Received: 3 February 2024 | Revised: 8 June 2024 | Accepted: 17 July 2024

DOI: 10.1111/rati.12422

SPECIAL ISSUE ARTICLE

WILEY

Four false dichotomies in the study of teleology

Daniel W. McShea[1] | Gunnar Babcock[2]

[1]Biology Department, Duke University, Durham, North Carolina, USA

[2]Department of Microbiology, College of Agriculture and Life Sciences, Cornell University, Ithaca, New York, USA

Correspondence
Daniel W. McShea, Biology Department, Duke University, Box 90338, Durham, NC 27708, USA.
Email: dmcshea@duke.edu

Gunnar Babcock, Department of Microbiology, College of Agriculture and Life Sciences, Cornell University, 123 Wing Dr., Ithaca, NY 14853, USA.
Email: gb545@cornell.edu

Funding information
John Templeton Foundation, Grant/Award Number: 62601

Abstract

The study of teleology is challenging in many ways, but there is a particular challenge that makes matters worse, distorting the conceptual space that has set the terms of debate. And that is the tendency to think about teleology in terms of certain long-established dichotomies. In this paper, we examine four such dichotomies prevalent in the literature on teleology, the notions that: 1) Teleological explanations are opposed to mechanistic explanations; 2) teleology must arise from processes operating either internal to an organism or external to it; 3) systems are either alive and teleological, or nonliving and not teleological; 4) humans are teleological, on account of our ability to intend, seek, prefer, etc., while other systems without these capacities are not. Here, we use our own view of goal directedness, field theory, to show for each dichotomy that there is an alternative, a view of teleology that either violates these dichotomies or demands revision of them. What this reveals is not only the dangers of dichotomous thinking, but a widespread lack of clarity about what teleology is.

KEYWORDS
field theory, goal directed, intentions, life, mechanism, purpose, teleology

1 | INTRODUCTION

'Are you with us or against us?' People are prone to dichotomous thinking. When the stakes are high, as so often in politics and war, taking a stand, one way or the other, can be important. It matters. But the urge to dichotomize is often quite strong on lesser matters as well, even where the gain in doing so is questionable. 'Are you a cat lover or a dog lover?' can seem like a reasonable question, despite the fact that it demands an unnuanced answer and discourages the exploration of alternatives. Maybe pangolins are loveable animals too? Further, dichotomies sometimes carry implicit and undefended assumptions, hiding the perspective dependence and arbitrariness of the boundaries they draw. “Do you prefer the city or the country?” not only obscures the fact that there are intermediates, but leaves unspoken and unexamined what “city” and “country” mean. To a New York City resident, the upstate township of Peekskill is the country, while to an Alaskan, Fairbanks – with about the same population as Peekskill – is a big city.

The same trouble exists for the most contentious issues in the academy, from ethics to questions of scientific fact. We find dichotomies everywhere: pluralism versus monism, objects versus processes, nature versus nurture. Sometimes forced choices are good, revealing unspoken commitments, hidden allegiances. But they can hide other options, and gloss over other ways to pose the contrast, thereby protecting the habits of mind that so commonly block intellectual progress, keeping us in our intellectual ruts. In the long history of the study of teleology, dating back at least to Plato, the discussion has fallen into a number of such ruts, into entrenched habits of dichotomous thinking.

Here we consider what we take to be the central problem of teleology, how to account for the strange behavior of goal-directed entities, as they seem to seek, pursue, intend, and so on. Bobbing and weaving, suffering setbacks, regrouping and setting out anew, these entities seem to be on a mission to get somewhere, to transform in some particular way, to achieve some goal. And they do it persistently, in a way that looks out of place in a Newtonian universe. Whether it's a bacterium climbing a chemical gradient to find food, or a Canadian goose migrating north to its breeding ground, or an acorn mysteriously – against all odds and in the face of great adversity – growing into an oak tree, these entities seem able to pull off the near impossible, moving and transforming themselves in ways that should by all rights be beyond their capability. And that has been the central mystery. How do they do it? In attempting to answer this question, historically in teleological inquiry, a number of dichotomous conceptual separations have been made, each with built-in assumptions about the best way to think about the problem. Here we address four of them:

1. Mechanism versus non-mechanism. The assumption has been that these are alternatives, that a sufficient explanation of goal directedness must either refer only to mechanisms – paradigmatically, processes akin to machine mechanisms – or must invoke various non-mechanistic factors, including unique substances, vital forces, or emergent properties of some kind.
2. Internal versus external. The assumption has been that teleological entities are organisms, considered as wholes, and that the guidance they require must come either from within, from their internal parts or organization (or classically, an inner nature, as Aristotle proposed), or from some external factor, some power acting on the entity from outside of it (classically a god or demiurge, as Plato proposed).
3. Living versus non-living. In many threads of teleological discourse, the assumption has been that teleology is a feature unique to life, while non-living entities present only the appearance of teleological behavior, their behavior merely analogous to the true teleology of living organisms. That is, the assumption has been that teleology is all-or-none, and that organisms have it while non-living entities have none.
4. Human intentionality versus everything else. The assumption has often been that teleology in a mind, especially a human mind, is wholly distinct from, and operates according to different principles than, non-mental teleology, the teleology of bacteria and acorns and so forth.

To each of these dichotomous separations we offer a view, arising from what we call ‘field theory,’ that challenges the dichotomy and its assumptions, either by denying that the choice it seems to require is necessary and offering a third alternative, or by showing how the common understanding of the alternatives is not well formulated and offering a better formulation. We also endeavor to show how the alternatives and clarifications we offer can open new avenues of inquiry, in some cases, empirical inquiry, in turn leading to new discoveries. Importantly, our aim here is not to advocate some kind of poststructuralism, by opposing the very notion of a dichotomy, but to make note of the ways particular dichotomies have distorted the debates around teleology.

Only a thumbnail explanation of field theory will be offered here, and no formal defense of it. Nor do we compare field theory with its various competitors, ancient or contemporary. That work is done in other papers (Babcock, 2023; Babcock & McShea, 2021, 2023a, 2023b, 2024; Lee & McShea, 2020; McShea, 2012, 2013, 2016a, 2016b, 2023).

2 | THE CENTRAL PROBLEM OF TELEOLOGY

Teleological entities behave strangely. Their behavior is what Sommerhoff (1950) and Nagel (1979) called persistent and plastic. Persistence is the ability of an entity to return to a trajectory toward a goal following perturbation. This type of behavior seems utterly unlike a ball that someone has thrown. If deflected by a gust of wind, the ball does not return to its original trajectory. It lacks persistence. In contrast, a bacterium moving up a food gradient deviates from a straight-line path all the time. Some deviations arise from the viscous resistance of the water, others from the imperfect gradient-climbing device built into the bacterium's flagellar mechanism. Regardless of the source of the deviation, however, the bacterium recovers – so long as it remains in the food gradient – and continues to move on average toward higher food concentration. Plasticity is closely related and refers to the flexibility of the entity with respect to its starting point. A bacterium can enter the food gradient at any point and immediately begin to move on average toward higher concentration. The result of these capabilities is that the entity seems to 'seek' its goal, to 'know' where it is going, and to 'try' to get there, all things that – understood literally – it is obviously incapable of. The same goes for many other tropisms and taxes, such as the tendency for land plants to grow upward, against the pull of gravity, for certain snails to climb up a beach, for Christmas Island crabs to migrate toward the sea – and countless other goal-directed behaviors accomplished by organisms with little or no mental capacity in the usual sense.

But the real mystery, the one that confounds our imaginations every time we confront it, is organismal development. If the mission of the universe were to baffle us with teleology, then you would think acorns turning into oak trees would do the job. But even oak trees look simple compared to the transformation of an embryo of a multicellular animal into an adult. From an egg, a single cell, to a multicelled embryo, a symphony of biochemistry, operating deep within the embryo's myriad cell–cell and tissue-tissue interactions, plays out, all without any evident musical score. A complex anatomy arises, differentiated into multiple cell types and organs, arranged spatially in some way seemingly prefigured, and all nested within each other and connected mechanically, electrically, hydraulically, in a functioning whole. Improbably, it all plays out persistently and plastically, with the many errors that regularly occur just as regularly corrected. And all that from a simple egg, from nothing, as if Notre Dame had arisen by itself from a pile of rock and timber, but outshining even that architectural marvel in the intricacy, precision, and most stunningly, the repeatability of the final product. How does it work? Aristotle provided what was, perhaps, the first compelling answer to the problem with his four causes – material, efficient, formal, and final – with final causes directing the construction at the highest level. However satisfying that story may have been at the time, today we have, for certain transformations in certain animals, a more powerful story to tell. The actors in our contemporary story are cells and tissues, and at a lower level, genes. But as we will explain later, even that story is insufficient.

And finally, there is animal wanting and intentionality. This teleological marvel seems to involve explicit representations of the future in the mind of the animal, with the motivational states evoked by these representations somehow able to guide the animal's behavior, in a way that no other goal-directed system seems to have even the slightest capacity for. I want to clean up the pinecones in my front yard, and then, prepared with a mental vision of a future pine-cone-free yard, I decide to do it, I get on my shoes, I find a coat, and I leave the house to do it. And I do these things persistently and plastically. Distractions come along. My mind wanders while putting on my shoes. I interrupt to grab a snack. I get a text requiring me to divert to a higher priority chore. But the intention to collect the pinecones persists, and eventually I head out to my front yard. This all seems complicated, if not psychologically then surely neurologically, but in fact it is really more complicated yet. Because I actually do *not* want to clean up pinecones. I can tell you there are other things I would prefer to do instead. It is just that I *should* clean the yard, and the net result of my various competing wants – competing teleological inclinations – is a somewhat resigned intention to go ahead with the job despite all my misgivings, despite my many other motivations. The complexity of this process may or may not be greater than that of organismal development, but both would seem to be light years beyond a bacterium in a food gradient.

While there are undoubtably other domains in which teleological explanations crop up (evolutionary trends?), in our reckoning these three – organismal behavior (including tropisms and taxes), organismal development, and psychological states of intentionality or wanting – are so steeped in teleology that it is almost impossible to imagine how they could be studied without attributions of goal directedness. These systems are paradigms of purpose. We think that this is not a temporary condition, that the necessity of framing these systems in teleological terms is a permanent feature of science. This is not a metaphysical stance of ours. Rather it is an informed bet, based on what is known about the goal-directed systems that are already well understood. As we will explain shortly, teleological systems seem to share a common architecture, a hierarchical structure – things within things – one that cannot be captured by explanations at a single level, e.g., in some underlying chemistry or physics. In other words, teleology will forever defy reductionist elimination. If that bet pays off, if a multi-level structure does turn out to be essential for explaining persistence and plasticity in all of these disparate systems, then we would need some unifying term to describe the dynamics in the general case. Happily, we already have such a term, teleology. We could invent a different one, perhaps in order to distance the field from failed ancient solutions to the problem – adoption of the term 'teleonomy' was such an attempt (Corning, 2019; Pittendrigh, 1958) – but the coverup would be cosmetic. No one would be fooled. Much easier to call it what it is.

3 | FIELD THEORY

Hierarchical thinking is not the norm in causal analysis. In daily life, explaining how systems work – especially biological and mechanical systems – typically involves entities of about the same size, interacting with each other adjacently, entities contacting each other first at their exteriors. Consider a billiard ball colliding with another, a molecular catalyst interacting with a reactant, one person jostling another. In contrast, at the heart of the field theoretic view of goal directedness is the interaction between a large-scale structure of some kind, a field, and a smaller entity that is contained within it. For example, a homing torpedo is guided toward a target ship by the sound field emanating from the ship. The interaction might be described as 'vertical' in contrast to the 'horizontal' interactions listed above. The smaller goal-directed entity is guided by a field that is big and enveloping, and therefore reliably present over the whole trajectory of the entity, present and providing guidance no matter where the entity wanders. And it is this omnipresence that makes goal directedness possible. The goal-directed entity that deviates from a path toward the goal can be redirected by the field back to the right trajectory. That is persistence. And an entity can begin its journey toward the goal from anywhere within the field. That is plasticity.

Consider two biological examples, the first an organismal tropism. When a dung beetle leaves a dung pile it takes with it a large package of resources, a ball of dung. Its goal is to roll the ball in a straight line, as far and fast as possible away from the pile, to minimize the chance that the ball will be stolen by other dung beetles still in the pile. But given the inevitable deviations arising on uneven terrain, moving in a straight line is not a trivial undertaking. It requires guidance, which is the case of the dung beetle turns out to be provided by a large external field, a *very* large external field, the Milky Way galaxy. The Milky Way is a beacon in the night sky, a reference marker with a stable orientation, which the beetle's neural mechanisms can use to navigate and to make course corrections.

The second example is drawn from development. As an embryo transforms into an adult, it does so persistently, making corrections along the way for the myriad errors that plague all complex biological processes. How does it do it? Embryology is today poorly understood, even for most simple multicellular organisms. Textbooks tell us that the goal directedness of development in a multicellular organism is ultimately accounted for by the genes, which according to this story orchestrate the changes from one cell type to another, as well as the movements and patterning of cells that are needed to allow a fertilized egg to blossom into an adult. But the genetic explanation is incomplete. The genes live only within cells, and over most of development, each cell is a negligibly small component in the much larger embryo, so small that neither it nor its genes can much influence the whole, much less guide it. But even if it could, buried down inside a single cell, a single set of genes has by itself no information that would help guide, no information about its own ultimate role and location within the embryo, or about those of other distant cells. So how is development guided? The first-order answer is that each cell is a little factory, secreting small quantities of regulatory substances, which when produced in bulk by many cells, set up large-scale molecular gradients spanning large swaths of cells, sometimes large fractions of the whole embryo. These gradients are called morphogenetic fields, and it is these fields that tell the cells within them what to do. In short, it is fields that guide embryonic development. For example, at an early stage in a developing fruit fly, cell secretions generate mRNA gradients that span the entire embryo, with the changes in concentration along the gradient guiding the division of the body into segments, the differentiation of those segments, and ultimately the locations of head and limbs along the body axis. The cells generate the mRNA molecules, but it is the larger morphogenetic field they form that informs the decisions (McShea, 2012; Rosenberg & McShea, 2007).

We could continue with examples drawn from technology, like self-driving cars that are directed toward their target destinations by microwave fields emanating from cell towers. Other examples could be drawn from human daily life, like the social fields (e.g., families, friend groups, co-worker groups, etc.) and economic fields (markets and advertising), that guide our individual behaviors to some extent (Babcock & McShea, 2023b). And of course, our individual wants, intentions, preferences, etc. are teleological, and we have things to say about the neural fields that might be involved in those. The theory's handling of all of these is spelled out in Babcock & McShea (2024, and earlier papers; see above).

4 | FALSE DICHOTOMY #1: MECHANISTIC VERSUS NON-MECHANISTIC EXPLANATION

Kant famously pronounced there would never be a Newton for a blade of grass, because life, he thought, defied mechanistic explanation. There is some debate about how best to understand Kant's position on the complicated relationship between teleology and mechanism (see Gambarotto & Nahas, 2022). And today we can still easily recognize the problem Kant saw: the limitations of what, in modern terms, would be a called a bottom-up explanation. In other words, an explanation of high-level behavior in terms of lower-level parts and their interactions, in terms of mechanisms. Skeptics of this sort – many of them not Kantian at all – have accordingly sought non-mechanistic alternatives, offering explanations in terms of the special, and sometimes nonphysical properties of certain emergent wholes, especially for organisms (see below). Historically, a variety of non-mechanistic theories have been proposed, including vitalistic theories, explanations of teleology deploying what today are considered metaphysically suspect ontologies (Bergson, 1907; Driesch, 1929). Other more contemporary accounts have sought to ground teleology in neo-Kantian idealist frameworks because, they argue, certain forms of biological phenomena have stubbornly resisted efforts to be naturalized (e.g. Cooper, 2018).

Meanwhile, others in the modern era have made naturalistic efforts to make sense of Kant's blade of grass. Some of the earliest efforts came from cybernetics (Rosenblueth et al., 1943; Wiener, 1948) which tried to make sense of goal directedness through feedback loops. In this view, things like thermostats and homing torpedoes are exemplars, with feedback loops guiding goal-directed entities persistently and plastically toward their targets. Later, Sommerhoff (1950) and Nagel (1979) appealed to certain internal regulatory mechanisms in an effort to rein in the vast array of systems that could be described as feedback loops. In Nagel's favorite example, variations in the speed of an engine are damped by a governor, nudging the engine's speed toward constancy in the face of deviations. Around the same time, the evolutionary biologist Ernst Mayr (1988) pointed to genomes as internal programs of a sort, analogous to computer programs – the gold standard of mechanistic thinking in the past half century or more – to explain how organismal development, physiology, and behavior could behave in seemingly goal-directed ways. (See Garson, 2016 for an overview of these twentieth century approaches to goal directedness.)

All of these views have difficulties of one kind or another, but our mission here is not to evaluate them. Nor is it to compare them unfavorably with our alternative, field theory, which itself some would argue has difficulties. Rather, it is to point out that the choice between a mechanistic and non-mechanistic answer is a false one, and that field theory points the way toward an alternative that fits neatly into neither category.

That third alternative arises from a hierarchical perspective in which mechanism has an important role but is only part of the story. Mechanism, as it is understood by the 'new mechanists,' is the view that higher-level phenomena are explained by decomposing them into the lower-level mechanisms and activities that those mechanisms are engaged in (see e.g. Craver, 2007). To explain the phenomenon of a toaster's power to toast, we look to mechanisms inside the toaster and their activities. To explain a laptop's computing capacity, we look to mechanisms inside the laptop. Following such theories, organismal behavior should be explainable by reference to mechanisms inside the organism. But for teleological systems, an ontology composed solely of mechanisms seems insufficient. A sunflower tracking the sun across the daytime sky has internal mechanisms that control from moment to moment the movement of the head of the flower, but those mechanisms have by themselves no information about the location of the sun. To track appropriately, a field of light is needed, emanating from the sun and present throughout the day. Solar light is not a mechanism that is a part of the sunflower or its behavior, rather it is a field that exists apart from those phenomena. Treating it as a mechanism obscures how the field's guidance capacity works. The light field is what provides the teleological direction: no matter what accidents happen to the sunflower – perhaps it is bent in the wrong direction by a passing animal – there is the light field directing the mechanisms inside the plant, which in turn bring the plant back into alignment with the sun. Those mechanisms effect the change in orientation, but the direction, the guidance, the information about which way to turn, comes from the sun.

Field theory lives well within the mechanist tradition in the sense that it takes the importance of lower-level mechanisms seriously, and in the sense that it invokes only physical causes, rejecting all non-physical ones. In essence, it shows that Kant's worry is unfounded. But field theory adds physical hierarchy, and the guidance that higher-level structures, fields, can impart to entities within them, a kind of hierarchical causation that is absent – or if not absent then peripheral – in mechanistic explanation. Consider an old-style mechanical watch, the epitome of mechanism. It is not goal-directed in that when the vicissitudes of daily operation cause the mechanism to falter, and the time shown to deviate, there is no correction. The watch simply runs behind, or ahead, until manually reset. However, a modern watch – bathed in the bluetooth field emanating from a cell phone (which in turn is immersed in the microwave field from a cell tower) – does correct itself. And this capability arises, partly from the mechanism inside the watch, but most crucially from the flow of signals from the larger field. All of this is mechanistic in the sense that it is just physical objects interacting. But field theory adds that the nestedness of some of those objects matters, that in order to generate the necessary downward causal arrow, one of those objects – the field – must be large, and the others need to be small and contained within the bigger one. The watch and phone can self-correct, despite the fact that their locations are constantly changing, because they lie within a field that is effectively everywhere. Such a 'withiness' relationship is overlooked in standard mechanistic thinking (Babcock & McShea, 2023b). Thus, field theory is mechanist in the sense that it appeals only to physical causes. But if all mechanisms are by definition lower level, as the new mechanist school insists, then field theory is not (purely) mechanistic.

Field theory also incorporates the insights of the organizational school (see e.g. Moreno & Mossio, 2015; Mossio & Bich, 2017). That view understands the limits of pure mechanism, and invites us to think about something larger and more abstract, the organization of parts into something closer to the scale of the whole. The organizational view also emphasizes organizational closure, requiring that the parts of a teleological system participate in their own self-maintenance and do so in a way that regenerates them. Field theory is consistent with all of this, but it is more general. The fields that guide teleological behavior can emerge from the parts, as in circadian rhythms in complex organisms, but can also originate entirely externally, as in the sunflower case. The organizational view also points out that organisms facilitate their own closure by generating subsystems that maintain the integrity of the larger whole. Still, many exogenously directed systems generate parts within themselves, parts that help to maintain the whole (Babcock & McShea, 2021). Hurricanes, for example, arise from exogenous masses of rising warm moist air, and yet generate their own internal parts, such as the eye and eye wall that serve to facilitate the flow of air, and thus maintain the overall structure. Though hurricanes lack organizational closure, they are teleological in that they persist, dynamically stabilizing themselves in the face of perturbations. Finally, the organizational view is concerned mainly with teleology in the sense of homeostasis or self-maintenance. Field theory is concerned with those things but also with directionally changing systems like developing embryos and intentionality. Both of these involve self-maintenance, but a lot of what they do is aimed at change going forward. They aim at becoming something new, not just persisting. Thus, field theory applies across a wider domain than the organizational view, applying not just to organisms or self-making systems, but to all persistent and plastic systems, including some very simple and non-living ones (See below).

Thus, from the perspective of field theory, a purely mechanistic view can recognize hierarchy, but misses a key feature of it, the causal power and efficacy of the upper levels of nestedness. And while the organizational view does not deny hierarchical organization either, its adherence to the closure of constraints, which demands that all teleology arise intrinsically, blinds it to the important role of often-quite-simple external fields – gradients, boundaries, and other large-scale structures – and therefore blinds it to the simple teleology present in some nonliving systems.

In sum, the issue for teleology is not mechanism versus some non-mechanistic alternative. Taking hierarchy seriously obviates that dichotomy.

5 | FALSE DICHOTOMY #2: INTERNAL VERSUS EXTERNAL

Plato – the originator of what is now called teleology – located the source of purpose in the universe in a god-like figure, the demiurge, who directed the material of the cosmos toward what was rational and hence good. Aristotle located the source of directionality in internal formal causes. Given the historical influence of these views, and of the philosophical giants who proposed them, it is hardly surprising that modern treatments of teleology almost automatically classify novel theories as either internalist or externalist (see e.g. Ruse, 2018), often with the subtle implication that these are the only options available to a new account of teleology, short of treating it heuristically. Internalist theories then bear the burden of either accepting a connection to an Aristotelian metaphysics or laboring to distance themselves from it (Mayr, 1988; Pittendrigh, 1958). And external theories bear a milder but similar burden with respect to Plato and religion. Field theory is no exception. In Babcock and McShea (2021), we draw attention to the external origin of goal directedness, which for some must automatically ally us with demiurge-istic modes of explanation, modes that we emphatically reject.

What complicates things here, however, is that the words internal and external are necessarily relative to some specified system. Or in terms of hierarchy theory, particularly as it is found in the work of Feibleman (1954), Salthe (1985) and Wimsatt (1994, 2007), which views complex systems as a series of physically nested hierarchical levels, internal and external are 'level relative.' Conventional thinking about teleology usually takes for granted that the relevant level is obvious, obviating the exercise of explicitly specifying it. For biological goal directedness, the relevant level is virtually always taken to be the organism, which means that theories positing a source of guidance outside the organism are externalist, while those positing a source inside, 'under the skin' so to speak, are internalist. It places 'the divide' between the organism and its environment. This might sound like a common-sense approach, and there are good reasons to give the organism-environment divide particular attention (see e.g. Walsh, 2015), but it generates some awkward questions. What shall we call goal-directed processes within an organism, such as those in development, that are guided by morphogenetic fields external to the guided entities but internal to the embryo, such as the large fields that guide cell movement and transformation (Levin, 2012, and see the fruit fly example above). Calling them external, without saying anything further, could create the impression – for those with an organism-centered inclination – that they lie outside the organism. Calling them internal simply because the guiding field lives within the boundary of the organism misses the critical hierarchical relationship that makes their downward guidance of contained cells and tissues possible.

Our proposal here is that when external and internal are applied to goal-directed systems, they should include an explicit statement of the relevant level. This is done routinely for many level-relative concepts. It is widely appreciated, for example, that the representation of, say, women on the faculty of a university could be rising at the level of the university, at the same time as it is falling at the level of the department. This could happen, say, if one large department were hiring large numbers of women, while other departments were losing women. This is called Simpson's paradox, but it is not a paradox at all. The seeming contradiction is resolved simply by requiring that frequency data be accompanied by a statement of the level at which they are applied. For goal directedness, this should be straightforward. The morphogenetic fields that guide development are external with respect to the guided cells and internal with respect to the embryo as a whole, the key phrase in this sentence being, 'with respect to.' Similar cases abound, such as the recent work that views transposable elements as operating within the 'ecology' of a genome (Kremer et al., 2020).

Field theory adopts this level-relative approach to explaining goal directedness, for example, in its claim that guiding fields are always external with respect to the guided entities. In this view, their location with respect to the organism boundary is a separate matter, and is expected to vary among different kinds of goal directedness. The locus of guidance for a sea turtle navigating using the earth's magnetic field is a field external to the sea turtle. And the most powerful homeostatic fields operating in physiology, like those governing circadian rhythms, are located mostly internal to the organism. However, and without contradiction, in both cases, the fields are external with respect to the entities they guide. As we will see, when we turn to human intentionality, the practice of identifying the relevant level, of 'level transparency,' simplifies the story enormously.

6 | FALSE DICHOTOMY #3: LIVING VERSUS NON-LIVING

Do teleological explanations of living things fall into a separate category, involving different substances and different principles, from those of non-living things? The vitalists and orthogeneticists of the nineteenth and twentieth centuries would have said yes. Those approaches no longer have many adherents. Nevertheless, a strong thread of bio-exceptionalism runs through most modern-era thought, for example in the work of notable biologists like Dobzhansky. It is also present implicitly in most contemporary theorizing on teleology. For example, in Mayr's development of his notion of teleonomy, he clearly intended to limit it to organisms and their artifacts, in particular, computers. For Mayr, the guiding program was DNA, something that physical and chemical systems showing persistence and plasticity obviously do not have. And then he adopted a different term, "teleomatic," to describe the seemingly teleological behavior of these non-biological, law-governed systems.

In the contemporary era, it is hard to find views that do not recognize the living-non-living dichotomy. Although, interestingly, Plato and Aristotle's founding work on teleology does not imply that teleology is somehow unique to life and absent from everything else. And recently, Oderberg (2008) takes an Aristotelian view that challenges the current dominance of bio-exceptionalism. Nevertheless, most approach teleology with a bio-exceptionalist view that might be traced back to Robert Boyle, and was later solidified by Kant. (This, of course, does *not* deny a much longer-standing tradition of human exceptionalism that is deeply engrained in the history of philosophy, discussed in the next section.)

Field theory is bio-indifferent in this respect, seeing the same hierarchical architecture underlying persistence and plasticity in both living and nonliving systems, as argued in Babcock (2023). Under field theory, organismal behavior, physiology, and development are all goal directed in that they are guided by fields, both inside and outside the organism. But so is a ball rolling around in a bowl headed persistently and plastically toward the bottom, guided by a gravitational field, and so is a hurricane developing persistently and plastically over a warm ocean, generating and restoring itself under the guidance of an enormous field of rising warm, moist air. These are not alive, by conventional standards, but under field theory, they are goal directed.

More precisely, we should say, they are goal directed *to some degree*. That is, living and nonliving teleological entities share the same causal architecture, but the difference in complexity of that architecture could be – and likely is – enormous. We intend the word complexity here in a precise sense that, first, points to number of levels of nestedness, what has been called 'vertical complexity' (Sterelny, 1999). Entities with fewer levels of internal nestedness are less goal directed than those with more. A dung beetle's navigation system is deeply nested, consisting of multiple levels of entities within fields of various kinds. In contrast, the ball in the bowl has one degree of nestedness, the ball moving within a gravitational field, with no relevant deeper levels nested within the ball. Complexity has another sense, its 'horizontal' sense, which refers to number of part types, and the beetle is complex in this sense as well. It not only has cognitive and motor systems with considerable depth, but other parallel hierarchical systems as well. It undoubtedly has another for steering around obstacles in its path. And others for detecting and responding to the odors of dung, mates, and presumably other features of the environment. Plus, it has the usual array of internal animal systems that direct growth, development, and repair, all of these hierarchically organized and goal directed, as well as a large repertoire of homeostatic mechanisms for controlling its internal physiology, each to some degree independent of the others (see Figure 1). In contrast, the ball in the bowl has none of these parallel hierarchical systems. In sum, field theory accords some greater degree of goal directedness to the beetle on account of the depth and multiplicity of its hierarchical organization.

The difference between the complex beetle and a simple teleological system like the ball in the bowl is the complexity of the architecture. The ball in the bowl has one level of hierarchical structure, a solid homogeneous object moving within a gravitational field. The beetle has multiple levels of nestedness. It is complex, both in terms of number of parallel hierarchies and in terms of hierarchical depth (Babcock & McShea, 2024). The contrast is like that between a tent at a campsite in the wilderness and a modern suburban home. The tent is a barrier, providing privacy and keeping out rain. A modern home provides privacy and protection too, but does so on multiple levels within the home – separating rooms from each other, the contents of a dresser from the room the dresser lives in, the contents of one drawer from another, and so on. And the modern home provides so much more, beyond privacy and protection. It is not just more complex in some vague sense, but more complex in two clearly specified senses, one having to do with greater hierarchical depth and the other with having more parts (McShea, 1996).

Our point is that the universe need not be divided into a teleological-versus-non-teleological dichotomy, corresponding to a living-versus-non-living one. A third alternative exists, namely continuity. Granted, it is a continuity that leaves open the possibility that differences in degree of complexity of nested organization could produce something like the observed gap between the living and the nonliving. But it also leaves open the possibility that there could be a well occupied middle ground. Indeed, a major virtue of an inclusive understanding of teleology is that it invites exploration of the middle ground between the nonliving and the living, exploration that could reveal the seeds of the complex teleology evident in living organisms today. We know the transition from nonliving to living took place, some 3.5–4 billion years ago, and we have some theories about how it happened. How intriguing it would be to examine the increase in hierarchical structure that undoubtedly accompanied the transition from simple teleology to complex teleology, to launch an empirical investigation of how that happened. Another virtue of the inclusive view – which some will understand as a burden – is that it raises a new issue, pressing bio-exceptionalists to explain what it is about teleology that requires it to have emerged at the moment of life originated, and then to explain what accounts for this happy coincidence. Finally, there is one last virtue of an

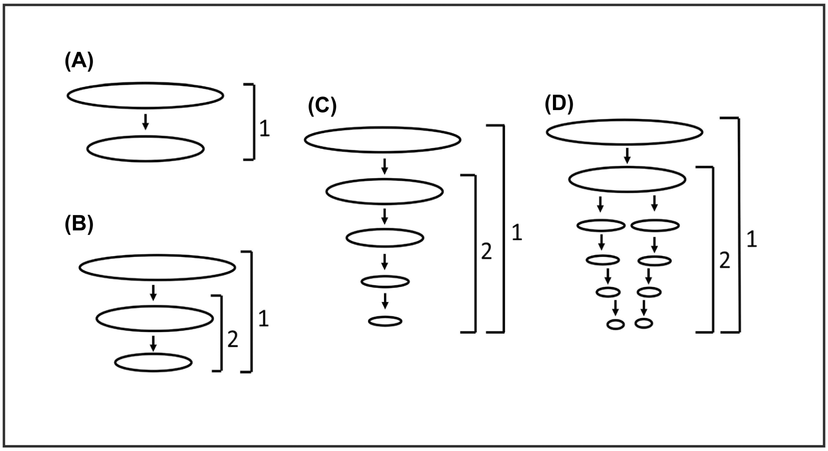

FIGURE 1 Degrees of teleology. Ovals represent hierarchical levels in a system (bracket 1), and vertical arrows are causal, running downward from larger upper-level fields to contained lower-level entities. For purposes of illustration, levels are shown as separate from each other, smaller underneath larger, but they should be understood to be contained, smaller within larger. In all cases, the top, largest oval represents a field, external to the goal-directed entity. (A) A system consisting of an upper-level external field (top oval) that directs (vertical arrow) a contained lower-level entity with no internal hierarchical structure of its own (bottom oval), like the ball in a bowl. (B) A case where the guiding external field (top oval) directs an entity with shallow internal nesting (middle and bottom ovals, bracket 2). The goal direction delivered by the middle oval to the bottom oval occurs entirely within the bracket 2 entity, which makes the pair somewhat teleological. An example might be a bacterium following a food gradient. The biggest oval represents the food gradient and the middle and bottom ovals together represent the nested structures and signals lying entirely within the bacterium. (C) A case in which the entity (bracket 2) is much more deeply nested internally (vertical complexity). An example might be the control system inside a beetle that directs it away from a dung pile. For the beetle, the top oval is the external field – the light field from the Milky Way galaxy – that directs the beetle's overall path. (D) A system showing how hierarchical structures within an entity (bracket 2) can run in parallel, adding another dimension to the hierarchical structuring of the system (horizontal complexity). Again this might represent a dung beetle, but now taking into account more goal-directed processes (e.g., goal-directed hormonal regulation) than those involved in moving away from a dung pile.

inclusive notion of teleology that most will agree on, namely it opens the door to a fully naturalized teleology. Or think about it this way: teleology as the link that connects mostly-naturalized biology to already fully-naturalized chemistry and physics.

7 | FALSE DICHOTOMY #4: HUMAN INTENTIONALITY VERSUS EVERYTHING ELSE

Human teleology has always stood apart. A laptop might be said to 'want' to frustrate us, and an earthworm said to 'try' to find moist soil, but the teleologically salient words are almost always in quotes, either actual or implied, signaling that the intentionality is intended only metaphorically. The intentionality is 'as-if.' It has seemed clear to most modern students of teleology that whatever it is that the laptop and the earthworm are up to, it is very different from, say, a human struggling to make ends meet. Interestingly, neither Plato's nor Aristotle's views seem to imply any such clean separation. For Aristotle, the sense of touch provided by a plant's soul was a sort of wanting that was essential for its growth. However, for most of twentieth century philosophy, this sort of wanting has seemed far too primitive, too unlike the robust autonomous teleology that humans possess, to merit the same word. For example, Frankfurt (1971) famously argued that it is the human capacity for second order wants or desires that gives rise to autonomy and if it were not for these, humans would be mere wantons. Human action is autonomous because of the hierarchy of human desires, and these desires make our behaviors truly chosen, intended, and the source of our responsibility. Setting aside the question of autonomy and how it gives rise to responsibility, field theory argues that human teleology is not so fundamentally different from the other forms of teleology found elsewhere that it requires its own special treatment.

Some remarks on word choice are needed. In this section, we will use the words wanting, desiring, seeking, preferring, caring, and intending more or less interchangeably. All refer to brain states that in modern terms might be called affective or valenced, or in less modern terms, to what Hume called the calm passions. They carry with them an implication of an organism not just 'thinking' about some idea related to thought or action, but 'leaning into' thought or action. Thinking, cognition, and so on we take, like Hume, to be value neutral, without motive force, while affective states have some oomph to them, some push in the direction of action or thought. Also our discussion of affective mental states, or wanting, could seem to some to limit the discussion to humans, but we understand them to be present in many non-human organisms as well. Certainly that group includes our nearest kin, the apes and other primates, and quite likely all vertebrates and at least some mollusks (e.g., octopuses). For present purposes, we do not need to take a stand on how far wanting extends across the animals, or on whether it further extends to organisms without neurons, say, plants, protists, and bacteria, or beyond the living to hurricanes, or indeed whether we want to invoke a kind of pan-intentionality. These are questions for another occasion. Although we feel compelled to add here that it is surprising, and a little discouraging, that anyone could take intentionality to be a purely human phenomenon. Anyone who has spent any time with pets or even farm animals knows as certainly as they know anything that these organisms have wants, purposes, intentions. They have goals that can be acted on and realized, like any of 'the best laid schemes o' mice an' men,' or thwarted when they 'gang aft a-gley' (Burns, 1785/1906, p. 72). Consider Russell's (1923) argument that, based on what each of us knows about our own experiences, thoughts, desires, etc., we can generally infer that when something else exhibits behaviors similar to our own, it is likely the other thing has a similar mind. If this argument has even a shred of validity, then it ought – when combined with the current advanced state of research on animal minds – easily be applicable to wide swaths of the rest of the animal world. In any case, when we refer to wanting here, we are including at least all of neuro-intentionality, while remaining agnostic about possible further extensions.

The dichotomy of interest here, the one we seek to undermine, is between wanting and other manifestations of goal directedness, from bacteria climbing a food gradient to the parts of fruit flies differentiating during development, to temperature regulation in mammals. Field theory points instead toward continuity. Still, we undertake this challenge to the uniqueness of neuro-teleology with some humility. Despite enormous advances in neurobiology in recent decades, and considerable conceptual progress in philosophy of mind, wanting remains quite mysterious. Much is known about the neurobiology of extreme affective states, emotions (Barrett, 2017). And somewhat less but still a fair amount about the neurobiology of wanting (Berridge, 2018). But our impression is that most of what we have come to understand has to do with the way that wanting and other affective states affect decision making, with the biases they impose on cognition, with their context dependence, and with the questions of about their universality versus their cultural boundedness. Very little is known about what – in neurobiological terms – a want or affective state *is* or about its architecture.

Given the current state of ignorance, we have to acknowledge the possibility that organismal neuroteleology could be something entirely different from other forms of teleology, and that therefore our effort to establish continuity could be misguided. But, we proceed on the assumption that this is not the case, the rationale for doing so being that connecting them offers a way forward for empirical research. If wanting and other forms of teleology share a common architecture, then principles that apply to the simpler forms enable us to make predictions about neuroteleology. In other words, if we assume that all goal directed systems share the same hierarchical architecture, then we should look for, and test for, a hierarchical structure in neuroteleology.

To begin, we acknowledge that the materials underlying the neural processes of teleology in humans and other animals could be unique and quite unlike the materials in the majority of other physical goal-directed systems. The material makeup of the fields and mechanisms in play in a homing torpedo share little, if any, similarity with what you find inside the human brain. One is mostly metals and synthetic electronics while the other is mostly organic matter and water. Field theory says only that the *architecture* of goal-directed systems includes the same hierarchical organization, an architecture that is realized across many different material media. In this sense, field theory embraces multiple realizability. Field theory could be seen as a very distant echo of Aristotle's formal or final cause and their relationship to efficient and material causes. The overarching 'form' that goal-directed systems take is a particular kind of hierarchical relationship between levels of organization.

Now consider the case of human wanting. We have motor mechanisms, that is, systems that organize the muscle activity that in turn direct us to move, to respond with action in moments that call for decision. And we have additional mechanisms that organize conscious thought, deployed to analyze situations and propose alternative motor responses. But none of these motor or cognitive mechanisms, however complex, provide any guidance. Cognitive and motor mechanisms by themselves are unvalenced. In addition to these mechanisms, motivation is needed. Field theory argues, speculatively (Babcock & McShea, 2021), that valancing is achieved by fields, that these fields – from strong passions to mild preferences – are larger than, external to, and more enduring than the motor and cognitive mechanisms they guide. I walk to the post office, powered by the desire and intention to mail a letter. Distractions arise – a neighbor stops me for a chat, a dog chases me off the sidewalk – but all the while, the desire to mail the letter is present. Whether it is there in the mental foreground or background, it stands ready on a moment's notice to nudge me back to a trajectory toward the post office. Field theory's proposal is that this desire to go to the post office is – like all of the other wants I experience – physically manifest as a field, presumably a field of neurological activation of some kind, although such a field could be constituted in other ways. Fields constituted by chemical morphogens are also a possibility, and recently the suggestion has been made that electromagnetic fields could be involved (McFadden, 2020). In any case, field theory argues that my cognitive decision to go to the post office, along with the motor execution of that decision, are caused by an affective field of some kind, acting downwardly on the motor and cognitive mechanisms that lie embedded within it.

Importantly, this hypothesized hierarchical relationship, with an affective field or 'wanting field' that is inside the brain but still external to the cognitive and motor-control centers embedded within it, is not intended metaphorically. For goal directedness to be achieved, the withinness relationship, would have to be literal and physical. It would have to be a hierarchical architecture with embeddedness configured in neurons. We discuss this further in (Babcock & McShea, 2023a, 2023b).

Again, this account of the relationship between wanting, on the one hand, and cognition and motor control on the other, is speculative. It is uncontradicted by what is known about that relationship in neurobiology, but positive support for it is lacking. Still, its empirical plausibility carries some weight here, at a minimum showing that a shared architecture with other less complex forms of teleology is worth investigating. If that bet pays off, then the dichotomy between simple teleological systems and affect or wanting in humans and other animals is dissolved in favor of a continuum. Importantly, such a move would not deny the obvious differences. Field theory acknowledges the possibility that quantitative differences in the complexity of hierarchical structure could add up to a real difference in degree of sophistication, or capability, of the teleology at work. Still this move to continuity has real consequences for how we think about teleology generally. It gives us permission to recognize, if we choose, that the ball in the bowl 'wants' to get to the bottom, with the quotation marks intended not to indicate a metaphorical usage, but to recognize the huge quantitative and even qualitative differences in complexity (in the senses above) between the ball and a human experiencing and acting upon a want. Obviously, the ball in the bowl generates no analysis of its situation, considers no alternatives, and makes no decisions. But wanting could nevertheless share the basic hierarchical structure as the ball in the bowl, the same architecture that is common to all teleological systems.

8 | DICHOTOMIES, TELEOLOGY, AND PURPOSE

In conclusion, we have argued against four dichotomies – and the assumptions that underlie them – that are common in thinking about teleology, showing how field theory undermines them, and in some cases points toward future empirical research. Beyond this, we would like to offer some thoughts on why dichotomies are particularly prevalent in thinking about teleology. We think this has to do with the ambiguity in what's meant by 'teleology.' On the one hand what it means is fairly obvious. Teleology implies goals or ends. On the other hand, teleology has become a vague term. Plato and Aristotle did not have the word; they talked about final causes, or 'for the sake of.' When Christian Wolff coined the word, 'teleology' in the eighteenth century, he did so to distinguish between efficient and final cause in the sciences, arguing that there needed to be a science of final causes alongside a science of efficient cause (Wolff (1963/1728). So the very word 'teleology' arrived as a dichotomy. Regardless of whether Wolff intended to create a division in the sciences – those treating final causes separate from those treating efficient causes – the dichotomy that the word teleology introduced has subsequently had that effect. Physics delivers efficient-causal stories while biology delivers final-causal (as well as efficient-causal) stories. Notably, Aristotle saw no such division. For him, all phenomena had *both* efficient and final causes (not to mention formal and material causes). But Kant picked up the word "teleology" from Wolff, and after that it seems we have been off to the races with dichotomous thinking in teleology.

Also, and perhaps as a result, the meaning of the word teleology has slowly morphed, taking on meanings beyond just a science of final causes, its vagueness allowing the user to stake out territory at conceptual extremes, at the poles of a number of dichotomies, creating spurious linkages among them. In particular, the label teleological has come to imply that something is nonmechanistic, or that something is self-organized in such a way that it is alive, or that it has intentionality, or that it is somehow connected with human intentions. Sometimes all of these, all at once. In using teleology in these ways, it is easy to overlook that the connections among them are entirely optional and unnecessary. Nonmechanistic does not necessarily imply alive. Intentionality might or might not be limited to humans, and their close relatives, and it might or might not be unique to organisms. These are questions to be investigated, ideally empirically, not treated casually, with answers buried under implicit dichotomous assumptions.

In any case, it is worth considering whether our reflexive dichotomizing has not only caused us to overlook alternatives, but has clouded our understanding of the phenomenon itself, teleology. In other words, the fact that teleology stands at one end of so many not-obviously-related dichotomies, and that it crops up in so many disparate areas of study, suggests that we are fundamentally unclear on what the word means. How to get clarity? One way to begin is by dissolving the dichotomies, by reformulating the questions, before we try to answer them.

ACKNOWLEDGEMENTS

We thank an anonymous reviewer. Research for this paper was funded by the John Templeton Foundation, grant no. 62601.

FUNDING INFORMATION

Research for this paper was funded by the John Templeton Foundation, grant #no. 62601.

ORCID

Daniel W. McShea https://orcid.org/0000-0001-9398-0025

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How to cite this article: McShea, D. W., & Babcock, G. (2024). Four false dichotomies in the study of teleology. *Ratio*, *00*, 1–15. https://doi.org/10.1111/rati.12422