). To achieve its negative goal, radical enactivism has challenged key notions on which the representational view is based. As for their positive goal, it mostly consists in construing cognitive processes in non-representational terms.

2.1.1. The hard problem of content

A well-known objection Hutto and Myin (2013, pp. 57-82) have presented against representationalism is what they call "the hard problem of content" (HPC). As they note, subsuming mental content as a case of informational covariance allows for a naturalizable explanation, since covariance is an extensional relation. Nonetheless, mental content is supposed to essentially involve notions such as truth, accuracy, reference, and implication. Those are intensional notions that cannot be accounted for as informational covariance. Therefore, the notion of mental content seems to meet incompatible demands: it is supposed to be naturalizable and substantially include intensional notions.

Hutto and Myin (2013, pp. 75-82) highlight that the problem is no less serious for views in which mental content arises within the organism's cognitive system instead of from information picked up in the environment. Teleological explanations maintain that the reason some internal states represent the environment is that they have the *function* of so doing, adding that mental content arises from responding to certain features of the environment. However, Hutto and Myin point out that teleological explanations are extensional and thus vulnerable to the HPC.

However, Miłkowski (2015) has observed that the HPC derives from a limited understanding of the teleosemantic notion of function. In teleological theories, mental content arises from reliable processes that are supposed to indicate the presence of some features to guide behavior (i.e., functions). However, the operation of those functions is not nomological—they are fallible (just reliable enough). Thus, it might happen either that the content-producing subsystem behaves as if the feature it is supposed to track was present, or the content-using subsystem behaves as if the content-producer was indicating the presence of such feature. Malfunction

in this context is cognitive error, notion kindred to intensional ones and allowing for them, while the above description of error is compatible with naturalism.[2]

Finally, it is worth noting that the idea that content is determined by the described function of indication is acknowledged by Hutto and Myin (2013, pp. 69-70) as a possible way out of the HPC for the teleological theorist of mental content, although they think that it requires more clarity. (For a reply to Miłkowski, see Hutto & Myin, 2017).

2.2. "Ecological enactivism"

Chemero (2009, 2016) has also questioned key representational notions in developing an antirepresentational view, extending those criticisms even to notions belonging to forms of enactivism (as in Chemero's 2016 criticism of the notion of sensemaking used in autopoietic enactivism: according to him, there are forms of enactivism allowing for representational claims that they are supposed to purge). Unlike autopoietic, radical or sensorimotor enactivists, Chemero (2009) tries to combine ecological psychology and dynamic systems theory to build an account of cognitive phenomena—whereby his view is not influenced by phenomenology either.

2.2.1. Disarming the cognitivist "epistemological claim"

In contrast to Hutto and Myin, Chemero (2009) thinks that it is the claim that representational explanations are necessary to explain cognition that must constitute the target of antirepresentational views. He is therefore committed to provide a non-representational account of the kind of phenomena that are usually alleged to require representational explanations, for instance, "representation-hungry" cognitive tasks (Clark, 1998; Chemero, 2009, pp. 38-43). A central tool of Chemero's radical enactivism is Dynamic Systems Theory (DST). The only issue he sees in the DST approach is an *ex-post facto* character preventing it from predicting empirical results (Chemero, 2009, p. 78-83). Thus, he proposes to supplement such an approach with Gibsonian ecological psychology.

In the ecological psychology framework, perception is direct awareness of things not requiring representations and intrinsically relevant for action, so that the information required for the guidance of

[2] Let us not forget that advocates of teleological theories have long insisted that their notion of biological function allows for the kind of normative claims (including those about satisfaction conditions and the like) required by the notion of mental content.

action is available in the environment (Chemero, 2009, Chapter 6; Gibson, 1979). To understand what an animal perceives, one needs to look at the structure of the environmental information, in particular the opportunities for action, that such a structure specifies (the affordances).

In Chemero's (2009, Chapter 7) view (let us call it 'ecological enactivism', for lack of a better term), such a framework points to the need for a theory of information allowing non-specifying variables to carry information: one situation carries information about another if there is a connection between situation types reliable enough to guide behavior. As to affordance perception, his claim is that it is better understood as the placing of features—affordances being relations (between abilities of the animal and features of the environment) arising in situations that comprise animals and features and supporting/demanding a certain kind of action.

Whether or not Chemero's argument that representation-hungry cognitive tasks can be accounted for without representations is satisfactory, he must deal with another major objection against anti-representationalist views. This objection focuses on certain perceptual experiences, customarily called "perceptual illusions," and contends that those views are unable to fully account for them (let us call it "the objection from illusion"). This is the objection I want to concentrate on, since it might be more trenchant. If 'ecological' or radical enactivism work, they should certainly work in a less cognitively demanding domain as perception. In order to address the objection, I will begin presenting three accounts of those experiences—two from 'ecological enactivism' and another one from radical enactivism. The first is Chemero's (2009) defense of the idea that perception can be direct and mistaken. The second is Favela and Chemero's (2016) argument that perceptual illusions are to be dealt with as normal cases of visual perception. Finally, the third is Hutto and Myin's (2013, 2017) claim that the concept of a perceptual illusion might be empty in that it supposes a conflict between high-level contents of the same kind. Then, I will make an unavoidable detour on illusions—how they are (and have been) understood, what kind of experience falls under the concept, and their bearing for perception theory—to subsequently assess the adequacy of those three accounts.

3. Three Anti-Representationalist Explanations of Illusions

Before getting down to business, two caveats are in order. First, the previous section must be kept in mind as the background in which those explanations of illusions are built. Along with the very explanatory goal, such

a background constrains the accounts in terms of commitments and scope. Second, as noted in the introduction, anti-representationalist treatments of illusions are rare. I am not aware of substantial or detailed discussions of perceptual illusions from defenders of autopoietic or sensorimotor enactivism. Although radical enactivists are among the few that explicitly address the subject, it concerns passages or sections (the most remarkable exception is Favela and Chemero's 2016 paper). So, despite their brevity, it is the best we have at our disposal.

3.1. "Ecological enactivism": tracking, coupling, and environmental conditions

3.1.1. Tracking and coupling with inappropriate objects

In accordance with his claim that representational explanations are unnecessary, Chemero (2009) contends that an anti-representationalist explanation of error can be provided. After offering a depiction of Gibson's view and rejecting a dispositional interpretation of it, Chemero focuses on a way of thinking about direct perception—as "tracking." According to Chemero, direct perception can be seen as tracking something that is present in the environment, and animals can be said to be coupled to the perceived as they track it (2009, pp. 114-116). Objects can be tracked despite disruption ("noneffective tracking"), due to causal factors, alternations between effective and noneffective tracking, or residual information under environment light.

In this context, Chemero (2009) observes that perception can be direct and mistaken: according to him, in noneffective tracking, the animal not only can lose track of the object, but it can be coupled with an inappropriate object as well. As an example of the latter, he discusses a moth tracking a lightbulb instead of a full moon, claiming that "the moth will be effectively tracking whichever of the two it happens to be connected with", only that "[w]hen the moth is effectively tracking the lightbulb, it is making a mistake" (Chemero, 2009, p. 115). He argues that if one needed mental representations to explain those mistakes, one would need them to explain normal cases (so that perception would never be direct). He further adds that "the moth is directly perceiving the moon or misperceiving the lightbulb via a non-specifying optical variable" (the same optical pattern), and that this is a matter of non-specifying variables: "[a] variable is nonspecifying when its presence is not one-one correlated with some object in the environment" (Chemero, 2009, p. 116).

3.1.2. Typical and atypical environmental conditions

On a different note, Favela and Chemero (2016) have contended that notions like "veridical" and "illusion" are conceptually loaded, inclining us to grant a representational view. So, they contend, an ecological psychology understanding of direct perception can deal with visual illusions by rejecting any dichotomy between veridical and illusory perceptions. Instead, the ecological psychologist will rather claim that an object either affords an action for an animal or it does not (Favela & Chemero, 2016, p. 72).

Favela and Chemero's (2016) answer begins with the claim that the explanatory goal is accounting for perceptual happenings and that ecological psychology provides an account focused on the information available to animals depending on environmental conditions. From this point of view, they claim, classical cases are explained away without seeing them as illusory: the stick perceived as bent when submerged in water is an utterly natural case of visual perception (Favela & Chemero, 2016, p. 74), just as it is to see it as straight in a regular medium with healthy eyes. Among the environmental conditions that must be considered, they mention myopia as an example of a condition in which the subject inadequately picks up information that is conveyed by the environment. Thus, they conclude, so-called visual illusions are no different from usual ways information flows in animal–environment interactions and utilized for action (Favela & Chemero, 2016, p. 81).

3.2. Radical enactivism: conflict and illusion

The space Hutto and Myin (2013) devote to accounting for perceptual illusions is much briefer. They address them on the basis of a particular definition of what an illusion is—which they seem to assume captures the usual notion. According to them, those experiences are said to be "*cases in which the content of what we see conflicts with the content of what we know and what we ought to believe*" (Hutto & Myin, 2013, p. 123). Whence, they claim, it follows (i) that the conflict can happen only if the two states possess contents of the same general kind (otherwise, one might guess, there would not be a common ground to clash), (ii) that illusions depend on high-level capacities, and (iii) that *this* conflict is the *only* evidence we have that there is an illusion. Since, in their view, perception does not depend on high-level capacities —like belief— but rather arises from the "dynamic interaction between organisms and their environments" (Hutto & Myin, 2013, p. 5; see also Chapters 5 and 6)—the conflict cannot arise, or it arises outside perception. Thus, in a manner similar to Favela and Chemero's,

they conclude that it is not obvious that perceptual illusions exist or that perceptual experiences are true or false, accurate or inaccurate, veridical or illusory.

Hutto and Myin (2013), Chemero (2009), and Favela and Chemero (2016) seem to have different cases in mind when discussing illusions. The waterfall illusion and the bent stick cases appear paradigmatic of the first and third treatments, but not the moth case. Notably, none of them discusses classical illusions, such as the Müller–Lyer. It is worth making a digression on what is typically meant by "perceptual illusion," the development of the notion, and why it is important for a theory of perception. Not only this will help us clarify whether the above explanations account for the kind of perceptual experience called "illusion," but it will show whether the notion of a perceptual illusion is biased in favor of representationalism. As we will see, it is a crucial notion for theories of perception with a long history predating representational cognitivism.

4. Perceptual Illusions

Perceptual illusions are typically said to be experiences in which perceived ordinary objects appear other than they are (Crane & French, 2021; Fish, 2009). For instance, when partially submerged in water, a straight stick appears to be bent. Likewise, two identical lines may appear of different lengths if shorter lines are diagonally placed at their extremes (shorter if placed in arrow-like position, longer if rotated to the opposite side). Similarly, two identical circles may appear of different size depending on whether they are surrounded by bigger or smaller circles (bigger when surrounded by smaller circles and vice versa). In this way, the color, motion, length, and size of perceived ordinary objects may appear different than they are.

Illusions are to be distinguished from hallucinations (as when there appears to be an oasis or a body of water in the desert) and probably from ambiguous images (as the famous duck-rabbit or similar images that have become common in contemporary popular culture). In the former, the source of the experience seems to be purely within the experiencer (whether it is because of dehydration, intoxication, or any other physiological condition): hallucinations are experiences similar to perceptions but in which there are no perceived ordinary objects (Crane & French, 2021). In the case of ambiguous images, changes in what the image presents may depend on the focus of attention, but the source of the ambiguity seems to be the way the image is built (Fish, 2009). Illusions are also intuitively different from cases of perceptual misidentification, such as waving to someone because

he or she seems to be one's colleague from afar but on a closer look ends up being someone else (or a mannequin). (In this vein, they are probably different from grasping that some object has some color or shape under bad lighting).

There are good reasons for perceptual illusions to have received increasing theoretical attention over the years. Common sense dictates that perception is key to our capacity to navigate the environment, insofar as it informs us about the current status of our surroundings and the objects in it. However, how can sense perception fulfill its function when there are illusory experiences mixed with true perceptions? How can we be in a cognitive relationship with ordinary environmental objects if there is this kind of deceitful experience? Perceptual illusions are thus an unavoidable subject whenever one is addressing issues like the justificatory status of perception (see, for instance, Ayer, 1940) or our navigational relation to our surroundings.

Despite theoretical interest in illusions dating back less than two centuries, illusions have always been familiar to us. According to Wade (2017), visual illusions are already mentioned in sixth-century BCE Mesopotamian tablets, as well as by Euclid and Lucretius. Their existence was also mentioned by Aristotle (1984), who referred specifically to the waterfall illusion in *On Dreams*. Indeed, Ptolemy provided one of the first detailed accounts of visual illusions, classifying them as of color, position, size, shape, and movement. Similarly, the discussion of visual illusions was crucial in Galileo's heliocentric view (Wade, 2017, p. 6). However, illusions did not receive a great deal of attention from philosophers, if it was not to point out that they were a deviation from knowledge. Likewise, earlier discussions grouped together illusions with different phenomena, some of them explainable as arising from optics. It was not until the mid-nineteenth century that phenomena as apparent motion, geometrical illusions, after-effects, multistable stimuli, and illusory contours, among others, became systematic objects of study. Behind this interest in illusions was the idea that those experiences might help in understanding the principles of human perception (Shapiro & Todorovic, 2017, p. xxii).

Summing up, the term "perceptual illusion" typically refers to experiences in which perceived ordinary objects appear to be different from what they are, despite adequate perceptual conditions (e.g., proximity, time, or lighting). So understood, illusions have been known for centuries, while they were sometimes grouped with other kinds of perceptual experiences resulting purely from optical conditions. However, with the rise of perceptual psychology, they became a subject in their own right. The bearing of illusions on perception theory thus comes from the fact that

such a theory cannot just assume that perception simply tells us how our environment is at a particular time, despite allowing us to move in it and justifying some of our beliefs. Illusions thus can neither be discarded on the grounds that theory should be built around ordinary rather than deviating cases nor be said to belong to the representationalist framework: they are both a daily-life and a theoretical notion that has been around throughout the ages and in several cultures. They are a legitimate explanandum that must be addressed by any acceptable theory of perception. With this picture at hand, in what follows I will argue that none of the previous accounts of illusions succeeds, so that we still lack a radical or ecological enactivist explanation of that kind of perceptual experience.

5. The Persistence of Illusions

5.1. Affordances and mistakes

5.1.1. "Ecological enactivism" vs. Wild errors

Why is a moth effectively tracking a lightbulb making a mistake? Of course, why moths are attracted to light is common knowledge: they travel by "transverse orientation" (i.e., they have evolved to navigate using the moon's glimmer, keeping it in a certain position in their visual field). As electric lights produce the same optical pattern as the moon, the moth is drawn to put it in a specific position in regard to its body. So, the moth's navigational system developed to track the moon, not lightbulbs. The case is reminiscent of that of a frog darting its tongue at a plane—it makes a mistake due to the plane's producing a similar optical pattern to flies. Likewise, for the magnetotaxis of some anaerobic bacteria that might be tricked to reach a highly oxygenated environment by the effect of magnets (for their magnetosome would receive the same signal it gets to move towards less oxygenated sediment) (Faivre & Schuler, 2008).

How can we make sense of these facts? A biologist (who is indifferent to the discussion of this paper) would answer that what makes the lightbulb an inappropriate object to be coupled with is that the moth is supposed to use this optical pattern to couple with the moon (for successful night navigation). Put slightly differently, among the functions of the moth's navigational system is the tracking of the moon by means of the optical pattern it produces. Analogously, the frog's visual system responds to an optical pattern usually correlated to the presence of edibles, whereby the plane is an obviously inappropriate object for the frog to couple with. As for the magnetotactic bacteria, the function of its navigational system is

to keep it in less oxygenated environments, which it manages to do by orienting its flagellum towards subsurface habitats.

Nevertheless, the above naïve explanation (after all, nothing in it seems to be particularly theoretically loaded, at least not with any of the competing accounts) looks very much like the outline of a teleofunctional theory of representation. In general, teleological theories posit that mental content stems from biological functions, whose fulfillment was that some items were selected for. Roughly, a mental representation has its content because the function of a mental mechanism is to gain information about environmental items (Millikan, 1989; Neander, 1991, p. 174; also, Dretske, 1995, p. 7). As a mechanism's capacity to fulfill its function may sometimes fail (and for several different reasons), the possibility of misrepresentation opens. And, as to the determination of those items' functions, those views usually claim that they are determined by its history of selection (their contribution to fitness).

To avoid this short slide into teleofunctionalism and maintain Chemero's (2009) antirepresentational stance, one could reply that tracking need not be representational; instead, it is the coupling of the moth and the object. The coupling of two things does not seem to be the kind of relationship that requires representations. Yet, it is still true that this specific coupling is possible because of a (reliable-but-not-infallible) correlation between a certain optical pattern and the moon (that the moth's visual system evolved to exploit).[3]

Over the years, philosophers such as Millikan (1984) and Dretske (1995) have maintained that the use of this correlation is content-informational:

> The fundamental idea is that a system, S, represents a property, F, if and only if S has the function of indicating (providing information about) the F of a certain domain of objects. The way S performs its function (when it performs it) is by occupying different states $s_1, s_2, \ldots s_n$ corresponding to the different determinate values $f_1, f_2 \ldots fn$, of F. (Dretske, 1995, p. 2)

Hutto and Myin (2013, p. 73-76) label that claim the "strengthened Millikan maneuver" to deal with what they call the principle of "no acquired content." In sum, it can be argued that the (fallible) function of the moth's

[3] So, it would be inaccurate to say that "the moth is directly perceiving the moon or misperceiving the lightbulb" (Chemero, 2009, p. 116). This is certainly a case of misperception, but the error seems to lie in the fact that the moth acts as if it was the moon (i.e., it acts as it evolved to act in the presence of the moon).

visual system is representational in that it provides information (*aka* informational content) about the object.

Of course, the ecological enactivist will insist on rejecting the teleological account. But to do so effectively, they must (1) reject the naive explanation (or show that, despite appearances, it does not lead to the teleological one), and (2) provide an account that clarifies cases like the moth's mistake—one that, unlike the provided notion of coupling, avoids sliding into some kind of representationalism. Until this is done, "ecological enactivism" cannot be said to address the objection of illusion.

5.1.2. "Ecological enactivism": Factivity vs Normativity

It is worth noting that the moth example also challenges the claim that a psychological explanation can be purely descriptive. We could limit ourselves to say that the pattern produced by the lightbulb in the moth's visual system generates a motor response that makes it approach the lightbulb, in a process known as (positive) phototaxis. However, saying just that leaves too many important questions unanswered: why do moths have phototaxis? Why do they keep being attracted to lights even at the expense of their lives? (Likewise: Why do certain kinds of retinal activations in the frog's visual system mobilize its tongue-dart reflex? Why do some bacteria keep orienting by magnetotaxis if it can lead them to death?). Closer to the familiar than magnetotaxis and phototaxis, it is known that some pets behave as if they were in front of an actual hole when they see rugs whose fabric is designed to imitate the visual pattern of a hole. We would have left out questions like the precedent if we just say that the pattern of environmental light reflected by the rug is analog to that of a hole—in other words, that it affords the possibility of falling off.

Note that what is at stake here is not whether perception is intrinsically relevant for action or whether the environment is rich in action-guiding information (nor that an object either affords an action for an animal or it does not). The issue is rather whether that is enough to account for cases in which what is afforded to an animal does not correspond to structural features of its environment (the rug affords "fall-off-ability," but you cannot fall off a rug). There is something missing in any pure description of what happens in those cases. To grasp this missing element, we need some kind of normative basis—like that in terms of the fulfillment of functions offered by teleological theories. This allows to talk of appropriateness, mistakes, and the like.

It is a truism that an object or environmental item either affords an action for an animal or it does not. That is what happens both when

a fly and a plane afford edibility to the frog (even when the latter is not edible for it) and when a lightbulb affords successful navigation to a moth, or when a mug affords graspability to me. Insensitivity to what seems to go wrong in some of those cases might reveal that an explanation of them is misguided. To avoid platitudes, a more interesting question is whether the afforded actions can in principle be carried out or allow the organism access to what it looks after (food, a safe environment, a reference point, and so on). Needless to say, the answer sometimes is *no*: frogs cannot catch planes with their tongue, and what they perceive is not something edible (neither a safe environment for magnetotactic bacteria nor an appropriate reference point for the moth). If so, even though there is a sense in which the ecological psychology description of affordances is infallible, this is not the sense we need to account for the differences in the affordances at issue.

"Appropriate", "mistake", "error", and the like are normative notions—they imply a standard by which something is evaluated. We need these notions to explain perceptual illusions. Purely descriptive language, on the other hand, can only depict what is (or is not) the case, and is silent about what should or ought to be the case. Whether or not that settles the issue in favor of the existence of representations, we are at least bumping into the "explanatory claim" of representationalism: not only might an explanation not positing representational content of any kind render itself insufficient to explain the cases at hand, but the representational explanation proves itself to be perfectly capable of dealing with them. The mind may not be a mirror of nature, but in order to explain cases such as the moth's, it is unlikely that a purely descriptive explanation will suffice.

5.1.3. Digression: "Situation-dependent" properties

Let us dwell for a moment on what happens in the bent stick case. The stick looks bent because of different speeds in light refraction. In this sense, it might be considered similar to the case in which an object viewed from a certain perspective appears to have a certain shape it does not have, or in which an object appears to be of a different color because of lighting conditions. All of them can be considered the result of environmental conditions. Yet, the two latter changes in the visual appearance of objects would hardly be included in the category of illusions.

So, someone could say, to claim that the bent stick is an illusion is as flawed as claiming that myopic people are prey to an endless visual illusion. Those would instead be cases of inaccurate perception. Alternatively, they could be seen as cases of (veridical) perception of "situation-dependent" properties of objects (Noë, 2004, pp. 83-84; Schellenberg, 2008), namely

properties the object indeed has (appearing as such-and-such) under certain circumstances.

If the above is right, what prevents the Ebbinghaus or Müller–Lyer illusions to fall into the category of inaccurate perceptions or perceptions of situation-dependent properties? An initial answer could be that they do not meet the criteria to fall under those categories. First, the illusion will remain untouched after changes in our perspective relative to the two lines or circles. Second, those illusions do not arise because of environmental conditions like lighting. While changing our perspective regarding some objects sometimes will be enough to realize that it is not (say) oblong (or does not have a certain color), no change of perspective (no matter how close you are or well-lit the surroundings are) will make the stick look straight or the circles/lines in the Ebbinghaus and Müller–Lyer illusions to look the same in magnitude—the two circles/lines will keep appearing of different magnitude even after you measure them. Unlike inaccurate perspective-dependent visual perceptions, in illusions we have *mistaken* experiences (i.e., of objects as having perspective-independent properties they do not have).

It could still be said that, even if the Müller–Lyer and Ebbinghaus cases do not arise because of bad lighting or cloudiness, neither are due to a perspectival property of one object; they depend on a situation-dependent property: the presence of adjacent lines or circles, respectively. Pinpointing that property and what this is a property of may prove challenging. On the one hand, as Sarcone's (2015) and Obonai's (1954) variations of the Ebbinghaus illusion show, the so-called property can be characterized as stemming neither from a direct correlation between the size of the central and adjacent circles nor from an inverse correlation. On the other hand, simply saying that it is the property of being surrounded by other objects is highly unspecific and vague (most of the objects we perceive are surrounded by other objects). But this is not a principled argument. If so, it could be a possibility that the Ebbinghaus or Müller–Lyer cases might not be visual illusions.

This should seem too good to be true, and the reasoning of the previous paragraph should have already led us to harbor reasons for suspicion regarding the notion of situation-dependent properties. Let us begin with the way those properties are specified. What would be the relevant "situation-dependent properties" involved in the bent-stick case? There seem to be two: *apparent-shape-in-aeriform-medium* and *apparent-shape-in-liquid-medium*. In the Ebbinghaus and Müller–Lyer illusions, there would be *size(length)-when-surrounded-by-bigger/smaller(longer/shorter)-circles(lines)*. What should appear fishy is that those "specifications" of "situation-dependent properties" seem to be nominalized restatements of

the conditions under which the experience is produced: when a non-bent stick is partly in an aeriform medium and partly in a liquid medium, it looks as if it were bent, and so on. If so, appealing to this notion of situation-dependent is not explanatory but circular (the property *apparent-shape-in-aeriform / liquid-medium* is defined as the apparent shape of an object when it is in an aeriform/liquid medium). To understand why the stick looks bent in this situation, we might rather want to appeal to the idea that the visual system cannot help but take the ambient light as a trustworthy indicator of the shape of the stick—even when that leads to error: the perceived shape is *not* its shape.

In sum, appealing to situation-dependent properties (perceptual properties that objects would only have under certain circumstances, such as certain shapes, shades, or sizes) to account for perceptual illusions is as promising as are the chances of adequately pinpointing these properties (and specifying them in an informative, non-circular fashion). For the time being, the latter are not entirely clear.

5.1.4. "Ecological enactivism" and underexplored or atypical environments

Part of Favela and Chemero's rejection of the postulation of illusions comes from the claim that perceptual errors predictably appear when the animal cannot explore the environment sufficiently to make the discriminations relevant to guide its behavior (2016, p. 77). In this vein, the Ebbinghaus and Müller–Lyer cases could be rejected on the basis that they are not ecologically valid.

However, it is not true that after meticulously exploring (even measuring) the Müller–Lyer lines or the Ebbinghaus circles one sees them as equal in length/size—so it is not a problem of having a temporarily extended interaction. Nor is it true that after exploring the environment one is always able to make the relevant discriminations. Likewise, it is inaccurate to link illusions to the evolutionary typicality or atypicality of environmental conditions. For instance, it is well documented that the great bowerbird (*Ptilonorhynchus nuchalis*) uses a combination of forced perspective and the Ebbinghaus illusion to make both itself and its home appear bigger to impress females (Kelley & Endler, 2012). There cannot be a more typical environmental situation than finding a mate.

5.2. Radical enactivism: low-level conflicts and the verdict of abduction

Unsurprisingly, the problem with Hutto and Myin's (2013) anti-representationalist treatment of illusions stems from their definition of

them. Here I begin presenting three reasons why this definition is not adequate to deal with the kind of experience we have been discussing. Then, I consider a predictable reply to one of those reasons, arguing that it does not shield the explanation at issue.

1. The main argument against the claim that illusions depend on high-level capacities is that animals are most likely prone to experiencing illusions. We already noted the case of domestic animals, as well as the great bowerbird case. We have also discussed what happens to moths, frogs, and even some bacteria. There is additional mounting evidence that animals experience perceptual illusions. Most of it comes from research on animal visual perception (Parrish, 2021), and it ranges from fruit flies to higher mammals (monkeys, cats, etc.) and includes fish and reptiles (Kelley & Kelley, 2014). Therefore, it does not seem true that illusions happen only to subjects with high-level capacities like conceptual thinking. Of course, there might be some temptation to make the move of stretching the domain of concept users to animals—a daring move, for which one needs strong independent grounds as well as a sufficiently robust notion of concept possession, neither of which we have been provided with.

2. In illusions, the content of what we see may conflict not only with that of some of our beliefs, but also with the content of other perceptions (visual or otherwise). Think, for instance, of the visual perception of the bent stick versus the subsequent visual perception of the straight stick or the simultaneous tactile perception of the straight stick. If so, a perception–belief conflict is not the only (first-person) evidence we have of illusions.

3. Relations between mental states have been typically understood as rational, that is, such that a mental state (or its content) counts as *reason* for another. Even though the paradigm of a rational relation is justification, it has been argued that this is not the only rational relation in which mental states can engage. The content of a mental state (e.g., a perception or an emotion) could stand in relations as "being consistent with" a belief (Bermúdez & Cahen, 2015; Heck, 2000; Vision, 2009). Unlike justification, those logical or evidential relations would not require the content of the relevant states to be the same. If so, perceptions do not need to have the same content of beliefs to support them or be evidential of them—or to be in tension with them. Hutto and Myin (2013) would be wrong to think that there can be a conflict between a perception and beliefs only if they have contents of the same kind.

In order to demonstrate that any conflict between (the content of) mental states associated with illusions can only happen between states with the same kind of content, the radical enactivist has to prove either that evidential relations require sameness of kind of content or that

justification is the only rational relation two mental states can engage in. As far as can be seen, neither of these claims seems easy to achieve or has been tried by them.

The idea that illusions can be reduced to conflicts between perceptions and beliefs may seem adequate to a reading of the bent-stick case (we see that the stick is bent, while we believe—and we ought to believe—that it is not bent), but it does not resist closer scrutiny: it is unable to account for the fact that non-human animals experience illusions, and it assumes unwarrantedly that illusions are limited to conflicts between perceptions and beliefs, and that mental states require sameness of kind of content to conflict with each other. It might be objected that the first reason depends on taking action as third-person evidence of the conflict between mental states associated with illusions—in particular, behavior that is unfitting. However, Hutto and Myin observe that "there is no compelling reason to suppose that inappropriate responding of such kind involves errors of content attribution" (2013, p. 126). Contrary to such a remark, the situation seems to be the opposite, on abductive grounds.

Even if we conceded, for the sake of the argument, that empirical evidence from inappropriate responding underdetermines the case for or against illusory content—which might sound too big a concession to Parrish (2021) and to Kelley and Kelley (2014)—it might be the best explanation under certain circumstances. Remember that the conclusions of abductive reasoning are backed by explanatory considerations about when an explanation is the most plausible. Those considerations regard some explanations' traits as theoretical virtues: epistemic simplicity, generality or explanatory power, ontological parsimony (adherence to Ockham's razor), and coherence with well-established theories, among others.

Illusory content functions as a theoretical posit aimed at explaining what happens in the kind of experience at stake in terms of representational content that does not match the object's properties. What we have been arguing is that such an explanation is at least more powerful than Hutto and Myin's (2013) competing account (conflicts between what we see and what we know) in that it is capable of fully accommodating the features of the relevant phenomenon (or, alternatively, that the competing account cannot be generalized to all the known forms of the phenomenon). It is also epistemically simple in that it posits a single kind of construct explaining the whole phenomenon. Its ontological parsimony and coherence with well-established theories will no doubt be disputed by Hutto and Myin. Yet, the former may be the price to pay to achieve the other theoretical virtues mentioned. Remember that Hutto and Myin have argued that the notion of mental content is not naturalizable, that is, it cannot be accommodated

in a certain scientific explanation. I examined the HPC above, indicating that there is not necessarily a tension between scientific explanations and the notion of mental content. If the above is right, the kind of abductive reasoning massively employed in both every day and scientific reasoning will be as reliable here as it is anywhere else.

Hutto and Myin (2013) do not make clear what (if anything) can be inferred from inappropriate responses in cases described as illusions. We can strengthen the present point by considering other inferences we can draw from inappropriate responses in those cases and then showing their weakness:

(1) Inappropriate responding could be the result of motor malfunction, as in tics. This, however, does not capture the behavioral flexibility and phenomenal dimension of the experiences at issue.

(2) It might be that subjects of those experiences respond inappropriately *on purpose* (they somehow "just feel like it"). This inference clearly lacks epistemic simplicity (the response is not only not explained but rather obscured) and probably has issues concerning some features of the phenomenon (e.g., the result of involuntary physiological measures).[4]

(3) Subjects respond inappropriately not because of illusory content but because of inaccurate perception. However, as stated in our discussion of so-called situation-dependent properties, there is a principled difference between *inaccurate* and *mistaken* perceptions.

To put it differently, whenever one can discard motor malfunction, inappropriately responding on purpose, and inaccurate perception, among others, there might be good reason to infer representational content that does not match the object's properties—for this inference is explanatorily powerful, epistemically simple, and probably coherent with well-established theories. It is peculiar that Hutto and Myin claim that the inference cannot be drawn because "[t]hat things look and feel a certain way does not entail that perceptual states possess or attribute content" (2013, p. 134). Something looking a certain way is precisely what some take as the primal form of content (see, for instance, Cussins, 1992).

6. Closing Remarks

To sum up, the discussed accounts of perceptual illusions do not reach their goal. On the one hand, it is unclear how Chemero (2009) would

[4] To be clear, subjects can say (perhaps confabulate) that they responded inappropriately on purpose (Johnson et al., 2000). However, the mentioned issues allow one to doubt such claims if stated by participants.

normatively ground the account in order to be able to speak of those experiences as mistakes. The only known normative ground is the notion of function, which leads to a teleofunctional theory of representation. On the other hand, without such a normative grounding, the resulting purely descriptive account (Favela & Chemero, 2016) seems to be hopelessly incomplete. Appealing to notions such as situation-dependent property might be attractive to the "ecological enactivist" to the extent that it could allow treating illusions as regular cases of perception. However, on a closer look, it is unclear whether paradigmatic cases of illusion can be fitted under such a notion, and, if pressed to fit, the very notion proves vague and problematic. Similarly, associating illusions with underexplored environments or evolutionarily atypical conditions does not work.

As for Hutto and Myin's (2013) radical enactivist account, their definition of what an illusion is does not fit our current comprehension of illusions. On the one hand, it is highly contentious that illusions necessarily demand a conflict between perception and belief, or that those two need to have the same kind of content to interact. On the other hand, it leaves unexplained the fact that some animals seem to experience illusions—indeed, in maintaining that illusions depend on high-level capacities, it predicts that animals cannot experience them. Replying that unfitting behavior does not (deductively?) allow inferring illusory content is unwarranted: the inference seems abductively legitimate, in that it exhibits theoretical virtues that the radical enactivist alternative lacks. We cannot say, therefore, that we have an adequate radically or 'ecologically' enactive, antirepresentational treatment of perceptual illusions—and the closer to the discussed attempts, the less promising will be the prospects of achieving one. Without such a treatment—that is, without appropriately dealing with a non-negligible part of perceptual experience—it can hardly be said that a new paradigm for understanding perception or cognition is upcoming from any of those two views.

The heart of some radical and "ecological" enactivist criticisms of representational cognitivism might be in the right place: the proliferation of representations (almost in each step of every cognitive process) might be unjustified, and the indiscriminate use of representations might risk trivializing the concept; also, some computationalist theses may be problematic and perhaps inadequate to characterize human cognition. Likewise, an important challenge for representational cognitivism to meet is articulating a discrete view on representations with the continuous nature of brain activity. Yet, as Nanay (2015) observes, those criticisms do not necessarily mean that representationalism is doomed but that it has issues with which it needs to deal.

At any rate, the kind of error that takes place in illusions seems to require a kind of explanation that radical or ecological enactivism are unable to provide and is best addressed by representational cognitivism. Whether that sort of explanation can be provided without talking about representations is an open question, but all indications are that we need to look elsewhere. It also remains to be seen whether this is a problem for radical or ecological enactivism alone: the use of normative claims seems to be unavoidable to account for illusions (without the former, the latter must be denied, against compelling evidence), and those claims require grounding; the challenge is to do this without talking about functions at all, thus avoiding the short slide into admitting representations. If any of these elements were missing, the resulting view would be either incomplete or inadequate, and then abduction would seem to support the postulation of representational content to account for illusions.

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