A DUAL PROPOSAL OF MINIMAL CONDITIONS FOR INTENTIONALITY

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Abstract. Naturalist theories of representation have been attacked on the grounds of being too liberal on the minimal conditions for intentionality: they treat several states that are not representational as genuine representations. Behind this attack lies the problem of demarcation: what are the minimal conditions for intentionality that a state should satisfy to be genuinely representational? What are the limits of intentionality? This paper develops a dual proposal to solve this problem. First, I defend the explanatory role criterion in order to assess proposals of minimal conditions for intentionality. I start by proposing the success pattern condition: a state represents a given external feature provided that there is a success pattern present in the behavioural output, and the system uses this state as a proxy for the presence of this external feature. However, this condition is not sufficient for minimal intentionality – there are both intentional and non-intentional success patterns. Another minimal condition is, hence, required to draw this distinction. I propose the constancy mechanism condition: a state is representational provided that the system employs a constancy mechanism in its production. The success pattern and constancy mechanism conditions jointly constitute the dual proposal for minimal intentionality. I argue that this proposal is explanatorily justified and, so, properly demarcates the limits of intentionality.

Keywords: minimal intentionality; problem of demarcation; naturalist theories of representation; constancy mechanism; success pattern.

This paper addresses a specific question. What are the *minimal conditions* for intentionality that a given state should satisfy to constitute a representational state? This is the *problem of demarcation.* Its solution requires a principled demarcation of the limits of intentionality. The goal of this paper is to develop a *dual proposal* of minimal conditions for intentionality. First of all, I introduce the problem of demarcation and show its relevance for the debate on the viability of naturalist theories of representation. I start by proposing the *success pattern condition*. Its starting point is that intentional explanations of behaviour have the distinctive explanatory power of explaining successful behaviour. This gives rise to the success pattern condition: a given state is representational provided that there is a success pattern present in the behavioural output, and the system uses this state as a proxy for the presence of the relevant external condition. However, this minimal condition alone draws the lower border of intentionality too low. The *objection of liberality* is that the delivered demarcation is too liberal because it treats systems that are clearly not representational as representational. The establishment of another minimal condition is, hence, required. I propose the *constancy mechanism condition*: a given state is representational provided that the sensory system employs a constancy mechanism in its production, such that the production of the state remains constant when the external feature obtains, despite the variety of proximal stimuli reaching the system's sensory apparatus. Together, the success pattern and constancy mechanism conditions give rise to the dual proposal for minimal intentionality. I argue that this proposal draws the genuine limits of intentionality.

1. Minimal Intentionality and the Problem of Demarcation

Some states represent the world. Beliefs, desires and other mental states are typical representational states. For instance, my belief that London is an English city is a mental state that represents London as an English city. But how is it possible for a state to represent anything in the first place? Naturalist theories of representation try to give an account of representational states by taking as a starting point the assumption that representational states are natural states. Paradigmatic examples are teleological (Millikan, 1984, 2004; Papineau, 1993, 2017) and causal-informational theories (Dretske, 1981; Fodor, 1987).

However, naturalist theories are often attacked on the grounds of being too *liberal* on the minimal conditions that a state should satisfy to be representational (Sterelny, 1995; Burge, 2010; Rescorla, 2013). That is, they consider certain states that are clearly not representational as genuine representations. But how do we decide when a given theory of representation is too liberal? What is at issue here is the extent of the ultimate *limits of intentionality* that distinguish borderline cases of

representational states from non-representational states. A theory is too liberal when it sets these limits too low. This is the *problem of demarcation*: what are the *minimal conditions* that a state should satisfy to be genuinely representational? Which states have minimal intentionality?

Evidently, some representational states are more *complex* than others, i.e., there is a hierarchy of representational states. Complex representations lie at the top of this hierarchy, while primitive representations are at its bottom. Consider higher-level states such as propositional attitudes, representations of molecules or republics, etc. Their representational status is uncontroversial – this is a starting point in the debate on minimal intentionality. What is at issue is the representational status of lower-level states: which ones are genuinely representational? Here there are several candidates. Are tropistic states of amoebas, planaria and paramecia genuine representations of light? Are honeybees' waggle dances representations of the direction of nectar? Are frogs' sensory states that trigger the catching behaviour real representations of flies?

Minimal conditions for intentionality are those satisfied by primitive representations, in contrast with non-representational states. That is, a given candidate for primitive representation is not representational if it fails to satisfy them. The establishment of minimal conditions for intentionality is required to draw the limits of intentionality and, so, to solve the problem of demarcation. Only then will there be a principled proposal for the limits of intentionality, in opposition with a merely arbitrary one.

Consider a range of candidates for primitive representational states: some of these lower-level states are genuinely representational, while others are not. Now suppose that there is a demarcation line distinguishing representational from non-representational states. In particular, it distinguishes borderline representational states from borderline non-representational ones. The problem of demarcations consists in how to properly draw this line. The role of minimal conditions for intentionality is precisely to distinguish, among borderline lower-level states, those with genuine representational status from those that lack it.

Here I assume that primitive representations are *sensory states*.[1] The distinction between representational and non-representational lower-level states consists in a distinction between representational and non-representational sensory states. For instance, tropism is the movement of the sensory system (or parts of it) in a given direction, in response to an external stimulus. Paramecia are unicellular tropistic organisms that move in the opposite direction of light. Do they really *represent* the presence of light or just *sensorily register* it? Non-representational systems only *sensorily discriminate* the relevant external stimuli, while representational ones *represent* them.

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[1] Naturalist philosophers often follow this assumption. See Millikan, 2004, p. 158; Burge, 2010, pp. 315-317; Schulte, 2015.

In light of the problem of demarcation, consider naturalist theories of representation. It is not possible to assess each one here, so let us focus on arguably the most promising one – *teleosemantics*. According to teleosemantics, representational states are reducible to natural states in terms of the notion of *biological function*. The relevant conception of biological function here is aetiological: the function of a given biological trait is the effect for which it was *selected*. It is the history of selection of traits of a certain kind that determines their biological function. The paradigmatic selection process is *natural selection*: the selected effect is that one which increased biological fitness – success and reproduction of the biological trait. Hence, the function of the pineal gland is to secret melatonin because ancestral pineal glands were selected for that. Teleosemantics establishes the following minimal condition for intentionality.

> **<u>Teleosemantics</u>**: a sensory state is representational provided that (T1) the behaviour triggered by the tokening of this state has a *biological function*; (T2) the system which produces the behaviour *uses* this state as a proxy for the presence of some external condition.[2]

(T1) requires that the system which produces the behavioural output was *selected* to produce it as a response to the tokening of the sensory state in order to fulfil the selected effect. It follows that the behaviour has a biological function. (T2) requires that this system should use the sensory state as a guide or proxy for the relevant external condition. For instance, the system will produce different behavioural outputs accordingly to the location of the represented external condition. Notice that the teleosemantic minimal condition implies that tropistic systems, frogs, honeybees, anaerobic bacteria and other primitive systems are genuinely representational.[3] Let us illustrate it with the paramecium again.

On one hand, the avoidance behaviour of the paramecium has the function of avoiding light because ancestral paramecia were naturally selected for that. Such avoidance was adaptative for the paramecium throughout its evolutionary history. So, the paramecium's tropistic state which triggers this avoidance behaviour satisfies (T1). On the other hand, the paramecium uses the tropistic state as a proxy or guide for the production of the avoidance behaviour: when light is located in L1, the paramecium moves in the opposite direction from L1; when light is in L2, the paramecium moves in the opposite direction from L2, etc. So, this tropistic state also satisfies (T2). In sum, the

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[2] This is a very simple characterization of the teleosemantic minimal condition for intentionality. For more developed ones, see Millikan, 2004, Papineau, 2017.

[3] Teleosemanticists themselves explicitly assume this implication. For instance, Millikan (2004, pp. 157-160) claims that anaerobic bacteria and honeybees are genuine representational systems: "there is intentionality here in the sort of way that zero is a number. These are the most humble sorts of limiting cases of intentionality" (2004, p. 158).

paramecium's tropistic state is genuinely representational according to the teleosemantic minimal condition.

This implication led several philosophers to object that the teleosemantic minimal condition draws the lower border of representation too low (Burge, 2010, pp. 303-304). According to the *objection of liberality,* teleosemantics is too liberal since it treats as representations several states that clearly are not representational: sensory discrimination of light in tropistic systems such as paramecia (Fodor, 1986, p. 10), planaria and amoebas (Burge, 2010, p. 303); alignment of magnetosomes of anaerobic bacteria (Burge, 2010, p. 300; Rescorla, 2013, p. 94; Schulte, 2015, p. 122); saliva as representing the presence of food (Sterelny, 1995, p. 256); and so on. But how do we settle the issue of whether these states are representations or not? Why do some take it to be so clear that they are not genuinely representational?

Here one may argue that these sensory states are not representations because their representational status is highly *counter-intuitive*. However, an intuitive criterion for minimal intentionality is hard to establish: it not clear what the supposed intuitions behind it are. After all, what some may find intuitive, others may find counterintuitive. Anyway, it is not my goal here to assess this debate on the intuitive criterion; rather, I will propose another one – the *explanatory role criterion* (Burge, 2010; Rescorla, 2013; Ramsey, 2007).[4]

 Representation plays a *distinctive explanatory role* in cognitive science and other sciences of mind. Successful scientific theories posit representational states to explain the behaviour of several organisms: rats (O'Keefe & Nadel, 1978), toads (Ewert, 1980), honeybees (von Frisch, 1967), vervet monkeys (Seyfarth & Cheney & Marler, 1980), etc. However, with great power comes great responsibility: the positing of a sensory state as representational should make some *explanatory difference*, otherwise the state should not be qualified as a representation. That is, one is justified to posit a given state as a representation, in order to explain the behaviour of an organism, provided that it has an *explanatory purchase*. There should be something that the intentional explanation is capable of explaining which the non-intentional explanation cannot explain. Suppose that a given cognitive theory posits that a sensory state is a representation: the organism behaves in a given way because it *represents* a certain external condition. According to the explanatory role criterion, such a positing is justified only if this sensory state plays the distinctive explanatory role of representational states.

The debate on minimal intentionality is centred on the explanatory constraint for assessing the representational statuses of primitive sensory states. But what is, after all, the *distinctive*

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[4] I assess the intuitive criterion elsewhere, see Souza Filho, 2018, pp. 116-129.

explanatory role of representational states? This is the hard problem that will be pursued throughout this paper. The specification of the explanatory power of representation goes hand in hand with the specification of the minimal conditions for intentionality. The purpose of this paper is to develop a fully justified demarcation proposal in light of the explanatory role criterion.

2. The Success Pattern Proposal

The success pattern proposal maintains that the positing of a representational state gives rise to an intentional explanation with the distinctive explanatory power of *explaining success* (Ramsey, 1990; Whyte, 1990). That is, the intentional explanation specifies the external condition in which the triggered behavioural output succeeds in achieving the organism's *pursued result*. By contrast, the non-intentional explanation does not appeal to any pursued result and, hence, cannot explain success. According to the success pattern proposal, this is the fundamental explanatory distinction between intentional and non-intentional explanations. But how does the fact that the representation pursues a given result make any difference to the explanation of behaviour?

Suppose that a given organism has a behaviour pattern B in response to a certain internal state S that is triggered by an external condition C. What is the explanation for such behaviour? The non-intentional explanation consists in a specification of the causal chain of the tokening of C that triggers S which results in B. It is potentially capable of explaining every causal transaction that occurs between the tokening of C and the production of B. A full causal explanation of behaviour is possible by establishing a wiring diagram that shows how environmental inputs affect states of the organism that, in conjunction with other states of the organism, originate the behavioural output. In light of this, a serious problem arises for the justification of intentional explanations: given that the non-intentional explanation has the power of providing a full causal explanation of behaviour, what is left to be explained by the intentional explanation?

The starting point is that intentional explanations are *external explanations*, while non-intentional explanations are *internal ones*. The non-intentional explanation of behaviour establishes no relation or connection between the organism and the external environment; it is true of the organism irrespective of its external environment. If everything is changed in the external environment with the exception of the proximal stimulus that triggered the causal chain that resulted in the bodily movement, the causal explanation would still be true of the organism. By contrast, the intentional explanation is an external explanation. It establishes a new set of relations between the organism and the external environment where it is embedded by establishing relations between representational states and environmental features (Shea, 2013, p. 498). The non-intentional explanation only specifies the relation between the organism and a certain proximal feature of the

environment, namely, the proximal stimulus that triggers the relevant causal chain. Once this stimulus is specified, the non-intentional explanation has nothing more to say about the environment. Hence, the establishment of relations between the representation and environmental features is distinctive of intentional explanations. They do it in two steps.

First, the intentional explanation specifies the result or end that the organism pursues with the tokening of the representation and the resulting behaviour. The pursued result is directed towards a given external feature – e.g., eating or avoiding something. Second, the intentional explanation specifies the success conditions for the behavioural output to achieve this external result. The establishment of the relation between the organism and the external feature comes in two steps because the establishment of success conditions presupposes the specification of the pursued result; otherwise, it would not be possible to establish whether the behaviour succeeds in achieving it or not.

The distinctive explanatory power of intentional explanations consists in the *explanation of successful behaviour*, i.e., the establishment of the success or failure of the behavioural output in achieving the organism's pursued result. Intentional and non-intentional explanations establish different descriptions of behaviour at different levels, namely, the *success pattern description* and the *non-intentional description*. No matter how complete the non-intentional specification is of the causal chain that leads from proximal stimulus to behavioural output, it is not capable of explaining the success of the organism in achieving the pursued result. That is, the non-intentional explanation is not capable of explaining successful behaviour.

Consider an organism which pursues the avoidance of predators. Now suppose that in a given situation the tokening of a sensory state is what triggers the avoidance behaviour towards some predator. The non-intentional explanation of this behaviour consists in the specification of the *causal chain* that starts with the stimulus input, leads to the token of the sensory state, and ends with the behavioural output. The intentional explanation is that the organism escapes because it *represents* the presence of the predator. The point of positing the sensory state as a representation is that it gives rise to an explanation of the success or not of the organism in achieving the relevant result – escaping from the predator. The true representation of the predator leads to the avoidance behaviour which leads to the success of escaping from the predator; the false representation leads to the failure of such avoidance because there is no predator around. The intentional explanation is required here precisely for the explanation of the success or not of escaping from the predator. Two factors guarantee success: first, that the sensory state *truly represents* the presence of the predator – the external condition of the presence of the predator obtains; second, that the behavioural output is the proper avoidance behaviour. The truth of the representation guarantees success provided that the

behaviour is appropriate.

The explanatory power of intentional explanations lies in the capacity to explain success, i.e., the achievement of the organism's pursued result. There is a characteristic pattern assumed by intentional explanations, *the success pattern*: a certain appropriate behaviour *B* in pursuing result *R* is prompted by representational state *S* that represents external condition *C*; when *S* is true (i.e., when *C* obtains), the performance of *B* leads to the achievement of *R*. The truth of the representation explains the success of the appropriate behaviour in achieving the pursued result and the falsehood explains the failure to achieve this result. The positing of the representational state by the intentional explanation provides it with the *success explanatory power* that is absent in non-intentional explanations. This is what justifies the positing of the representational state.

The success pattern proposal for the limits of intentionality was originally proposed by success semanticists (Ramsey, 1990; Whyte, 1990) and is also assumed by teleosemanticists (Millikan, 2004; Papineau, 1993, 2017). However, the success pattern proposal was not originally formulated as a solution for the problem of demarcation. My job here is to adapt it as a proposal for the minimal conditions for intentionality.

Furthermore, I take success patterns to be real in the sense of *real patterns* as introduced by Daniel Dennett (1991). Success patterns are *patterns of interaction* between the behaviour of the organism and the input stimuli from the environment. To say that a given success pattern exists in an organism is to say that the behavioural output of the organism exhibits such a success pattern. A success pattern is real because the behavioural output has this pattern irrespective of whether there is anyone who recognises that it is there. Consider the catching behaviour of an organism towards food in different situations. The intentional explanation for this behaviour is that the organism represented the presence of food and, so, catches it. The success pattern is present in this behaviour throughout these situations and it would be there even if an observer had never existed to verify its presence. That is, there is a fact of the matter as to whether the behaviour has a success pattern. In sum, intentional explanations pick up *real success patterns* of the way the organism interacts with the surrounding environment.

But how do intentional explanations determine the external result that the organism pursues? For instance, what is the criterion for the specification that the organism's pursued result is the avoidance of a predator but not a different result? It is here that teleosemantics comes into play (Papineau, 2017). Teleosemanticists claim that the pursued result of a representational state is constituted by its *biological function*. The organism tries to fulfil a certain biological function via the tokening of the representation and the triggered behaviour. It is the biological function that determines the organism's pursued result, i.e., what it was *selected for*. Hence, a representational

state has a function that determines its pursued result and, so, determines the success conditions for the resulting behavioural output. In the predator example, the goal of the representational state is to avoid predators because this is its biological function. In short, *success conditions* are *biological success conditions*. However, the success pattern proposal is independent of any specification of the pursued result, teleosemantic or not. Note that the fact that the organism's pursued result is specified in functional terms does not play any explanatory role in the success pattern proposal. The success pattern proposal just assumes that there is a result; what determines it is an independent matter. In what follows, I remain neutral on the problem of the specification of the pursued result.

Last and not least, the success pattern condition does not only require that in order for a given sensory state to be intentional, the presence of the success pattern in the behavioural output is enough. It also requires that the organism should *use* the sensory state as a *proxy* for the presence of the relevant external condition in order to achieve the pursued result. That is, the sensory state *guides* the production of the behavioural output in the achievement of the organism's pursued result. The organism has a pursued result that is only achievable when a given external condition obtains. Thus, it uses the sensory state that stands for the external condition as a guide for achieving this result via the production of the behaviour. In the predator example, the sensory state is a representation of the predator because it satisfies both requirements. First, the behaviour has a success pattern – the success condition is the avoidance of predators. Second, the organism uses the sensory state as a proxy for the whereabouts of the predator to escape from it (e.g., to move in the opposite direction). The sensory state guides the organism in the production of behaviour by informing the organism about the location of the predator.

> **Success pattern condition.** A sensory state represents an external feature provided that there is a success pattern in the system's behavioural output and the system uses the state as a proxy for the presence of the external feature in the production of this behaviour.

3. The Objection of Liberality

The core thesis of the success pattern proposal is that the distinctive explanatory power of representational states is the explanation of successful behaviour. The success pattern condition rules out the intentionality of several systems: first, systems that have a behavioural output with no success pattern; second, systems that do not use the relevant sensory state as a proxy for some external feature in the production of behaviour. For instance, an eagle's wing has success conditions constituted by the biological goal of soaring, but the eagle does not use the wing state as a proxy for the presence of any external feature. So, the wing state is not representational.

So far, so good. But here *the objection of liberality* strikes again. There are several systems that satisfy the success pattern condition but nevertheless are clearly not intentional. What happens is that success patterns are *wide spread*. They are present in very simple organisms – very doubtful representational systems satisfy the success pattern condition. Such organisms not only have the behavioural output with a success pattern, but also use the relevant sensory state as a proxy for the external condition to achieve their pursued goals. For instance, the success pattern proposal implies that tropistic states, antidiuretic hormones and saliva are representational.

Consider osmolarity in human blood (i.e., the number of solute particles in a quantity of blood plasma). When it reaches above a given level, the hypothalamus produces the antidiuretic hormone. This hormone then triggers an action from the kidneys which ultimately lowers the level of osmolarity. The antidiuretic hormone clearly satisfies the success pattern condition. The hypothalamus has the biological goal of keeping osmolarity at a given level and, in order to do that, produces this hormone to indicate high osmolarity. Finally, the kidney uses the hormone as a proxy for high osmolarity to lower the level of osmolarity. Nevertheless, the antidiuretic hormone is clearly not a representation of high osmolarity: such a positing plays no distinctive explanatory role (Schulte, 2015, p. 126).

Tyler Burge (2010, p. 300) and Kim Sterelny (1995) argue for the explanatory idleness of positing that these very simple sensory states are representational. Magnetosomes of maritime anaerobic bacteria are attracted to the geomagnetic field and, hence, to the bottom of the ocean. Moving in this direction is adaptative for bacteria since the surface of the ocean contains oxygenated waters that are lethal. Once again, the bacteria clearly satisfy the success pattern condition: first, there is a success pattern present on their behaviour constituted by the biological goal of reaching oxygen-free water; second, they use the alignment of magnetosomes as a proxy for the direction of oxygen-free water. However, Burge claims that positing the alignment of magnetosomes as a representational state is not explanatorily justified. The bacteria's behaviour is *fully explained* by the non-intentional explanation by specifying, first, the causal chain between the magnetic field and the bacteria's movement towards it; second, the biological goal of magnetesomes – avoiding oxygenated waters. There is nothing left to be explained by the intentional explanation: positing the alignment of magnetosomes as representational is explanatorily idle. In Burge's own words:

"Everything in the example can be explained using the notion of biological function (with respect to oxygen poverty), normal environmental conditions, and sensory discrimination

(with respect to magnetic forces). Adding an odd use of the term 'representation' contributes nothing to explanation." (2010, p. 300).

The same line of reasoning shows that positing the antidiuretic hormone as genuinely representational is explanatorily idle.

But maybe this line of reasoning against the success pattern proposal is not fair. Burge objects that the explanation of the successful behaviour of tropistic systems are not genuinely intentional because they fail to have the distinctive explanatory power of intentional explanations. After all, one can always rephrase these explanations without appealing to any representational notion: everything about the behaviour of tropistic systems can be explained using the notions of biological function, sensory discrimination, etc. But note that *any naturalist theory* which aims to reduce representational states to natural states is *automatically open* to this objection: just replace any notion of representation with the notions of the reducing natural states (e.g., biological function, sensory discrimination, etc.). Burge's line of reasoning does not show that the relevant naturalist theory fails to pick out the distinctive explanatory power of intentional explanations. Why can't the relevant natural notions play the distinctive explanatory role of representational notions? This is something that needs to be shown, one cannot just assume that this is the case.[5]

Still, Burge's objection to the success pattern proposal may be developed to become more robust. At its core is the idea that the success pattern proposal *trivialises* the explanatory role of representational states. Tropistic systems satisfy the success pattern condition: their behavioural outputs have success patterns and they use the tropistic states as proxies for the relevant external conditions to pursue their biological goals. What happens is that they are so simple that it is very implausible that the positing of tropistic states as representational is explanatorily justified. But why is it so implausible?

A full response to this question will have to wait until the next sections. However, for the present purpose it is sufficient to point out that the tokening of a tropistic state is *fully chained* to a very specific stimulus (Sterelny, 1995): in the case of the paramecium, light stimulus; in the case of the anaerobic bacterium, magnetic stimulus, etc. That is, if the stimulus is present, the tropistic state is tokened, and, so, triggers the behavioural output; if the stimulus is absent, there is no tokening at all. But then it becomes very implausible that the positing of the tropistic state as representational could give rise to the distinctive explanatory power of intentional explanations. How could tropistic

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[5] As Nicholas Shea puts it, "[t]his supposed challenge is not really a challenge at all, because it concedes everything we need, leaving only a dispute about the appropriateness of the label 'representation'" (2020, p. 205). I thank an anonymous referee for pressing this objection.

systems harbour representational states with such chained behaviour? Genuine intentional explanations simply have a more distinctive explanatory role. The positing of tropistic states as representational states is not explanatorily justified.

The lesson to be taken is that the satisfaction of the success pattern condition is not enough to give rise to intentional explanations. The fact that there is a success pattern in the behavioural output, and that the organism uses the sensory state as a proxy for the external condition to produce this behaviour, is not sufficient for intentionality. The positing of the representation is not explanatorily justified in the cases of the antidiuretic hormone, paramecium, anaerobic bacterium and tropistic states in general. The conclusion is that the success pattern proposal is too liberal; it draws the limits of intentionality too low. Thus, some further minimal condition for intentionality is required to make it more restrictive. In what follows, I defend the adoption of a second minimal condition. The result is a dual proposal to demarcate the limits of intentionality.

4. Constancy Mechanism Plus Success Pattern: A Dual Proposal

Intentional patterns are a *subset* of success patterns. Every intentional pattern is a success pattern, but not the other way around. For instance, behavioural outputs of anaerobic bacteria and paramecia have *non-intentional* success patterns. The explanatory purchase of representational states is only justified in the case of systems with intentional success pattern behaviour. Success patterns are patterns of interaction between the organism's behaviour and some external condition. They are present as long as the behavioural output pursues the achievement of a certain result, giving rise to the explanation of *successful* behaviour. So, in what does the *distinction* of explanatory powers due to intentional and non-intentional success patterns consist?

The presence of the success pattern gives rise to the explanation of successful behaviour, but this is not enough to justify the positing of the representation. The right approach to draw this distinction is to take a deeper look at the explanatory powers given rise to by success patterns in general, and, then, to select among these explanatory powers the ones that are *distinctive* of intentional explanations.

In what follows, I defend that the positing of representational states requires further explanatory powers, i.e., explanatory powers that are not given rise to by the success pattern. I argue that the employment of a *constancy mechanism* gives rise to further explanatory requirements by allowing the *recognition* of the presence of the same success pattern despite the *variety* of input stimuli. So, a success pattern in the behavioural output is intentional provided that the organism employs a constancy mechanism in the production of the relevant sensory state. On one hand, the presence of the *success pattern* guarantees the rising of certain explanatory powers that originate in

the *behavioural output* triggered by the representation. On the other hand, the employment of the *constancy mechanism* guarantees the arising of other explanatory powers that originate in the *triggering* of the tokened representation. They are distinct but complementary explanatory powers.

In sum, the distinctive explanatory power of intentional explanations, the one that justifies the positing of the representation, is constituted by the *output explanatory power* (i.e., the explanatory power given rise to by the presence of the success pattern)*,* and by the *input explanatory power* (i.e., the explanatory power given rise to by the employment of the constancy mechanism). In the case of dissatisfaction of either the success pattern or the constancy mechanism condition, the sensory system is not intentional. They are *both* minimal conditions for intentionality.

Let us start by introducing the constancy mechanism condition:

Constancy mechanism condition. A sensory state represents an external feature provided that the sensory system employs a constancy mechanism in its production, such that the production of the state remains constant when the external feature obtains, despite the variety of proximal stimuli reaching the system's sensory apparatus.

Let us call "object properties" those properties of objects that remain constant, such as colour, size and shape: a *rectangular* door, a *grey* coffee cup, etc. *Perceptual constancy* is the perception of object properties as *remaining constant* even when illumination, distance, viewing angle and other things cause changes in the *proximal stimuli* reaching the sensory system (Goldstein, 2010, p. 309). For instance, a grey coffee cup looks a uniform colour even when one views it under *uneven* illumination. That is, the coffee cup still looks uniformly grey despite the fact that the light reflected by the coffee cup's *unshaded* regions to our retinas is very different from the light reflected by its *shaded* regions. This is a classic case of colour constancy: the visual system still sees the object as having the same colour despite big differences (to a given degree) in lighting conditions. The literature is full of examples of perceptual constancies such as colour, size and shape constancies.

What sensory systems with constancy mechanisms have in common is that they are capable of *stably producing* the sensory state in response to the presence of an *unchanging* external feature (e.g., colour or size), despite huge *variations* in proximal stimuli coming from the environment.[6] Assuming for the sake of the argument that a given sensory system is representational, the

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[6] This is, evidently, a rough characterization of perceptual constancy. A deeper one needs to assess several problems which emerge from distinct characterizations, but it is beyond the scope of this paper to assess the debate on perceptual constancy. For an overview, see Cohen (2015).

employment of the constancy mechanism guarantees that the sensory state still represents the *same* external feature despite the variety of proximal stimuli.

According to the constancy mechanism condition, a sensory state is representational provided that the sensory system employs a constancy mechanism in its production. This minimal condition was proposed, in different versions, by Burge (2010) and, arguably, Sterelny (1995). As previously shown, both reject the success semantics condition on the grounds that it is too liberal. As an alternative, they propose the constancy mechanism condition. Here I take a different route. I appeal to constancy mechanisms precisely to draw the distinction between intentional and non-intentional success patterns.

Suppose that a certain stimulus makes a tropistic system move in the opposite direction. There are *three* different explanations for this avoidance behaviour. First, *the causal-sequence explanation* is the specification of the *causal chain* that starts with the presence of the stimulus and ends with the avoidance behaviour. The explanation is that the system has this avoidance behaviour because of this causal chain. Second, *the non-intentional success explanation* is the specification of a *non-intentional success pattern*. It specifies the causal chain and posits a *goal-directed intermediate state*, between the stimulus and the avoidance behaviour, that produces a goal-directed behaviour. The explanation is that the system has this avoidance behaviour because it tries to achieve its pursued result. Note that the causal-sequence explanation is *just* the specification of the causal chain, while the non-intentional success explanation posits a goal-directed intermediate state in the causal chain to explain the avoidance behaviour. Finally, *the intentional success explanation* – the intentional explanation – also posits a goal-directed intermediate state, but in contrast with the non-intentional success explanation it posits an intermediate state that is not only goal-directed, but something more: a *representation*. The explanation is that the system moved in the opposite direction from the stimulus because it represented its presence and this representational state triggered the avoidance behaviour.

The biological goal of avoiding the relevant stimulus constitutes the success pattern of the tropistic system's behavioural output. According to the intentional success explanation, this success pattern is intentional – the intermediate state is representational; according to the non-intentional success explanation, this is a non-intentional success pattern – the intermediate state is *just* goal-directed. However, from an explanatory point of view, it makes no sense to posit this success pattern as representational because the intentional success explanation that it gives rise to has *the same explanatory powe*r as the non-intentional success explanation. That is, there is nothing left to be explained and, so, the positing of the representation should be ruled out.

Now contrast the tropistic system's non-intentional success pattern with a genuinely

intentional one. Here the representational state is triggered by *several stimuli* (s^1, s^2, s^3…) that trigger behavioural outputs to pursue the same result. In all of these cases, the intentional explanation *bridges across* a variety of different input stimuli. The positing of the representational state allows the intentional explanation to *identify* the presence of the *same success pattern* despite the variety of proximal stimuli. By contrast, the non-intentional success explanation *misses* the identification of the same success pattern that is present throughout these cases because they involve *different* causal chains that start with different proximal stimuli. For every different causal chain, the non-intentional explanation provides a *distinct* and *independent* explanation of behaviour, missing that the *same* success pattern is common between them.

It is true that one can sum up all distinct causal chains into one single causal explanation by simply conjoining them. But that would not allow for the identification of the same success pattern – the mere conjunction of distinct causal explanations does not make any *connection* between them. The identification of the same success pattern is only possible by positing the intermediate state as representational. Such a positing allows for the recognition of the same success pattern that is present in all of these distinct causal chains. But note that this recognition is only possible because the sensory system employs a *constancy mechanism* in the production of the representation that allows it to represent the same external feature despite the variety of proximal stimuli. The identification of the same success pattern endows the intentional explanation with three distinctive explanatory powers – *generalization*, *predictive* and *counterfactual* powers. Let us assess them.

4.1 Generalization, Predictive and Counterfactual Explanatory Powers

Perhaps the *generalization power* is the most evident one. The recognition of an intentional success pattern gives rise to a general explanation of different instances of the same success pattern in behavioural outputs triggered by different proximal stimuli. By contrast, non-intentional success explanations are capable of explaining why a *specific* behaviour achieved a given result, but not of providing a general explanation of why this kind of behaviour, originated by different proximal stimuli, achieved the same result. This is a *general* and *unified* explanation that embraces all instances of this kind of behaviour. What makes the difference is that the positing of a representation bridges across different proximal stimuli and, hence, give rises to intentional explanations of the form "organism O has the behaviour B because it represents R". The representation plays a *unification role* that makes viable the generalization over different behaviours triggered by different stimuli throughout the organism's historical and present behavioural situations.

Suppose that an organism manifested a successful avoidance behaviour throughout its behavioural history, and that now it is also manifesting this behaviour. What is common in all of these situations is the presence of some predator. Evidently, the pursued result is the avoidance of predators and, so, there is a success pattern present in these cases. How do intentional and non-intentional success explanations explain the organism's avoidance behaviour? The non-intentional explanation consists in the specification of a distinct and independent causal chain of a behavioural output and of the conditions under which it succeeds in avoiding predators. However, it *fails* to establish any connection between this specific behaviour and other avoidance behaviours triggered by different stimuli, since it does not establish any connection between their respective causal chains. In light of the non-intentional explanation, they are completely *independent* chains.

By contrast, the intentional explanation is a *general explanation* of the organism's behaviour in all these situations: the organism represents the presence of the predator, which triggers the avoidance behaviour, which leads to the successful behaviour of avoiding the predator. This is only possible because the intentional explanation abstracts from the specificities of different input stimuli that trigger the behaviour (e.g., a light array coming from a certain direction, another light array coming from another direction, etc.). It unifies these stimuli by establishing what is common to all of them: the presence of the predator. Hence, the intentional explanation is explanatory more powerful because it reaches a *generality level* that non-intentional success explanations are simply incapable of reaching. There are only individual and independent non-intentional explanations of specific behaviours in specific situations; there is nothing capable of unifying them by appealing to something *in common* throughout these specific behaviours. By contrast, the positing of the representation of the predator is precisely the *unifying element* that provides intentional explanations with generalization power.

The positing of representational states also provides intentional explanations with *predictive power*. The identification of the intentional success pattern gives rise to the prediction that the organism with the token representation will behave in the same way, and with the same success conditions, as it behaved in past situations in which the pattern was present.[7] The representation is a predictive element that allows the intentional explanation to imply that the organism will have the same behaviour, with the same success conditions, provided that the same intentional success pattern is present. By contrast, the non-intentional success explanation lacks this predictive power because it fails to identify the intentional success pattern that is present despite the variety of input

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[7] Notice, however, that the organism may fail to have a successful behaviour in virtue of an external problem (e.g., some external element prevents success) or an internal one (e.g., biological malfunctioning). Here I just assume that there is no external or internal problem.

stimuli. This is the case because the non-intentional success explanation lacks an element that bridges across distinct stimuli that trigger behaviours – different input stimuli give rise to distinct causal chains. In the absence of this unifying element, the intentional success pattern is not identifiable.

The intentional explanation of the organism's avoidance behaviour has a predictive power. It establishes that the organism *will* escape whenever the intentional success pattern is present in the avoidance behaviour. The presence of this pattern entails that the organism represents the presence of a predator. The representational state provides the intentional explanation with predictive power. It is the basis for the prediction that the representation of the predator will trigger the successful avoidance behaviour. By contrast, the non-intentional success explanation cannot make any prediction that the organism will have the same avoidance behaviour across different input stimuli because it fails to identify the pattern that bridges across these inputs. At best, it predicts what will happen in situations where exactly the *same proximal stimulus* triggers the behavioural output (e.g., the same light array coming from the same direction).

Last but not least, intentional explanations have *counterfactual power*.[8] The identification of the intentional success pattern via the positing of the representational state allows the intentional explanation to explain what would have happened in *counterfactual scenarios*, provided that the intentional success pattern is present in the behaviour. Suppose that in some past situation there was a predator in the environment and the organism escaped from it. Now consider these counterfactual scenarios: the organism or the predator are in different positions; different lighting conditions, etc. What would then have happened in these counterfactual scenarios?

According to the intentional explanation, the organism would have an avoidance behaviour because it would *represent* the predator. In counterfactual situations, the behavioural outputs that pursue the avoidance of predators are triggered by different input stimuli, but the positing of the representation allows the identification of the intentional success pattern despite this multiplicity of stimuli. By contrast, the non-intentional success explanation is not able to explain what would have then happened because these counterfactual scenarios involve behavioural outputs that are triggered by distinct input stimuli and, hence, by distinct causal chains. The non-intentional explanation lacks the unifying element that would allow it to bridge over the variety of stimuli, that triggers the causal chains, that would lead to successful behavioural outputs. Once again, the unifying element in the intentional explanation is the representation.

The difference between the predictive, generalization and counterfactual powers of

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[8] Sterelny (1995) argues that the counterfactual power is a distinctive explanatory power of intentional explanations since they are robust-process explanations, in opposition with actual-sequence explanations.

intentional explanations lies in *what* they explain. The predictive power is the explanation of *future* behavioural situations (i.e., how the organism will behave). The generalization power is the explanation of *past* and *present* behavioural situations (i.e., how the organism behaved and behaves). Finally, the counterfactual power is the explanation of *counterfactual* behavioural situations (i.e., how the organism would have behaved), in opposition with generalization and predictive powers that are the explanation of *actual* behavioural situations.

Here the following objection may arise to my argument that the identification of the intentional success pattern endows the intentional explanation with *distinctive* predictive and counterfactual powers. After all, non-intentional explanations support the prediction of what will happen and what would have happened. They are based on natural laws that give support to predictions and counterfactual assessments. Based on the law of universal gravitation, one can infer that because of gravity, if I had dropped an apple from my hand, it would have fallen. Similarly, if the apple is dropped, it will fall. So, why is there no non-intentional explanation of counterfactual or future behavioural situations?

Once again, the touchstone is the fact that the positing of the representational state allows the identification of the same success pattern throughout the organism's behavioural outputs, despite the variety of input stimuli. The fundamental explanatory difference is that the non-intentional success explanation is capable of explaining future and counterfactual scenarios that involve the *same proximal stimulus*. So, the non-intentional explanation is capable of explaining what will happen if the same stimulus occurs ("if the same stimulus happens, the organism will escape") and what would have happened if the same stimulus had occurred ("if the same stimulus would have occurred, the organism would have escaped"). By contrast, the intentional explanation is capable of explaining what will or would have happened in scenarios in which a variety of input stimuli occur or would have occurred. After all, the intentional explanation is capable of bridging across these distinct stimuli in virtue of the identification of the same success pattern throughout these scenarios. In sum, the intentional explanation has *more powerful* counterfactual and predictive powers because the number of counterfactual and future scenarios that it is capable of explaining is *much bigger* than the number of counterfactual and future scenarios that non-intentional explanations are capable of explaining.

4.2 Representational vs. non-representational systems

I have developed a dual proposal for the limits of intentionality according to which the success pattern and constancy mechanism conditions are both minimal conditions for intentionality. The presence of a success pattern is not enough for minimal intentionality because there are

intentional and non-intentional success patterns – the intentional one bridges across a variety of input stimuli, while the non-intentional one cannot do that. The dual proposal, hence, rules out the intentionality of success patterns present in the behaviour of several simple organisms.

Consider the antidiuretic hormone example again. The hypothalamus produces it to lower the osmolarity of human blood when it reaches above a certain level. As previously shown, it is clear that the antidiuretic hormone satisfies the success pattern condition. Nevertheless, it is not a representational state. The reason is that the hypothalamus does not employ any constancy mechanism. The production of the antidiuretic hormone is only triggered by the *same* proximal stimulus – high osmolarity. Such a line of reasoning also shows that anaerobic bacteria, paramecia and other tropistic systems are not intentional since they fail to employ the constancy mechanism.

What about sensory states that satisfy the success pattern and constancy mechanism conditions and, hence, are representational? There are plenty of cases. Vervet monkeys have a complex signalling system. They give acoustically different alarm calls in response to at least three different predators: leopards, martial eagles and pythons (Seyfarth & Cheney & Marler, 1980). The alarm signals are produced by the speaker monkey to signal to other monkeys the presence of predators, so they can have specific avoidance behaviours that vary from signal to signal. Let us concentrate on eagle alarms. When the monkeys are on the ground, eagle alarms cause them to look up and/or run into trees in order to avoid the eagle's stoops. When in the trees, eagle alarms cause them to evoke looking up and/or running out of the trees. The authors conclude that these distinct responses to the alarms suggest that "each alarm call effectively represented, or signified, a different class of external danger" (Seyfarth & Cheney & Marler, 1980, p. 802), that is, the eagle's presence. It is clear that vervet monkeys represent the eagle. There is a success pattern, constituted by the biological goal of avoiding predators, and the use of the alarm call as a proxy for the eagle. The production of the alarm call remains constant when there is some eagle around, despite the variety of proximal stimuli. The monkey produces the alarm call at different positions, distances and angles, which implies the employment of a constancy mechanism in its production (e.g., differences in lighting conditions).

Finally, simpler organisms such as some insects are also intentional. The honeybee performs a waggle dance whose properties correlate with the distance, from the hive, of some source of nectar. It dances to show other honeybees the direction of the source of nectar (Von Frisch, 1967). Does the honeybee represent the source of nectar? The waggle dance and the triggering of the foraging behaviour have a success pattern – to gather nutrients – and there is the use of the waggle dance as a proxy for nectar. It is also clear that the production of the waggle dance remains constant in light of the presence of the same source of nectar, despite the variety of proximal stimuli. Since

the flowers, where the honeybee gets nectar, are likely to change every few days when they are in bloom, the honeybee evolved the capacity to learn colours and shapes accurately. For instance, despite the change of colour or shape of some flower, the honeybee can still represent it as a source of nectar (Srinivasan, 2010). The honeybee employs a constancy mechanism in the production of the representational state of the location of nectar, otherwise it would not represent the same flower as a source of nectar despite variations of colour and shape. So, honeybees are representational systems.

5. Input and output explanatory powers

I have defended the claim that a minimal condition for a state to represent an external feature is that it bridges across a multiplicity of proximal stimuli coming from this feature. Does this bridging condition also apply to the behavioural output? That is, is it a condition for intentionality that the organism should produce a *variety of behavioural outputs* to achieve the pursued result? Not at all. There is room for the organism to be intentional even if it always has the same behavioural output triggered by the tokening of the supposed representation. But isn't there an *analogous* explanatory argument in favour of this requirement?

My argument for the requirement that intentional success patterns bridge across a variety of input stimuli appeals to the distinctive *explanatory powers* of intentional explanations. Intentional success patterns require a variety of input stimuli in order to have room for the distinctive explanatory powers of intentional explanations. So why not appeal to the analogous explanatory argument that intentional success patterns should bridge across a variety of *behavioural outputs* because otherwise there would be no room for the distinctive explanatory powers of intentional explanations? One could argue that the bridging across a variety of input stimuli by the intentional success pattern is not enough to leave room for the distinctive explanatory powers of intentional explanations. What is wrong with this argument? I think that the requirement that the intentional success pattern should bridge across a variety of input stimuli is enough to explain why intentional explanations have predictive, generality and counterfactual powers. The contrast with the requirement that the intentional success pattern should also bridge across a variety of behavioural outputs is clear.

The positing of the relevant sensory state as representational is justified because otherwise the recognition of the same success pattern as being present, despite the multiplicity of input stimuli, would not be possible. Notice that the positing of the sensory state as representational is the *unifying element* for the recognition of the presence of the same success pattern despite distinct input stimuli. By contrast, such a positing is not required for the recognition that the same success

pattern is present despite the variety of behavioural outputs. No matter how different the behavioural outputs are, one can still recognise the presence of the same success pattern simply because they pursue *the same result*. After all, they are produced by the organism to achieve this result. So, the pursuit of the same result is the *unifying element* for the recognition of the presence of the same success pattern despite the variety of behavioural outputs. But if that is the case, then the positing of the sensory state as a representation would make *no explanatory difference* for one to recognise the presence of the same success pattern despite the variety of behavioural outputs. That is, such a positing would not play the unifying role required for the recognition of the same success pattern. The conclusion is that the requirement that the representational state should bridge across a variety of behavioural outputs is not a minimal condition for intentionality.

The success pattern and constancy mechanism conditions are minimal conditions for intentionality. My arguments for both conditions are based on the explanatory powers given rise to, respectively, by the presence of the success pattern in the behavioural output and by the employment of the constancy mechanism in the production of the relevant sensory state. But what is the relation between these two explanatory powers?

Let us call "success explanatory power" the explanatory power given rise to by the success pattern and "constancy explanatory power" the explanatory power given rise to by the employment of the constancy mechanism. The fundamental distinction between them is that the success explanatory power originates from the *output process* that is triggered by the tokening of the representation, while the constancy explanatory power originates from the *input process* that causes the tokening of the representation.

On one hand, the presence of the success pattern is required in the behavioural output triggered by the representation. There is a success pattern provided that the sensory state pursues a given result by triggering a behavioural output to achieve it. Hence, the presence of the success pattern gives rise to an explanatory power that is generated by a *constraint* on the relevant *behavioural output* process. So, the success explanatory power is an *output* explanatory power. On the other hand, the employment of the constancy mechanism is a requirement that the sensory state should be able to still represent the same external feature despite the variety of *proximal stimuli* coming from it. Whatever the explanatory power is arising from the bridging across a multiplicity of input stimuli, it originates with a *constraint* on the *input process* that triggers the tokening of the state. So, the constancy minimal condition is an *input* explanatory power.

This is the reason that the dual proposal is *not* ad hoc or arbitrary. It is not a proposal developed only to neutralize the objection of liberality or a proposal that arises from an arbitrary conjunction of two minimal conditions that give rise to two different and unconnected explanatory

powers. Rather, this is a proposal that naturally *arises* from the verification that the constancy mechanism condition originates from a constraint on the input process that triggers the tokening of the sensory state and that the success pattern condition originates from a constraint on the output process that is triggered by the tokening of the sensory state.

What about the similarities between the success and constancy explanatory powers? The positing of a result pursued by the sensory state also gives rise to *generality*, *predictive* and *counterfactual* explanatory powers, just as occurs with the employment of the constancy mechanism. The pursued result allows the recognition that the same success pattern is present despite the variety of behavioural outputs. Such recognition gives rise to the *generality power* because it provides a *general* and *unified* explanation of different *behavioural outputs*, produced in different instances, as pursuing the same result. The explanation bridges across different behavioural outputs by recognising the presence of the same success pattern in all of them. The positing of the external result pursued by the sensory state also gives rise to *predictive* and *counterfactual powers*: it affords the recognition that, despite the production of different behavioural outputs in *future* or *counterfactual* situations, the organism will or would pursue the same result.

However, notice that the success pattern condition does not require that the organism should be able to produce a variety of behavioural outputs to achieve the pursued result. Therefore, there is room for the sensory state to always trigger the same behavioural output and still satisfy the success pattern condition. In such cases, the presence of the success pattern would not give rise to the generality, predictive and counterfactual powers since there would be no variety of behavioural outputs. Nevertheless, the positing of the pursued result would still give rise to the explanation of success. That is, the explanation specifies the external condition under which the behavioural output succeeds in achieving the pursued result. The conclusion is that the explanatory power of the success pattern condition is guaranteed both in situations where there is a variety of behavioural outputs as well as when the behavioural output is uniform.

Last but not least, one may wonder why the constancy mechanism condition alone cannot draw the proper limits of intentionality. That is, why isn't the satisfaction of the constancy mechanism condition sufficient for minimal intentionality, regardless of the satisfaction of the success pattern condition? Why the latter minimal condition is also required? The reason is that if there is no success pattern present on the behavioural output, there is *no explanation of success*. That is, if the behavioural output pursues no result, the behaviour of the organism cannot be assessed in terms of the *success conditions* for achieving the pursued result. As previously argued, this is a fundamental part of the distinctive explanatory power of intentional explanations. The

presence of the success pattern on the behavioural output gives rise to a *success explanatory power* that is absent in the non-intentional explanation, *even if* the organism satisfies the constancy mechanism condition. Furthermore, the employment of the constancy mechanism gives rise to an *input explanatory power* (the one given rise to by a constraint on the input process that triggers the tokening of the sensory state), while the presence of the success pattern on the behaviour gives rise to an *output explanatory power* (the one given rise to by a constraint on the behavioural output process). If the sensory state satisfies the constancy mechanism condition, but not the success pattern condition, it follows that this state gives rise only to an input explanatory power, but not to an output explanatory power. However, the distinctive explanatory power of intentional explanations is constituted by *both* input and output explanatory powers.

6. Conclusion

In this paper, I developed and defended the dual proposal for the limits of intentionality.

Dual proposal. A sensory state represents an external feature provided that it satisfies two minimal conditions for intentionality: (I) the success pattern condition: there is a success pattern in the system's behavioural output and the system uses the state as a proxy for the presence of the external feature in the production of this behaviour; (II) the constancy mechanism condition: the production of the state remains constant when the external feature obtains, despite the variety of proximal stimuli reaching the system's sensory apparatus.

The dual proposal has certain similarities with Peter Schulte's demarcation proposal (2015). He proposes the adoption of the constancy mechanism condition by teleosemantics to neutralize the objection of liberality. However, the two proposals have fundamental differences. First, they diverge on the resulting demarcation of the limits of intentionality. Schulte's proposal is committed to the thesis that it is the biological function that determines the organism's pursued result, while the dual proposal is *neutral* on this issue. The dual proposal just requires the existence of *some* pursued result, no matter whether it is functionally determined or not. Second and most important, the explanatory justifications of both proposals are fundamentally distinct. Schulte justifies his demarcation proposal by appealing to Sterelny's argument (1995), based on the distinction between actual-sequence and robust-process explanations, that counterfactual power is a distinctive explanatory power of intentional explanations. By contrast, the explanatory justification of the dual proposal is twofold. First, the satisfaction of the success pattern condition guarantees the explanation of *success*; second, the satisfaction of the constancy mechanism condition gives rise to

generality, predictive and counterfactual explanatory powers by allowing the recognition of the presence of the *same success pattern* despite the variety of proximal stimuli.

I started this investigation on the minimal conditions for intentionality with the proposal of the success pattern condition. However, this condition is not sufficient for minimal intentionality. The non-intentional explanation would have the same explanatory power by just specifying the relevant causal chain and the organism's pursued result. So, I argued that the employment of the constancy mechanism is required to distinguish *intentional* from *non-intentional* success patterns. After that, I showed that the success and constancy explanatory powers are *compatible* and *complementary*. The result is that the dual proposal is not ad hoc or arbitrary. The satisfaction of the success pattern and constancy mechanism conditions by the sensory state guarantees that its positing as a representation is explanatorily justified. The conclusion is that the dual proposal fulfils the explanatory role criterion for demarcation proposals of minimal conditions for intentionality and, so, solves the problem of demarcation. The lesson to be taken is that a naturalist theory of representation is immune to the objection of liberality as long as it is compatible with both the success pattern and minimal conditions for intentionality.

7. References

Burge, T. (2010). *Origins of objectivity*. Oxford University Press.

Cohen, J. (2015). Perceptual constancy. In M. Matthen (Ed.), *The Oxford Handbook of Philosophy of Perception* (1st ed., pp. 621-639). Oxford University Press

Dennett, D. (1991). Real patterns. *The Journal of Philosophy*, 88(1), 27-51.

Dretske, F. (1981). *Knowledge and the flow of information*. MIT Press.

Ewert, J-P. (1980). *Neuroethology: An introduction to the neurophysiological fundamentals of behavior*. Springer-Verlag.

Fodor, J. (1986). Why paramecia don't have mental representations. *Midwest Studies in Philosophy*, 10, 3-23.

Fodor, J. (1987). *Psychosemantics*. MIT Press.

Goldstein, E. B. (2010). Constancy. In E. B. Goldstein (Ed.), *Encyclopedia of perception* (1st ed., pp. 309-313). SAGE Publications.

Millikan, R. G. (1984). *Language, thought and other biological categories*. MIT Press.

Millikan, R. G. (2004). *Varieties of meaning*. MIT Press.

O'Keefe, J. & Nadel, L. (1978). *The hippocampus as a cognitive map*. Oxford University Press.

Papineau, D. (1993). *Philosophical naturalism*. Oxford University Press.

Papineau, D. (2017). Teleosemantics. In D. L. Smith (Ed.), *How biology shapes philosophy: New foundations for Naturalism* (1st ed., pp. 95-120). Cambridge University Press.

Ramsey, F. (1990). Facts and propositions. In D. H. Mellor (Ed.), *F. P. Ramsey: Philosophical papers* (1st ed., pp. 34-51). Cambridge University Press,

Ramsey, W. (2007). *Representation reconsidered.* Cambridge University Press.

Rescorla, M. (2013). Millikan on honeybee navigation and communication. In D. Ryder, J. Kingsbury, & K. Williford (Eds.), *Millikan and her critics* (1st ed., pp. 87-102). Wiley-Blackwell.

Schulte, P. (2015). Perceptual representations: A teleosemantic answer to the breadth-of-application problem. *Biology & Philosophy*, 30(1), 119-136.

Seyfarth, R. M., Cheney, D. L. & Marler, P. (1980). Monkey responses to three different alarm calls: Evidence of predator classification and semantic communication. *Science*, 210(4471), 801-803.

Shea, N. (2013). Naturalising representational content. *Philosophy Compass,* 8(5), 496-509.

Shea, N. (2020). *Representation in cognitive science*. Oxford University Press.

Srinivasan, M. V. (2010). Honey bees as a model for vision, perception and cognition. *Annual Review of Entomology*, 55, 267-84.

von Frisch, K. (1967). *The dance language and orientation of bees*. Harvard University Press.

Souza Filho, S. F. (2018). *Naturalising intentionality: A teleological approach.* PhD thesis, King's College London. Retrieved October 23, 2021, from https://kclpure.kcl.ac.uk/portal/files/103712183/2018_Farias_de_Souza_Filho_S_rgio_1465852_eth esis.pdf

Sterelny, K. (1995). Basic minds. *Philosophical Perspectives*, 9, 251-270.

Whyte, J. (1990). Success semantics. *Analysis*, 50(3), 149-157.