The Phylogeny Fallacy and Teleosemantics

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Abstract: The use of evolutionary explanations to account for proximate phenomena has been labeled by various authors as an explanatory error, the so-called phylogeny fallacy. In this paper, this fallacy will be analyzed in the context of teleosemantics. I will discuss whether teleosemantics projects that rely on the Selected-Effect Theory of Functions (i.e., mainstream teleosemantics) generally commit the fallacy. To frame the discussion, I will present two *desiderata* that, as argued here, every teleosemantic project must fulfill. The actuality *desideratum*, motivated by Brentano's problem, demands for a proximate analysis of the properties that make a system intentional. The historical *desideratum*, on the other hand, says that a teleological view of intentionality requires a historical dimension in order to understand the causal basis of teleological explanations. While I give some reasons why mainstream teleosemantics might be implicated in the phylogeny fallacy, my main argument aims to highlight an explanatory gap in mainstream teleosemantics: the population perspective on teleofunctions is inadequate to explain the proximate properties of intentional systems. In other words, the account of the historical *desideratum* in population-evolutionary terms prevents an adequate solution to the actuality *desideratum*. This is related to two central goals of teleosemantics: The goal of explaining content determination by recourse to natural selection processes makes it impossible to solve another goal of teleosemantics, the so-called problem of representational status. I analyze this situation and argue that inherited information (sometimes interpreted in a teleosemantic sense) plays the role of closing the gap. This leads teleosemantics into a complex situation: in order to close the gap, it must commit the fallacy. At the end of the article, I propose an alternative to fulfill both *desiderata*, motivated by an evo-devo perspective. I state that lineage explanations have the property of providing historical explanations based on proximate causes.

Keywords: Brentano's Problem; Representational Status Problem; Evo-Devo Teleosemantics; Actuality *Desideratum*; Historical *Desideratum*; Proximate/Ultimate Causes.

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> Speculation about adaptive significance is a favorite and surely entertaining ploy among evolutionary biologists. But the question, "What is it for?" often diverts attention from the more mundane but often more enlightening issue, "How is it built?"
> Stephen Jay Gould, 1983, 152

1. Introduction

The limits of scientific explanations have always been the subject of intense debate. This is also the case in biology. What is the scope of a particular biological explanation? What can we know about development when we look at evolution? What can heredity tell us about developmental processes? Does development tell us about evolutionary pathways? What a particular explanation does and does not explain is a complex question. Here I will analyze a controversial aspect of biological explanations: the phylogeny fallacy; i.e. the use of evolutionary explanations in the developmental sciences. I restrict my analysis to one particular area of research, teleosemantics. Thus, while various analyses of this fallacy generally refer to biological traits, our main target concerns intentional systems.

The aim of this paper is to analyze whether mainstream teleosemantic projects are suitable to solve some central explanatory goals of a naturalistic project of intentionality. I conclude that the population perspective of mainstream teleosemantics is insufficient to explain the proximate mechanisms and processes that are essential for distinguishing between an intentional and a non-intentional system – which is also crucial for addressing the so-called problem of representational status. At the end of this paper, I introduce lineage explanations in teleosemantics as a possible replacement for the population-based explanation of natural selection. Lineage explanations overcome the problems identified in this paper while preserving the advantages of a historical perspective on functions and norms.

The paper is organized as follows. In Section 2, I introduce the phylogeny fallacy and explain why a given explanation is subject to this fallacy. In Section 3, I present the actuality and historical *desiderata* as two central problems that any naturalistic project of intentionality must solve. I present mainstream teleosemantics as a suitable solution to the historical *desideratum*. In section 4, I analyze whether the situation is the same with respect to the actuality *desideratum*. In particular, I suggest that the solution to the historical *desideratum* proposed by mainstream teleosemantics leads to an explanatory gap between the explanation of population evolution and the explanation at the proximal level.

2. The phylogeny fallacy

The term *phylogeny fallacy* was introduced by Lickliter and Berry in 1990 and is based on extensive conceptual and empirical evidence from various fields, such as behavioral embryology (Kuo, 1976; Gottlieb, 1997), developmental systems theory (Oyama, 1985), and developmental psychobiology (Lehrman, 1953). The phylogeny fallacy is a conflation between different biological explanations – it is an explanatory error. In particular, it is a mixing of different levels of biological explanation, namely the use of population-level explanations and individual-level explanations. The problem here is not about inter-level causation. In a specific sense, a population can explain the characteristics of its individuals: an ant colony, for example, can constrain and causally influence the behavior of individual ants. More precisely, therefore, the phylogeny fallacy is a conflation of population-level explanations of natural selection (about how populations change over the course of phylogenetic history) and individual-level explanations (which explain how an organism changes over the course of its ontogenetic history). The phylogeny fallacy is not a problem related to the population causes *per se*, but specifically to the use of population causes of natural selection. For instance, in the case of the ant colony, the explanation of the influence of an ant colony on individual ants (e.g. the queen produces more offspring at the moment of colony expansion) is not an explanation of natural selection (the reproduction of the queen is regulated by mechanisms based on biochemical communication).

The explanatory error of the phylogeny fallacy is that we cannot answer individual-level questions by giving population-level answers about evolutionary processes. Individual-level questions, which relate primarily to developmental biology and physiology, ask about the causal mechanisms that lead to a trait. They require an explanation of how different processes and causes interact at different ontogenetic stages to produce a particular phenotypic outcome. Population-level explanations are concerned with the changes in the population over the course of evolutionary history that produce particular adaptive phenotypes. The nature of the causal explanations provided by the two levels of analysis is different: one level of analysis deals with the mechanism of development, the other with the evolution of populations. Explaining that a particular developmental mechanism has evolved is not the same as explaining how that mechanism operates in developmental processes; claiming that a trait has evolved does not inform us about the processes that build that trait during ontogeny. What do we know about developmental processes just because we say that a trait is the product of natural selection? As Oyama (1985, 159) said, "[it] feels right, but it explains nothing" So when we replace explanations for development with evolutionary explanations, we commit the phylogeny fallacy, a misleading argument. A theory commits the phylogeny fallacy when evolutionary explanations at the population level come into play to explain phenomena at the individual level, i.e. biological phenomena that do not fall within its explanatory scope.

The blending of evolutionary and ontogenetic explanations is not new in the history of biology. This (fallacious) argument has been constructed since the beginning of evolutionary theory (Keller, 2010). Nowadays, however, the characterization of the phylogeny fallacy in terms of causal explanations is understandable and is usually discussed in the context of the classification of biological causes proposed by Ernst Mayr (1961, 1974). According to this, evolutionary biology is concerned with evolutionary causes – so-called ultimate causation – and developmental biology and physiology (or "functional biology" in Mayr's terminology) with proximate causes. He also argued that each type of cause belongs to different explanations with different explanatory tasks. Ultimate causality explains *why-questions*: why are biological systems organized in a certain functional and adaptive way? Proximate causes explain *how-questions*: how different parts of a living system interact to produce phenotypic outcomes. Mayr's distinction can help us illustrate the fallacy: The fallacy is to confuse ultimate causation with proximate causation; it is to explain how-questions by giving why-answers. To return to our example: the statement that an ant colony explains the phenomena of individual ants is not an ultimate explanation, but a proximate explanation. The fact that life is organized on multiple levels has nothing to do with the phylogeny fallacy.

Different theories can commit the phylogeny fallacy. However, the most common theories subject to this fallacy are those that invoke *developmental dichotomies* inherent in the nature-nurture debate: the (explicit or implicit) use of the nature-nurture dichotomies to explain the development of traits, such as innate-learned, instinctive-acquired, inherited-environmental, etc. Critics of developmental dichotomies argue that the explanatory logic behind developmental dichotomies is to separate the causes of phenotypic outcomes (Lewontin, 2000; Keller, 2010; Rama, 2018). The first element of each duplex refers to phenotypes that are influenced, caused or explained by evolutionary processes, while the second element of each duplex refers instead to phenotypes that are influenced, caused or explained by ontogenetic processes. For example, the startle reflex in newborns is usually an example of an instinct or innate ability, whereas the ability of some birds to identify their own species due vocal learning would be a case of an acquired capacity. There are several problems associated with developmental dichotomies (Mameli and Bateson, 2007). However, the problem with using developmental dichotomies is that we do not say much about the causal processes that give rise to a trait just because we say it is an innate or evolved trait; developmental dichotomies are devoid of explanation when we are looking for the mechanisms of development. In other words, the use of developmental dichotomies to address how-questions about proximate processes is a case of the phylogeny fallacy. This problem has been described by many authors (Kuo, 1976; Gottlieb, 1997; Lickliter and Berry, 1990; Oyama, 2000; Griffiths, 2013; Bateson and Gluckman, 2011). Nativism may say something about developmental processes (e.g. that a trait is robust or that it is present from birth), but that is quite different from a causal explanation of how that trait came to be. If we want to the proximate mechanisms that produce a trait, it seems a pointless strategy to study the evolution of populations, or as Bateson and Gluckman (2011, 129) emphasized, "[t]he use of the distinction generates in researchers the false illusion that certain important empirical questions have already been answered."

Sometimes the phylogeny fallacy is not considered a problem if we accept that all traits result from the interplay of nature and nurture – that traits arise from the interplay of evolutionary causes (emanating from the populational, pre-ontogenetic level) and ontogenetic causes (emanating from the individual, ontogenetic level). This position is usually referred to as "consensus interactivism" (Stotz, 2008, 360; Oyama, 2000). However, this interactivism is still problematic: even if we argue that the causes interact, we are still dealing with two different levels of explanation. The problem with the phylogeny fallacy is not that assuming certain causes (e.g. genetic) leads to ignoring others (e.g. environmental) – this might be another problem (Kuo, 1976), not to be discussed here. Rather, the problem is that population-level causes are used as substitutes of individual-level causes. To claim that innate causes or mechanisms interact with learned ones is to conflate population-level and individual-level causes or mechanisms, and ultimately to argue that population-level explanations do play a role in developmental explanations. As a result, consensus interactivism still engages in the fallacious argumentation of the phylogeny fallacy.

3. The historical *desideratum* and the actuality *desideratum*

I have clarified the core of the phylogeny fallacy. Now it is time to introduce teleosemantics. Two central *desiderata* in the explanation of intentionality will be in the foreground: the historical and the actuality *desiderata*.

3.1. Brentano and the actuality *desideratum*

A classic problem in the foundations of mind and behavior concerns the normativity of mental representations – the fact that the content of our mental states may or may not correspond to the state of affairs in the world. This is well illustrated by the fact that our mental states can misrepresent the world. The possibility to misrepresent the world is not just a philosophical problem, but an inherent and central property of representations. Psychological explanations – within a cognitivist paradigm – explain behavior as a phenomenon caused by internal mental states that represent the world and are guided by internal goal states. This inevitably allows for the possibility of behavioral errors, which consist of not reaching goal states. Since behavior is (in part) caused by our representations of the world, misrepresentations are not just a reported case in our daily lives or a problem in experimental psychology, but an inherent and necessary condition for an adequate psychological explanation based on mental states and goal-directedness.

Frank Bretano (1874 [1995]) definitely saw mental states about non-existent entities as an obstacle to an adequate (scientific) psychological theory. In a world of causes, how is it possible for an entity to be associated with something that does not exist? How does natural science fit with this kind of normative explanation? Suppose we have two different systems, X and Y. X is an intentional system, e.g. a particular human being, while Y, e.g. a stone, is not an intentional system. A naturalistic theory of mental representation must specify the distinguishing features between X and Y that make the former an intentional system and the latter a non-intentional system. Which inherent characteristics of X are missing in Y? What are the differences between X and Y that make the former an intentional system and the latter not? It is important not only to determine the inherent attributes of X that give it intentionality, but also to clarify why the absence of such attributes in Y makes it non-intentional. Why is the motion of planets non-intentional while human behavior is intentional? What properties do intentional systems exhibit that are absent in planetary motion? Brentano was of the opinion that a naturalistic answer to these questions is not possible, or to paraphrase Kant (1790 [2007], 228), it is absurd to believe that there would be a Newton for mental states.[2] A naturalistic answer to these questions must conclude that intentionality is an inherent aspect of nature and that intentional explanations are scientifically justified. I call this requirement the actuality *desideratum*:

> (AD) *Actuality Desideratum*: A naturalistic theory of mental representations must explain the proximate causes that make the difference between an intentional system and a non-intentional system.

The relevance of AD for teleosemantics will be clearer later on when the representational status problem is introduced in Section 4.2. However, to better appreciate the significance of the AD, note that the errors are made by individual systems. Something happened to a certain individual that caused him to make a mistake. This proves the requirements of a proximate analysis of the properties of individual intentional systems, as demanded by AD. Suppose now that we have two intentional systems, x1 and x2, belonging to the same species X. How can we judge, for example, that x2 functions well while x1 does not, without looking at the proximate differences between these systems? What are the differences between x1 and x2 that caused the latter to be wrong? In short, we need to explain the proximate processes and causes of a system that make it intentional. We need to explain the AD.

3.2. MT and the historical *desideratum*

Teleosemantics is a central field within the philosophy of mind (see Papineau (2017), Neander (2008), and Schulte and Neander (2022) for introductions to teleosemantics). As mentioned above, a naturalistic explanation of mental representation must show how natural science can provide a solid foundation for

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[2] In reference to Kant's famous conclusion that there would never be a scientifically comprehensible account of teleology in biology such as the one Newton provided for physics (see Rama (2023) for parallelism between Brantno and Kant's views).

psychosemantic norms. Teleosemantics is presented as a naturalistic theory for precisely this reason: it aims to provide a solid scientific basis for normative explanations. Its naturalistic roots come from biology. Normative psychological explanations inherit their normativity from the biological function of representational systems. The proper function of a representational system is defined by its biological function.

Depending on which biological function theory one chooses, different teleosemantic projects can emerge. Here I will discuss mainstream teleosemantics (MT) – the teleosemantic theory anchored in the Selected-Effect Theory of Functions (SE for short; see Neander, 1991; Millikan, 1984; Papineau, 1984). The core of SE is that the function of a trait (in living systems) is defined by natural selection processes – a phenotype must do what it was selected for by natural selection.[3] MT's application of this theory states that the content of a representation – what a representational system must represent – is determined by selection processes over such representational systems during phylogenetic history. The function of a representational system is fixed by the effects of these systems in previous selection processes. To return to the classic example: The prey recognition system of frogs produces representations of flies because its function is to recognize them. This biological function is explained in evolutionary terms, more specifically by the causal role (Sober, 1984) of the prey recognition system in the natural selection processes during the evolution of frogs. Because of its biological basis, MT is considered a rich framework for understanding mental representations from a naturalistic perspective. Since its inception, MT has spawned several ramifications (e.g., between producer- and consumer-based theories) and a wide range of applications – from bee dancing to the visual system of frogs to human desires – making MT the main naturalizing project of intentionality. The goal of using this strategy to solve Brentano's problem is nicely illustrated in the following quote:

> Teleological theories of mental content are intended to be naturalistic theories. They take seriously the idea that intentionality is a biological phenomenon. Further, their proponents think that, not only have cognitive systems evolved, but—and here is the crucial, controversial claim—in the fact of this evolution lies the solution to Brentano's problem. (Neander, 2008, 384-385)

Precisely, one of the advantages of MT arises from the foundations of Darwin's theory of natural selection – the source of normativity in MT. The naturalization of teleology has always been a headache for philosophers and theorists of biology. It seems perfectly natural to give living systems goals and purpose, but there are serious obstacles to doing so in scientific explanations. The main problem with teleological explanations is causality. More specifically, the temporality of teleological causality. Supposedly, scientific explanations cannot violate the *principle of causal asymmetry* (Potochnik, 2017): causal relationships are always asymmetric; past events cause future events, not the other way around. While the foundations of science require that present events cause future events, teleological explanations make it seem as if present events (e.g. pumping blood) are caused by future events (the effects of pumping blood). There are many answers to this question. However, MT naturalizes intentionality on the basis of evolutionary processes. Here we find the central key to dealing with this question: recursive A-B-C chains. These chains are looped sequences of events. If the effect of event A is the cause of another event B, which in turn causes C, and C in turn causes A, then A-B-C-A chains are recursive processes in which causes and effects interact according to the asymmetric principle. From an evolutionary

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[3] There has been debate about whether it is appropriate to extend SE beyond living systems. Millikan originally wanted to do this, but Neander rejected it. I will limit myself here to analyzing functions in living systems, especially intentional systems. I thank an anonymous reviewer for pointing this out.

point of view, the effect of past selection leads to new organisms that are also under the control of selection. In this context, inheritance is the key. Inheritance enables recursivity: trait A in one generation produces a series of effects by which it is selected so that A reappears in the next generation through inheritance. Asymmetric causal relationships are thus preserved insofar as the effects of past events cause current events. This is the real causal structure of teleological explanations (Neander, 2018). The key message is well expressed by Nicholas Shea (2018, 59): "Without the historical angle we would be back to the mystery of teleological causation, the mystery of how it is possible to explain a cause in terms of the type of effect it is likely to produce." Following Rama (2022, 65) I refer to it as the historical *desideratum*:

> (HD) *Historical Desideratum*: Without a historical dimension concerning an adaptive bias operating in the past, there is no teleological (and intentional) analysis in the present.

MT, building on its Darwinian foundations, has the advantage of accounting for the HD. This has also helped to overcome other alternatives to biological function theories that lack a genuine teleological dimension (such as Cummins' (1975) theory). From this evolutionary perspective, the effects of past selection cause current events. As Macdonald and Papineau (2006, 10-11; emphasis in original) write:

> On this account of function, functions are the upshot of prior processes of selection. A trait has a function if it has been designed by some process of selection to produce some effect [...] An effect of a trait counts as its function if the trait has a certain history: in the past possession of that trait produced the relevant effect, which in turn had the consequence of facilitating the reproduction of items with that trait. In such cases, it is natural to adopt teleological terminology, and say that, in the normal case, the trait exists *because* of an effect the trait can produce, or *in order to* fulfill its function.

Continuing with the analogy used before (Section 3.1), not only was Darwin the Newton of the Blade of Grass, as Mayr (1998, 131) claimed, but also the Newton of mental states, as MT intends. So now, having clarified the AD and the HD, my question here is simple: is it possible to provide an evolutionary explanation of teleology based on natural selection that explains the proximate properties of individuals? Can MT's solve the HD and the AC at the same time? If this is possible, isn't it the phylogeny fallacy?

4. The phylogeny fallacy in MT

I end the previous section with many questions. Let us tackle them. In this section, I first show some clear reasons why MT commits the fallacy. Then I elaborate on the reasons why MT needs to explain the AD. My main aim in this paper, however, is not to argue that MT commits the phylogeny fallacy. Rather, in section 4.3, I show the explanatory gap in MT that prevents an adequate solution to Brentano's problem. This is the main conclusion of this paper. Finally, in Section 4.4, I discuss the way in which this gap is usually closed within and beyond MT.

4.1 Developmental dichotomies in MT

A preliminary reason why MT commits the fallacy is an "argument by ostension" (Neander, 2017a): naming the texts in MT that commit the fallacy. This can be seen in the ubiquitous use of developmental dichotomies in the teleosemantic literature. The result is a classical view according to which some representations are innate and others are learned. Nativism is usually defended in teleosemantics, an innateness is systematically attributed so several traits, such as innate perceptual-cognitive mechanisms (Millikan, 2006, 109), skills (Millikan, 2000b, 54), behavior (Dretske, 1988, 123), capacities (Neander 2017a, 82) sensory-perceptual systems, (Neander 2017a, 82), information (Neander, 1995, 111), representations (Neander, 1995, 112), beliefs (Papineau, 1984, 557), mental states (Marinez, 2013, 448), functions (Artiga, 2010, 206), or mechanisms (Artiga, 2010, 206). As expected, innateness is associated with the evolutionary level of explanation and explained in terms of evolved genetic programs; these innate traits are "genetically programmed systems" (Millikan, 2000a, 86), "explained in terms of such genetic selection" (Papienau, 2016, 118), "causally explained by the genes inherited" (Dretske, 1988, 92), "[explained by] genes coding for behavior" (Dretske, 1988, 125), "rigidly programmed behavior" (Dretske, 1988, 125), or "strongly phylogenetically determined" (Artiga, 2021, 2).

MT advocates an evolutionary and population-based perspective on biological functions. However, ontogenetic functions are also part of MT. The commitment to ontogenetic functions is usually related to the inadequacy of solving certain problems that arise from a purely evolutionary perspective (Papineau, 2017). *The problem of variation*: How is it possible that there are different representational capacities within one and the same species (e.g. between cultures)? *The problem of novelty*: How can new representations arise in humans (e.g. ELECTRON, WIFI, BITCOIN) if these representations were not subject to slow and gradual natural selection processes? *The problem of environmental dependence:* How can we explain the role that experience plays in the acquisition of representational skills? Learning processes provide evidence that ontogenesis plays a role in determining content. Given these scenarios and the need for an ontogenetic dimension, ontogenetic functions came into play.

The result is a mixture of explanatory strategies. The content of some representations is fixed by natural selection, while the content of others representations are fixed by ontogeny. This explanatory strategy illustrates the relationship between developmental dichotomies and the invocation of both types of functions. If a representation is innate or inherited, then SE theory explains its content. Instead, the content of culturally specific, learned, or environmentally conditioned representations is fixed by ontogenetic learning processes. For example: "In the case of *innate abilities,* no matter what dispositions a mechanism happens to have, what determines its abilities is what it *was selected for doing*. In the case of *learned abilities,* what natural selection selected for was the ability to learn in a certain way. It was selected for mechanisms that became tuned through *interaction with the environment* to do things of useful kinds" (Millikan, 2000b: 63; emphasis added). Neander also claims in this sense: "[W]hile the functions can be determined by phylogenetic natural selection, operating on a population over generations, they can also be refined or altered by ontogenetic processes involved in development or learning (Neander, 2017a, 153).

As expected, sometimes, the relationship between ontogenetic and phylogenetic functions adopts a consensus interactivist position. The content of representations is explained at the interplay of both evolutionary and ontogenetic functions, as Millikan puts it: "Inner states, such as the perceptual and cognitive states of organisms, can have proper functions that vary as a *function of environmental input* to the *genetically programmed* systems responsible for producing them" (Millikan, 2000a, 86; emphasis added). A similar view is supported by Dretske (1988, 31; emphasis added): "The old nature-nurture dichotomy is too simple. Behavior is the product of a dynamic interaction between genetic and environmental influences. The *innate and instinctive is inextricably intertwined with the learned and the acquired.*"

4.2 MT and actuality *desideratum*

However, this “argument by ostension” has only shown that some teleosemantic projects commit this fallacy. While this is problematic if one understands the phylogeny fallacy as a serious epistemological flaw, the argument by ostension does not show that the use of dichotomies in MT is essential or related to the foundations of MT. We could eliminate them and leave MT almost intact.

Nonetheless, my aim here is not limited to any particular literature. I want to question whether the population perspective of MT is appropriate for solving the AD. My conclusion will be that MT cannot solve this task. There is an explanatory gap between explaining population change by natural selection and explaining the proximate processes that make a trait intentional (the AD). To close this gap, MT must commit the phylogeny fallacy. My argument constrains the explanatory goal of MT for an adequate naturalistic project of representational mental states.

Before entering the debate, it is important to emphasize the importance of solving the AD for a teleosemantic project.[4] We have already argued that the AD is an obstacle to the naturalization of intentionality that needs to be surpassed. Intentionality is tied to individuals, and the absence of intentionality is also attributed to individuals. So there must be some latent properties in these individuals that make this difference. The same applies to the case of misrepresentation: there must be an actual difference between a system that represents correctly at time t1 and misrepresents at time t2. A system under the influence of drugs or hallucinations might misrepresent the plant on its balcony that it always knew was a plant. It is the proximate effects of drugs that make the difference. Representations are not Platonic ideas or Fregean senses. They are “here and now”, just like my computer, my cat, or the moon.

The commitment of MT (or any naturalistic teleosemantics) to solving AD is well appreciated when we make the distinction between teleosemantics as a theory of content and teleosemantic as a theory of representational status, a distinction well elaborated by Schulte and Neander (2022). A theory of content must explain in virtue of what a representation has the content it has, and not a different content (e.g. whether a frog catching a fly represents a fly, something edible, or whatever small black thing is flying out there). Instead, a theory of representational status must explain why one system (e.g., a fish) has representations while another system (e.g., a rock) does not. As Schulte and Neander (2022) note, both questions must be resolved by MT, and most teleosemantic projects address them together. We are concerned here with teleosemantics as a theory of representational status. As Schulte and Neander (2022) note, teleosemantics has typically been more concerned with a theory of content. I can see that this is to be expected. In general, all proposals in MT accept a common answer to representational status based on the SE. However, when it comes to providing a theory of content, differences have emerged within MT, especially between producer-based and consumer-based accounts. My argument comes from outside MT and therefore does not discuss the problems of content determination within MT, but rather the response to representational status anchored in the SE. The need to explain representational status is what the AD makes explicit: to explain in virtue of what a system has intentionality while other systems do not.[5]

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[4] I thank an anonymous reviewer for pointing out the importance of making this explicit and clearer.

[5] I am very grateful to an anonymous reviewer for pointing out the important distinction between theories of content and theories of representational status. It is central to my discussion and was not explicitly mentioned in the first manuscript.

Finally, the explanatory target of Brenatno's problem and MT is not to explain normative explanations in evolutionary biology. Rather, the commitment of MT to provide a proximate analysis is explicit to the fact that the explanatory targets of MT are functional explanations in neurophysiology and cognitive psychology (Schulte and Neander, 2022; Millikan, 2021; Mann and Pain, 2022). This is well elaborated in Neander (2017a, 2017b), where she emphasizes that the SE plays a role in normative neurophysiological explanations. Teleosemantic norms may (though not always) be present when neurophysiologists and psychologists provide functional explanations for normative behavior. It is generally recognized that these types of explanations are proximate explanations. At least (neuro)physiology was explicitly on Mayr's list of proximate disciplines in biology. So my point here is only that MT plays (or is supposed to play) an explanatory role in proximate explanations.

Now that I have shown MT's motivation for solving the AD, the question of how arises: how is it possible for a theory of representation based on an ultimate explanation to play an explanatory role in proximate explanations? How can MT explain the representational status problem? How does MT solve the AD?

4.3 Population explanations and the trait-token distinction

I have pointed out that MT is appropriate for dealing with the HD. Past selection of populations explains biological functions. Because there was a past history of selection, we have functions in the present, or as Garson (2016, 51) stated, "in the absence of selection, the activity [of that trait] should count as a lucky benefit, and not as a function." Riddles come when we look at the AD.

First, note that the teleological functions and thus the biological norms of the SE are defined at the population level. This is explicitly assumed by mainstream teleosemantics. First, because natural selection is a population process: it explains how heritable fitness differences in populations lead to adaptations. Second, the population approach of the SE is central to resolving the question of the normativity of intentionality. The SE thus defines norms at the population level: the biological function of a trait is defined according to the role it has played in selection processes. We refer here to trait types, not tokens. Biological norms in the SE are therefore properties of trait types, i.e. properties of a population. This allows the SE to define errors in the misinstantiation of a type: when a token does not function according to the type to which it belongs. An error occurs when a token does not match its type.

Does this really solve the problem of misrepresentation? The distinction between type and token is related to the delineation of levels presented in Section 2. Types refer to populations, tokens to individuals. Can we explain the proximate properties of tokens by defining proper functions as a property of types? How can we explain the proximate properties of a token that makes a mistake if the norms are defined at the population level? Natural selection itself cannot answer these questions. They all require an explanation of individual traits and processes, not population processes and trait types. Natural selection may be able to explain why a trait type works the way it does, but it is not sufficient to explain how a trait works in a particular way. As argued in this essay, Brentano's problem and the problem of misrepresentation require determining the proximate processes responsible for intentionality being part of nature. MT is blind to this kind of explanation.[6]

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[6] Bickhard (2003) comes to a similar conclusion by stating that MT is causally epiphenomenal at the individual level.

The fact that natural selection explains populations and not individuals leads to an explanatory gap between solving HD on the basis of evolutionary selection processes and AD's call for proximate-level analysis. From the perspective of the SE, what is the difference between an intentional system X and a non-intentional system Y? In contrast to Y, X has its origin in a phylogenetic journey shaped by natural selection, argues MT. However, this explanation falls short because it does not reveal the proximate features of X that give it intentionality. What insight does natural selection offer to understand the proximate properties of an intentional system? Unfortunately, not much. We can know nothing about the proximate mechanisms of a living system if we say that it evolved by natural selection. We do not get any new information about the differences between two systems that evolved by natural selection just because we say they evolved by natural selection. This is an obstacle to solving the problem of representational status. Human hands have evolved by natural selection (or so we assume), and they are definitely not an intentional system. So there must be a certain difference between a human hand and a belief state that makes the former a non-intentional trait and the latter a fully intentional one. This difference cannot lie in natural selection. There must be some proximate phenomena that make the evolution of human hands a non-intentional state and the evolution of belief states an intentional state. In other words, MT requires the distinction between intentional and non-intentional systems, –i.e. the very problem of representational status. As explained above, a proximal analysis is required to distinguish between intentional and non-intentional systems, e.g. between a plant and a human mind. MT presupposes that this distinction exists. MT is not a theory about the evolutionary origins of intentionality. This might be a different evolutionary strategy for Brentao's problem. But MT presupposes that the problem of representational status has already been answered.

The problem becomes even more difficult when we consider systems that are eligible for intentional attributes, such as plants. Plants have incredibly complex communication systems that are capable of processing a variety of environmental information under different biochemical substrates (see Sultan (2015) for several examples). Are plants intentional systems? Definitely, plants have evolved through natural selection. The point is that if we want to argue that there is a difference between plants and e.g. human brains, natural selection does not mention this difference. And that's what the problem of representational status is about, and that's what AD is asking. The discussion about the intentionality of plants takes place at the proximate level: What do plants do? How is information processed? What are plants missing? Attempting to answer these questions requires an understanding of what intentionality *is*. These questions have nothing to do with ultimate explanations. The analysis of what an intentional system is supposed to be is a proximate analysis of the complex and incredible proximate processes and causes that generate intentionality.

My argument is in some ways intertwined with the imaginary experiment of the swampman's case (see Davidson (1987) for the original argument). The swampman is created as a replica of a human by a sudden, random event, such as a random collision of atoms. Both the human and the swampman exhibit identical behavior and physiological characteristics. The swampman, however, lacks an evolutionary history and therefore lacks intentionality. The classic problem is that this is a counterintuitive conclusion since there is no proximate difference between the swampman and the human. However, I can note something else: namely, the inability of SE to explain the proximate properties of humans! Swampman is supposedly identical to a human "molecule for molecule". The proximate properties of swampman are identical to the proximate properties of humans. But MT offers no tools to explain the proximate properties of humans. This deficiency arises because the SE fails to get "under the skin" of the system and examine its proximate properties. Not only is the SE unable to point out the proximate causes and processes that leave the swampman without intentionality, but it is also unable to tell us which proximate causes and processes make a human being an intentional system. This is, after all, the problem of representational status again.

4.4 Inherited information: bridging the gap?

The argumentation so far does not allow the conclusion that MT commits the phylogeny fallacy. It merely points out a gap between the solution of the HD from a population-evolutionary perspective and the solution of the AD. I think this is sufficient to point out a problem for MT. We could simply say that because MT aims to naturalize intentionality, it must commit the fallacy. I think that various proponents of MT believe that ultimate explanations can be present in proximate explanations. We saw it in the various uses of dichotomous categories in MT literature, in the advocacy of consensus interactivism, or in Neander's analysis of normative neurophysiological explanations (Neander, 2017a, 2017b). The core message, however, is different: MT seems to fail in one of its main goals, namely to explain what makes a system intentional (and how we can explain it from a naturalistic point of view). MT answers this question by pointing to properties that are not present in the system we are explaining but in the history of a population to which the system belongs.

The problem is how to download the properties of populations to the proximate level. Certainly this problem is not specific to MT, but it is indeed a central topic of discussion in the philosophy of biology (Walsh, 2015). For the same reason, the phylogeny fallacy and the aforementioned explanatory gap are not specific to MT, but a general explanatory pattern in the philosophy of life sciences. How is the gap normally closed? How has the population perspective based on natural selection processes explained the downloading of ultimate causes onto organisms? The main element is the view of heredity espoused by the neo-Darwinian Modern Evolutionary Synthesis, the theory on which MT has been based since its inception and which has helped close the gap on some occasions. Let's take a closer look at this theory and its connection with MT.

The view of heredity at play here was popularized by Dawkins under the replicator theory. However, this view was already present in biological thought long before Dawkins popularized it within and outside the scientific field (Ågren, 2023). The basic idea is that certain units of information are transmitted from parents to offspring. These units cause the development of certain characteristics on which selection acts. These units became known as genes, but they may also be epigenetic inherited information or culturally-transmitted information. Crucially, the correlation between inherited information (genetic or otherwise) and phenotypic information has been sufficient to do evolutionary biology since Mendel's laws were rediscovered. At the same time, however, the analysis of inheritance has been decoupled from the analysis of development (Amundson, 2005; Walsh, 2015, Rama, 2024c). Inheritance is the transmission of information, development is the expression of information. How information is expressed is relatively independent for evolutionary purposes.

I noted that the HD was solved by appealing to past, recursive chains in which a trait is confronted with multiple rounds of environmental pressures that define its function. I also emphasized that inheritance is key: the possibility of promoting a historical teleology relies on the fact that the same trait reappears generation after generation. It is definitely not the same trait token (e.g. my hand), but the same type of trait (e.g. the human hand). In the explanations of natural selection, the types of traits are the relevant ones to describe changes in the population. For this very reason, it is not necessary to go into the details of how traits are constructed. Mendel's laws or Morgan's advances in genetics were based on the assumption that certain inherited factors or determinants will produce the trait in the next generation. There was no proximate analysis. Since natural selection was integrated into the theory of heredity, replicator biology has been central for ultimate explanation.

In this context, several authors have argued that we must be cautioned against committing the phylogeny fallacy (Keller, 2010; Griffiths, 2013): Explaining the evolution of inherited information is a different task from explaining how that information is expressed in development. It is one thing to show that a trait is caused by inherited information. It is quite another to show how developmental processes give rise to such a trait. The latter is a proximate issue, whereas the former is not. The mixing of causes due to the use of hereditary information was a problem of Mayr (1961, 1974) himself. Living systems are teleonomic systems, he argued, and this ability is explained by the fact that a living system is controlled or generated according to a genetic program. However, Mayr seems to base his view on the fact that the inherited information has evolved through natural selection, rather than on the developmental mechanism that produces the "programmed traits". In other words, Mayr's teleonomy is not based on the fact that there is a genetic code, – i.e. a linear correspondence between amino acids and codons. This is not the place of teleonomy. Rather, teleonomy is based on the fact that the inherited information – in particular the nucleotide sequences that generate particular codons – has evolved through natural selection. Inherited information is seen as the ultimate cause of the emergence of the teleonomy of organisms. Mayr's teleonomic view probably represents the clearest way to close the gap using inherited information. As a result, many had noticed the phylogeny fallacy behind his reasoning (Lickliter and Berry, 1990; Griffths and Stotz, 2013, Stotz, 2019).

Mayr's proposal could be understood as a teleosemantic theory of inherited information. The most influential theory of this type was proposed by Shea (2007, 2013; see also Maynard-Smith (2000)), in which the inherited information has the function of producing certain characteristics that are due to previous selection of the inheritance systems that are responsible for the transmission of the inherited information. As already mentioned, this view is independent of how the inherited information produces a trait. So if the goal is to explain the proximate processes that produce a trait, then Shea's view is uninteresting. In other words, following the reasoning of Griffiths (2013), an adequate developmental explanation cannot be provided by looking at inherited information. So far, this is not problematic if our aim is not to deal with proximate causes.

However, teleosemantic projects in cognitive science – MT – are different. They do not aim to explain inherited information, but the information (the use or production) in cognitive systems, – i.e. intentional information in psychological processes. As detailed in this paper, MT must address proximate issues. Thus, a replicator view or a teleosemantic view of inherited information cannot be the strategy to explain AD. This would presuppose that inherited information plays an explanatory role that it cannot explain. Moreover, the problem of representational status remains. Therefore, it is important to separate the two types of teleosemantic projects. Inherited teleosemantic information cannot help MT. They have different explanatory goals. Intentionality is not downloaded in organisms by inherited information.

A direct link between replicator biology and MT is that it has been made clear that the concept of replication is at the heart of teleosemantics: "[c]entral to the etiological [those teleosemantic projects based on the SE] account is the idea that individuals gain functional traits as a result of being replicated" (Macdonald and Papineau, 2006, 12; emphasis in the original). The most explicit development of the replicator concept in teleosemantics is attributed to Millikan (1984, chapters 1 and 2), who uses the concept of copying to define proper functions in selection processes (see also Neander, 2017a, 135). The result is that MT must resort to the notion of replication to explain the proximate properties of intentional systems in order to bridge the gap between types and tokens. To explain individual properties (required by the AD) on the basis of population properties (natural selection), we must appeal to replicator explanations of development based on inherited information, i.e., we must engage in the misleading argument of the phylogeny fallacy. As I said, my point is not to show that all of MT has adopted a replicator. Rather, the problem is that if this is the case, then the phylogeny fallacy is committed.

5. Concluding remarks

At the beginning of this article, I introduced the phylogeny fallacy, the distinction between different levels of explanation and its connection with developmental dichotomies. Then I presented the actuality and the historical *desiderata*. The first is motivated by an analysis of Bretnao's legacy on the problem of intentionality, a central explanatory goal of teleosemantics. The historical *desideratum*, on the other hand, refers to the analysis of teleology. Among the many teleological content theories that could be developed, MT has the alleged advantage of being based on a historical view of teleology that is central to solving the problem of teleological causality.

Does MT commit the phylogeny fallacy? I think so. The argument by ostension in Section 4.1 is one way of showing this situation. However, my aim was not this, but to demonstrate a gap between the historical view of MT's teleology and the proximate requirements of intentionality that the AD makes. MT is perhaps more coherent if we consider it only as a theory of content determination. But that is not its only aim, and it is definitely not the problem Brentano had in mind. MT thus seems to leave the problem of representational status unexplained. When the question of naturalization comes to the fore, the problem of representational status is undoubtedly the central one: it requires an explanation of what intentionality is – which a cat has but a plant does not. This is a proximate issue, which as such deserves a proximate analysis.

Is there an alternative? Certainly, there are many. Organizational functions, for example, have led to some proposals in teleosemantics (Bickhard, 2003; Schroeder, 2004; Barandiaran and Rama, Under Revision), as have developmental approaches based on agency (Walsh, 2015; Rama, 2021, 2024a). This paper is not the place to find a solution to the AD or the representational status problem. But we can place two constraints on the *desiderata* discussed: Is it possible to construct a teleosemantic theory that satisfies both *desiderata*? There seems to be a tension between them. One seeks explanations based on past events, while the other demands explanations based on current phenomena. We have seen that the commitment to natural selection seems to be suitable for one *desideratum*, but not for the other. Also, some proposals based on intrinsic normativity – such as organizational functions or theories of agency – provide a proximate analysis of teleology – e.g., the analysis of thermodynamic properties, operational closure, regulatory mechanisms – but do not provide a historical account (Hundertmark, 2024). The required theory seems to ask for a historical explanation of intentionality based on proximate causation. In other words, they can explain how adaptive changes in proximate causes over history give rise to the intentional properties of living systems. In other words, to explain how adaptive changes in proximate causes across history produce the intentional properties of living systems. Do we have this kind of biological explanation in our toolbox? Yes, we do, the lineage explanations (Calcott, 2009; Kaiser, 2021) that play a central role in evolutionary developmental biology (evo-devo). Let us conclude this paper with some ideas that will guide future work in this area.

Evo-devo is one of the most important biological fields that opposes central tenets of the Modern Synthesis. One of the core ideas is that it is important to understand proximate mechanisms of development to account for central evolutionary questions such as phenotypic variation and novelty (Wagner, 2014). Lineage explanations are a common way to represent evo-devo explanations by focusing on how developmental mechanisms change over time. In other words, how certain traits of organisms are changed (or not) across lineages. Evo-devo explanations have been argued to represent a middle ground between the ultimate-proximate distinction proposed by Mayr (Calcott, 2013; Brown, 2021): they are historical and deal with evolutionary issues, while at the same time they are proximate and deal with developmental issues. This is exactly what we have been looking for: On the one hand, we could argue that representational norms are (partly) determined by lineage histories, while on the other hand we look for the proximate mechanisms responsible for the formation of representational norms at the proximate level. The problem of representational status is to be solved on the basis of the fact that there must be some developmental differences between the processes of generating an intentional trait and the processes of generating a non-intentional trait. The developmental processes that give rise to a horse's mind must be qualitatively different from those that give rise to a leaf, and therefore we could say that plants are not intentional systems, but a horse's mind is. Evo-devo explanations look precisely for differences in developmental mechanisms. Perhaps it is a difficult empirical task to uncover these differences, but it is important that, unlike population explanations, lineage explanations can account for such differences. Certainly, some specific evo-devo questions deserve answers, such as how lineage explanations integrate proximate views of inheritance (Amundson, 2005; Giresemer, 2016; Veigl et al., 2022; Cortés-García et al., 2024) or how the structuralist leanings of evo-devo explanations incorporate functional explanations (Love, 2007; Newman, 2023; Rama, 2024b). This is only an initial proposal that has not yet been explored in the literature. An evo-devo teleosemantics project is based on historical, proximate explanations and as such could be a prominent place to look for the evolution of those phenomena that make Brentano skeptical of possible scientific explanations.

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