Powers, Structures, and Minds

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Powers often depend on structures. It is because of the eye’s structure that it confers the power of sight; destroy that structure, and you destroy the power. I sketch an antireductive yet broadly naturalistic account of the relation between powers and structures. Powers, it says, are embodied in structures. When applied to philosophy of mind, this view resembles classic emergentist theories. I nevertheless argue that it differs from them in crucial respects that insulate it from the problems that beset them—including the problem of emergence and the problem of mental causation.

1. Structure in the World

Automobile engines have the power to move automobiles, computers have the power to calculate sums, and humans have the power to think, feel, and act. The reason they have these powers is that they have components that are organized or structured in the right kinds of ways. It is because the engine’s parts are organized as they are that the engine has the power to move the automobile, and because the human nervous system is organized as it is that humans have the power to think, feel, and act.

In Aristotle’s natural philosophy, the paradigm for a philosophy of powers, structure and power go hand in hand. Structure or form is a basic ontological and explanatory principle; it explains both what things are and what they can do. You and I are not mere quantities of fundamental physical materials; we are quantities of fundamental physical materials with a
certain organization or structure. That structure is responsible for you and I being humans as opposed to dogs or rocks, and it is responsible for you and I having the particular developmental, metabolic, reproductive, perceptive, and cognitive powers we have. Nor is the notion of structure and its connection with power a relic of prescientific thinking. Scientists frequently appeal to notions of structure, order, arrangement, organization, or configuration. Consider an example from a popular college-level biology textbook:

Life is highly organized into a hierarchy of structural levels, with each level building on the levels below it. . . . Biological order exists at all levels . . . [A]toms . . . are ordered into complex biological molecules. Many of the molecules of life are arranged into minute structures called organelles, which are in turn the components of cells. Cells are [in turn] subunits of organisms . . . The organism we recognize as an animal or plant is not a random collection of individual cells, but a multicellular cooperative . . . With each step upward in the hierarchy of biological order, novel properties emerge that were not present at the simpler levels of organization . . . A molecule such as a protein has attributes not exhibited by any of its component atoms, and a cell is certainly much more than a bag of molecules. If the intricate organization of the human brain is disrupted by a head injury, that organ will cease to function properly . . . And an organism is a living whole greater than the sum of its parts . . . [W]e cannot fully explain a higher level of order by breaking it down into its parts.

(Campbell 1996: 2–4)

This passage suggests that organization, order, structure, or arrangement is a real feature of things, one that plays an important role in them being the kinds of things they are, and in explaining the kinds of things they can do—their capacities or powers. This idea is echoed by other biologists:

All biologists are thorough-going “materialists” in . . . that they recognize no supernatural or immaterial forces, but only such that are physico-chemical . . . [T]he modern biologist rejects in any form whatsoever the notion that a “vital force” exists in living organisms which does not obey the laws of physics . . . All processes in organisms . . . strictly obey these physical laws . . . But [biologists] do not accept the naïve mechanistic explanation of the seventeenth century and disagree with the statement that animals are “nothing but” machines . . . Where organisms differ from inanimate matter is in the organization of their systems . . . [O]rganisms have many characteristics that are without parallel in the world of inanimate objects. The explanatory equipment of the physical sciences is insufficient to explain complex living systems.

(Mayr 1982: 2, 52)

Similarly, evolutionary explanations for the presence of organic structures typically appeal to the powers those structures confer. If structure S confers the power to engage in activity A, and A-ing is selectively advantageous for organisms in environment E, then there is a good evolutionary reason why organisms in E have structure S. The pattern of inference also works in reverse: paleobiologists frequently infer that extinct animals possessed certain powers based on the fossilized remains of their organic structures (e.g. Hopson 1975).

Many philosophers find appeals to structure like the foregoing unremarkable. But the notion of structure doesn’t come for free. If we are committed to countenancing the entities postulated by our best descriptions and explanations of reality, and we think those descriptions and explanations derive from the sciences, then scientific appeals to structure make a serious ontological demand. We can respond to it in at least four ways: *structure eliminativism* claims that there really is no such thing as structure; statements about structure are literally all false. *Structure reductivism* claims that some statements about structure are true, but only because structures can be identified with things that can be exhaustively described and explained without appeal to structure. Nonstructural discourse can thus take over all the descriptive and explanatory roles that structural discourse plays. *Nonreductive structure antirealism* tries to countenancing talk of structure without countenancing structure’s existence. Talk of structure satisfies descriptive and explanatory interests that nonstructural discourse cannot satisfy, and for that reason talk of structure is irreducible to nonstructural discourse. Reducibility requires that one conceptual framework be capable of taking over the descriptive and explanatory roles of another. If nonstructural discourse cannot satisfy the descriptive and explanatory interests that structural discourse satisfies, then it cannot take over the descriptive and explanatory roles structural discourse plays, and hence structural discourse is not reducible to it.¹ It is nevertheless possible, say nonreductive structure antirealists, to paraphrase appeals to structure in ways that do not commit us to denying that everything can be exhaustively described and explained without appeal to it. Finally, *structure realism* rejects the assumption that the foregoing antirealist approaches to structure have in common, namely, that everything can be exhaustively described and explained without structure. It takes ontologically serious statements about structure at face value.² Structure, it says, is a real and irreducible ontological and explanatory principle distinct from anything nonstructural.
I have discussed the argument for structure realism in greater detail elsewhere (Jaworski 2011: 296–302; cf. Ellis 2002: 173). It claims that the reality and irreducibility of structure is the best explanation for the success of scientific descriptions and explanations that appeal to structure. Rather than rehashing its details here, however, I will instead describe a version of structure realism suggested by the earlier quotes from biologists. It is a view worth taking seriously, I argue, for it not only provides a framework for understanding the powers of living things; it also has resources for solving the problems that beleaguer its closest competitors.

2. Hylomorphism

The grail of philosophy of mind for over 40 years has been an acceptable mind–body theory that is both antireductive and broadly naturalistic—a theory that affirms that we are physical beings with physical components, but that also denies that biology, psychology, and other special sciences are reducible to physics. Theories of this sort include various forms of nonreductive physicalism and emergentism (Figure 8.1). The kind of structure realism I have in mind is also antireductive and naturalistic, but it rejects both physicalism and some of the central tenets of emergentism.

![Figure 8.1](image-url)

**Standard Mind-Body Theories**

- Monism
- Dualism
  - Dual-attribute theory (DAT)
  - Substance dualism
- Physicalism
  - Eliminative physicalism
  - Reductive physicalism
  - Nonreductive physicalism
- Organismic DAT
  - Nonorganismic DAT
- Dualism
  - Dual-attribute theory (DAT)
  - Substance dualism
- Physicalism
  - Eliminative physicalism
  - Reductive physicalism
  - Nonreductive physicalism
- Organismic DAT
  - Nonorganismic DAT

**Non-Standard Mind-Body Theories**

- Mind-Body pessinism
  - Instrumentalism
  - Hylomorphism

A dashed line indicates the standard Theory to which the Non-Standard Theory is most similar.

Structure realism by itself is compatible with physicalism, the claim that everything is physical, that everything can be exhaustively described and explained by physics. If our best physics ends up postulating structures that are real and irreducible, physicalism ends up implying structure realism. But this is not the kind of structure realism suggested by the earlier quotes from biologists. That kind of structure realism distinguishes what physicists by itself can describe and explain from that which appeals to biological, or psychological, or social structure enable us to describe and explain. Organisms are not mere machines, as Mayr puts it, but have characteristics—emergent properties, to use Campbell’s term—not found among nonliving things. The explanatory apparatus of physics is thus insufficient to describe and explain living behavior—the physico-chemical story gets at only half the truth, to use the cyberneticist Gerd Sommerhoff’s (1969) expression. According to this version of structure realism, not everything can be exhaustively described and explained by physics; some things can only be described and explained by appeal to structure or organization at a biological, psychological, or social level.

When structure realists of this sort look at the world, they see the vast sea of matter and energy described by our best physics, but they see something more besides: structures of the sort postulated by biology, psychology, and other special sciences. Organisms are not mere quantities of matter and energy; they are quantities of matter and energy that are structured in various ways—“knots” of matter and energy, as Montgomery Furth (1978) puts it. The structures these things have are responsible for their abilities to grow and develop, to reproduce, to move around the environment, and to perceive and think about its features. They are responsible, in short, for the powers that qualify them as living beings as opposed to nonliving ones or perceptive, locomotive, cognitive beings as opposed to nonperceptive, non locomotive, noncognitive ones. This is a version of structure realism that rejects physicalism. It will be convenient to have a label for it. I would suggest **hylomorphism**.3

“Hylomorphism” is a compound of the Greek words hyle and morphe, which are typically translated as “matter” and “form” respectively. Because the label is not new it is worth emphasizing that the hylomorphic view I have in mind differs from the views of Kit Fine (1999), Mark Johnston (2006), and Kathryn Koslicki (2008). In addition, I cannot vouch for its similarities to the views of Aristotle, Aquinas, Leibniz, Merleau-Ponty, or any of the other philosophers whose views have been categorized as hylomorphic.4 It is nevertheless very close to the view Furth (1978: 638–9) attributes to Aristotle.5

Hylomorphism as I am taking it has five noteworthy features. First, it takes the subject matters of biology, psychology, and other special sciences
to be grounded in various kinds of structure. The distinction between living things and nonliving ones, for instance, is grounded in the organization of their components, not in the particles or materials that compose them.

Second, living things such as human beings are exhaustively decomposable into particles or materials of the sort described by physics—the very same kinds of particles or materials found in nonliving things. A hylomorphist could claim that living things have nonphysical components; Aquinas may even have endorsed a view of this sort. But the hylomorphists I have in mind reject it. They are committed instead to the empirical claim expressed in the quote from Mayr: living beings such as humans are exhaustively decomposable into the same fundamental physical materials found in nonliving things.

One implication of this claim is that living things cannot violate lower-level physical laws. This has further implications for how hylomorphists approach mental causation, a topic I consider in detail later (Section 5).

Third, because organisms consist of both structures and materials that are structured, hylomorphists claim that a complete account of living behavior must appeal to both. Consider an analogy: suppose a piano is not a mere heap of wood and metal, but wood and metal structured a certain way. If that is the case, distinguishing good pianos from bad ones will require knowing something both about piano materials and about piano design. Knowing only that the manufacturer used good materials to build this or that piano will be insufficient for determining whether it is a good one since good materials can be assembled in a shoddy way. Likewise, knowing only that the best craftsmen were employed to impose the best design on the available materials will be insufficient since good design and workmanship cannot overcome the limitations of shoddy materials. Something analogous is true of living things, say hylomorphists. Understanding their behavior requires understanding something both about their structures and about the materials that are structured in those ways.

Another way of stating this idea is by appeal to property pluralism: structured individuals have properties of at least two sorts: properties due to their structures (or their integration into individuals with structures), and properties due to their materials alone, independent of the ways they are structured. Consider an example. Subatomic particles, atoms, and molecules have physical properties such as mass irrespective of their surroundings. Under the right conditions, however, they can contribute to the activities of living things. Nucleic acids, hormones, and neural transmitters are examples. They are genes, growth factors, and metabolic and behavioral regulators. Each admits of two types of descriptions. They can be described in terms of the contributions they make to a structured system, but they are also independently describable in non-contribution-oriented terms. Descriptions of the former sort are expressive of the properties characteris-
(c) inadequate signage warning drivers of the curve;
(d) the driver’s high blood-alcohol level.

In a given context, any one of these factors might be cited as a cause or the cause of the crash. The mechanical engineer is interested in (a); the civil engineer in (b); the town planner in (c); the prosecutor in (d). Each of these factors, moreover, contributes to an explanation of the crash in a different way. The grading of the roadway contributes to the crash in a way very different from the driver’s blood-alcohol level. In the former case, we can describe the contribution purely by appeal to physical factors such as the car’s velocity. In the latter case, we need to bring in other factors—biological factors such as the effects of alcohol on perception and reaction time. Not only are there different explanatory factors, then, there are also different explanatory relations, different ways something contributes to an explanation of an effect.

Fifth, hylomorphism takes the notion of structure to be related to an account of composition or parthood. Lower-level entities such as atoms and electrons qualify as parts of higher-level entities such as organisms by virtue of contributing to their activities. An electron is part of me exactly if it contributes to my overall functioning—if, say, it depolarizes one of my cellular membranes or plays a role in the metabolic processes of one of my cells. Consider again the strand of DNA. When it is integrated into a cell, it makes a goal-directed contribution to the activity of the whole. On this view of composition, parts contribute to the activities of the wholes they compose, and different parts of a whole contribute to its activities in different ways.

Peter van Inwagen has recently defended a similar account of composition. According to van Inwagen, something qualifies as a part if and only if it is “caught up in a life,” an expression he borrows from the biologist J. Z. Young. He explains with an example:

Alice drinks a cup of tea in which a lump of sugar has been dissolved. A certain carbon atom . . . is carried along with the rest of the sugar by Alice’s digestive system to the intestine. It passes through the intestinal wall and into the bloodstream, whence it is carried to the biceps muscle of Alice’s left arm. There it is oxidized in several indirect stages (yielding in the process energy . . . for muscular contraction) and is finally carried by Alice’s circulatory system to her lungs and there breathed out as a part of a carbon dioxide molecule . . . Here we have a case in which a thing, the carbon atom, was . . . caught up in the life of an organism, Alice. It is . . . a case in which a thing became, however briefly, a part of a larger thing when it was a part of nothing before or after . . .

(van Inwagen 1990: 94–5)

Hylomorphism’s account of composition can be understood as a way of elaborating van Inwagen’s basic idea: to be caught up in the life of something is to make a goal-directed contribution to its activities, where it is up to biologists, neuroscientists, and other empirical investigators to describe the nature of the goal-directed contributions things make.

An account of composition like this has also been articulated by several philosophers of neuroscience including William Bechtel. According to Bechtel, something qualifies as a component part of a complex system—what he calls a mechanism—only if it performs an operation that contributes to the activity of a whole:

The component parts of a mechanism are the entities that perform the operations which together realize the phenomenon of interest. A structure within the mechanism may be well delineated (it has boundaries, continues to exist over time, is differentiated from the things around it, etc.). However, if it does not perform an operation that contributes to the realization of the phenomenon, it is not a working part of that mechanism.

(Bechtel 2007: 180)

Philosophers of biology and neuroscience, like Bechtel, have been attracted to a view of composition along these lines because this is the type of view suggested by actual work in biology and neuroscience—both the methods of those sciences and the kinds of explanations they employ (Craver 2007). Of central importance is a method of scientific investigation philosophers have sometimes called functional analysis (other names include “mechanical decomposition” or “functional decomposition”).

Biologists, cognitive scientists, engineers, and others frequently employ functional analysis to understand how complex systems operate. They analyze the activities of those systems into simpler subactivities performed by simpler subsystems (Cummins 1975; Lycan 1987; Bechtel 2007, 2008; Craver 2007). Consider a complex human activity such as running. Functional analysis reveals that running involves among other things a circulatory subsystem that is responsible for supplying oxygenated blood to the muscles. Analysis of that subsystem reveals that it has a component responsible for pumping the blood—a heart. Analysis of the heart’s pumping activity shows that it is composed of muscle tissues that undergo frequent contraction and relaxation, and these activities can be analyzed into the subactivities of various cells. Analyses of these subactivities reveal the operation of various organelles that compose the cell and that are composed in turn of complex molecules. The cell membrane, for instance, is composed of a double layer of phospholipids, each of which has a hydrophobic end that repels water, and a hydrophilic end that attracts it. Analysis of the water-attractive end reveals that it is composed
of a phosphate group with a distribution of electrons capable of attracting water molecules. The electrons are able to do this because they are negatively charged. If they have their charges not on account of the activities of some lower-level subsystems, but as an unanalyzable matter of fact, then no further functional analysis is possible. We reach a foundational level of functional parts. Functional analysis thus supplies empirical content to the idea that parts contribute to the activities of their respective wholes.

Two clarifications are in order about functional analysis. First, a remark about the name: “functional analysis” is a name that has been used by philosophers, but biologists often call the method “reduction” (Campbell et al. 1999; 4). This notion of reduction is different from the notion typically discussed in connection with the philosophy of mind (Jaworski 2011: 277). Reduction in the philosophy of mind typically concerns the ability of one conceptual framework to take over the descriptive and explanatory roles of another. To claim that, say, psychology is reducible to neuroscience implies that it is possible in principle for neuroscience to take over all the descriptive and explanatory jobs psychology currently performs. Any description or explanation we would normally express in psychological terms could be rewritten in neuroscientific ones. Ernest Nagel’s (1961) influential account of reduction formulated this idea by appeal to bridge principles—empirically warranted premises that identified the entities postulated by the reduced theory with entities postulated by the reducing one. These theoretical identifications would enable us to rewrite the descriptions and explanations of the reduced theory as descriptions and explanations of the reducing theory. If pain = brain state A, and anxiety = brain state B, then the statement “pain triggers anxiety” could be rewritten as “Brain state A triggers brain state B.” If psychological descriptions and explanations could be rewritten as neuroscientific ones in this way, then neuroscience would be capable of taking over all the descriptive and explanatory roles psychology plays. Psychology would be reducible to neuroscience.

By contrast, when biologists speak of reduction they are typically not speaking of the relation between conceptual frameworks I’ve just described, but of a method for studying complex systems—what I’ve been calling “functional analysis.” Here is an example taken from the biology textbook quoted earlier:

Reductionism—reducing complex systems to simpler components that are more manageable to study—is a powerful strategy in biology . . . Biology balances the reductionist strategy with the longer-range objective of understanding how the parts of cells, organisms, and higher levels of order, such as ecosystems, are functionally integrated.

( Campbell et al. 1999)

The authors clearly have in mind what they call a research strategy—a method for studying complex things. A commitment to employing this method does not imply a commitment to reduction in the philosophical sense. It might be impossible for neuroscience to take over the descriptive and explanatory roles of psychological discourse even though it is possible and even necessary to use functional analysis to understand how humans can engage in psychological activities. In fact, this is precisely what hylomorphism claims. Just as an explanation of what makes a good piano is not reducible to a description of wood and metal because of the distinctive explanatory contributions a piano’s structure makes, so too explanations of living behavior are not reducible to descriptions of the lower-level mechanisms revealed by functional analysis because of the distinctive explanatory contributions a living thing’s biological, psychological, and social structures make.

Why should we believe that hylomorphists are right about higher-level structures making explanatory contributions beyond the contributions made by lower-level things? Hylomorphists insist that this is supported by empirical considerations. As an empirical matter of fact, they say, higher-level structural discourse provides effective descriptions and explanations independent of any claims about reducibility. Consider Bechtel’s observations about descriptions and explanations in psychology and other special sciences:

[The] mechanistic explanations [provided by functional analysis] are in fact compatible with a robust sense of autonomy for psychology and other special sciences . . . In virtue of being organized systems, mechanisms do things beyond what their components do . . . Organization itself is not something inherent in the parts. Accordingly, investigators who already understand in detail how the parts behave are often surprised by what happens when they are organized in particular ways . . . [T]he organization of the components typically integrates them into an entity that has an identity of its own. As a result, organized mechanisms become the focus of relatively autonomous disciplines . . . This autonomy maintains that psychology and other special sciences study phenomena that are outside the scope of more basic sciences but which determine the conditions under which lower-level components interact. In contrast, the lower-level inquiries focus on how the components of mechanisms operate when in those conditions . . . The fact that mechanisms perform different activities than do their parts manifests itself in the fact that the activities of whole mechanisms are typically described in different vocabulary [sic] than are component operations. Traditional accounts of theory reduction implicitly
recognized this fact by requiring bridge principles to connect the different vocabularies used in different sciences, but little notice was given as to why different sciences employ different vocabularies. The vocabulary used in each science describes different types of entities and different operations—one describes the parts and what they do, whereas another describes the whole system and what it does.

(2007: 174, 185–6)

If Bechtel’s observations of scientific practice are correct, higher-level empirical disciplines and lower-level ones have different subject matters on account of the ways things are organized or structured. Because higher- and lower-level disciplines deal with different subject matters, they have different vocabularies, and provide different kinds of explanations, and these different vocabularies and explanations make higher-level disciplines autonomous—irreducible to lower-level disciplines in the traditional philosophical sense. In light of these kinds of observations about the autonomy of higher-level sciences, and the role structure or organization plays in explaining it, hylomorphists insist that the burden of proof is on their opponents to establish that claims about biological, psychological, or social structures are reducible to claims about things that lack them.

Second, the notion of function that gives functional analysis its name is different from the notion of function discussed in connection with functionalism in philosophy of mind. According to classic functionalist theories of mind, mental states are postulates of abstract descriptions framed in terms analogous to those used in computer science—descriptions that ignore the physical details of a system, and focus simply on inputs to it, outputs from it, and internal states that correlate the two (Putnam 1975: Essays 18–21). When it comes to functional analysis, by contrast, the notion of a function is not abstract in this way, and it has a teleological dimension: sub-systems contribute to the activities of the wholes to which they belong, and that contribution is their reason or “purpose” for belonging to the system (Lycan 1987; Sober 1985): the purpose of the spark plug is to ignite the fuel; the purpose of the heart is to pump the blood, and so on.

Teleological functionalism is a type of functionalist theory that appeals to a teleological notion of function along these lines as well. Lycan’s (1987) homunfunctionalism is an example. Like functionalist theories of all sorts, however, teleological functionalism claims that higher-level discourse is abstract discourse; higher-level properties are higher-order properties—logical constructions that quantify over lower-order properties. Because hylomorphists are committed to emergent properties with feature (4) above, they reject this understanding of higher-level properties. Higher-level properties, they say, are first-order properties in their own right. So although teleological functionalists and hylomorphists both claim that a system’s components contribute teleologically to its overall operation, they disagree about how the notion of contribution is to be understood. Teleological functionalists claim that descriptions of higher-level phenomena are simply abstract descriptions of lower-level occurrences. Hylomorphists claim that higher-level descriptions correspond to distinctive natural structures that factor into descriptions and explanations of living behavior in ways that cannot be eliminated, reduced to, or paraphrased in favor of lower-level descriptions and explanations.

Let the foregoing remarks suffice for a description of the general hylomorphic view. It provides a way of understanding the distinctive powers of living things. Those powers, it says, are embodied in the structured components of living things situated in a suitable environment: I have the power to run because I have components—physiological substrutures—that are organized so that their activities in a suitable environment contribute to my running in ways revealed by functional analysis. Those substructures, organized the ways they are, confer on me the power to run.

Consider now a hylomorphic approach to problems in the philosophy of mind—what I will call a hylomorphic theory of mind.

3. Patterns of Behavior: A Hylomorphic Theory of Mind

Our discussion of structures has so far focused on mechanical structures or mechanisms: arrangements of a thing’s parts that enable those parts to interact in novel ways that confer on the whole powers not had by the parts taken in isolation. Hylomorphists nevertheless insist that these are not the only kinds of structures that exist. Hierarchies of biological organization also include patterns of behavior—characteristic ways living things interact with each other and their environments.

The activities of living things follow regular patterns: birds build nests not webs, and lay eggs not acorns. Humans grow lungs instead of gills, and skin instead of scales. Squirrels bury nuts, and are active during the day; raccoons come out at night, and will rummage through our garbage if we do not take precautions. All of these are examples of patterns in living behavior. Just as the parts of living things are not assembled at random but have distinctive structures, so too the behavior of living things is characterized by distinctive patterns of social and environmental interaction. Some of these patterns involve the ways organisms acquire and utilize energy from the environment to maintain their distinctive structures against entropy. Others involve their abilities to respond to and interact with features of their environments—their capacities for sensation and movement. Yet other patterns involve states of motivation or arousal such as hunger, thirst,
fear, anger, and disgust; and still others involve cognitive capacities such as memory, learning, reasoning, and problem-solving.

A hylomorphic theory of mind is based on the idea that the patterns we find in the living world include mental phenomena. Thought, feeling, perception, and action are all patterns of social and environmental interaction—complex ways we interact with each other and the environment. Some of these ways we describe in perceptual or sensory terms: seeing, hearing, tasting, feeling. Others, such as knowing, wanting, believing, or remembering, are more complex and incorporate states of perception or sensation as subpatterns. These higher-level patterns, moreover, are often integrated into behavioral patterns that are more complex still such as intellectual habits or personality or character traits. Consider an example: the interactions between a young child and the candy hidden in the cupboard are at first almost completely unstructured—or more precisely, they are structured in ways we can describe and explain purely by appeal to physics: the child and candy exert a gravitational influence on each other, say. But the interactions between the child and the candy become structured in more complex ways once the cupboard door is opened. We describe these ways by saying the child wants the candy, is trying to get it, and remembers that it is there once its mother has re-closed the cupboard door. The same is true of the child’s interactions with its mother and with other people: it is chagrined and frustrated by her refusal to give the candy, but knows that its father is more pliable. Similarly, the father’s pliability and the mother’s prudence are also types of complex structured behavior. They represent broad patterns of choice, decision, thought, feeling, and action with long histories and long-term implications for future behavior.

The core idea of a hylomorphic theory of mind is that sensations, feelings, thoughts, perceptions, actions, and other psychological phenomena are complex patterns of social and environmental interaction like the ones just described. Thoughts, feelings, and perceptions are not occurrences in isolated heads, nor are actions the external trappings of inner, mental episodes. These phenomena are instead—all of them—ways that animals like us interact with each other and the environment—ways in which our behavior can be structured or organized. Plants, animals, and other living things are not just organized assemblages of parts; they are zones of structured activities. These activities include muscular contractions, bodily movements, and other physiological states as lower-level contributing factors revealed through functional analysis, but they also include higher-level interactions with other animals and the environment. Specifically human behavior, moreover, comprises biological activities and capacities that are incorporated into patterns of rational interaction—patterns that admit of evaluation in terms of rational, moral, aesthetic, and similar categories.

The idea that mental phenomena are patterns of social and environmental interaction is liable to remind some readers of behaviorism, and others of Dennett’s (1991) real patterns. Hylomorphism nevertheless differs from these views in significant ways. First, hylomorphism (of the sort we are considering) rejects physicalism; behaviorism and Dennett do not. Second, hylomorphists do not conceive of behavior as narrowly as behaviorists do. Behaviorists tend to conceive of behavior merely in terms of bodily movements or utterances—something that can be given an exhaustive description by physics but that is observable under pedestrian circumstances (Jaworski 2011: 106). According to hylomorphists, however, behavior comprises more than this. Thoughts, feelings, perceptions, and actions all involve social and environmental factors in addition to physiological ones. Hylomorphists thus reject the behaviorist project of analyzing psychological predicates and terms into longer descriptions of actual and potential bodily movements and states. Psychological language instead describes distinctive patterns of social and environmental interaction that cannot be analyzed or reduced to unstructured bodily movements, states, or dispositions. Third, hylomorphists and behaviorists endorse different semantics for psychological expressions. According to behaviorists, psychological expressions operate like abbreviations for longer physical descriptions of bodily movements and states. According to hylomorphists, by contrast, psychological expressions operate like natural kind terms that refer to patterns of social and environmental interaction, and that get their referents fixed initially by observing those patterns firsthand (Jaworski 2011: 334–9).

In addition, hylomorphists reject Dennett’s claim that psychological discourse is merely a framework for predicting and explaining physical processes in a way that is more efficient, if less accurate, than physics. For hylomorphists, psychological discourse and the special sciences in general are conceptual frameworks for describing and explaining behavioral structures at levels higher than those postulated by physics. We postulate patterns not simply for predictive and explanatory convenience, but because there really are higher-level patterns, and we are interested in describing and explaining what there really is. To use a slogan: real patterns are more real for hylomorphists than they are for Dennett, whose view is best understood as a variety of nonreductive structure antirealism (see Section 1).

4. Hylomorphism and the Problem of Emergence

The hylomorphic theory I’ve just described is similar in some respects to classic emergentist theories like Roger Sperry’s (1984) or C. D. Broad’s (1925). If emergent properties are defined by the four characteristics described in Section 2, then hylomorphists and classic emergentists both
claim that emergent properties exist. Kim (2006) has argued that views of this sort face serious philosophical problems: the problem of emergence and the problem of mental causation. Hylomorphism nevertheless has features that enable it to avoid these problems in a way classic emergentist theories cannot.

The problem of emergence is the problem of explaining how lower-level physical or physiological occurrences can generate or produce higher-level phenomena such as consciousness (Jaworski 2011: 229–33). How is it that the movements of tiny particles in my brain can give rise to the rich qualitative experiences I have? Some classic emergentists have looked to answer this question by appeal to a notion of mechanical structure. It is not the particles by themselves that generate consciousness, they say, but those particles organized a certain way that do. Critics nevertheless remain unconvinced. How, after all, is a difference in spatial organization supposed to make any difference to emergence? If a number of fundamental physical particles do not generate conscious states, how could repositioning those particles help in any way? It does not seem as though it could, critics urge. If it is a mystery how a number of fundamental physical interactions could produce consciousness, it is equally mysterious how spatially reorganizing those interactions could make any difference. Emergentists are thus committed to postulating emergence as a mysterious, unexplainable matter of fact—an awkward result.

Hylomorphists take a different approach to the problem. They look to nip it in the bud, for if hylomorphism is true, it is illegitimate even to request an explanation of how lower-level factors can give rise to higher-level behavior. It is legitimate to request an explanation of how it is possible that \( p \) only if it is possible that \( p \), and according to hylomorphists, it is not possible for lower-level physical or physiological occurrences to produce thoughts, feelings, actions, and other mental phenomena.

One key difference between hylomorphism and classic emergentism concerns how each understands the relation between emergent properties and lower-level things. Unlike classic emergentism, hylomorphism denies that emergent properties are generated or produced by lower-level processes or states. Higher-level phenomena are instead ways in which lower-level occurrences are structured, and structures in general are not generated or produced by the things they structure. The structure that makes something a piano is not produced by pieces of wood and metal; it is instead embodied in wood and metal; wood and metal contribute to the piano's overall operation in ways revealed through functional analysis. Likewise, say hylomorphists, brains do not generate or produce thoughts, feelings, and actions. The latter are patterns of social and environmental interaction; they are structured activities, regular ways in which the powers conferred by physiological subsystems are exercised. They are embodied in part in muscular contractions, neural firings, and other physiological occurrences; the latter contribute to their performance in ways revealed through functional analysis, but thought, feeling, and action are not generated or produced by physiological occurrences, for, on the hylomorphic view, structured things are not in general causal byproducts of the lower-level things they structure.

Consequently, to demand that hylomorphists explain how brains produce consciousness would be implicitly to beg the question against their view, for it would assume the existence of a kind of occurrence that hylomorphists deny exists, namely the generation of higher-level phenomena by lower-level states. On hylomorphists' own terms, then, it is not legitimate to request an explanation of lower-level generation any more than it is legitimate to request that a meteorologist explain how the will of Zeus produces rain. If their view is true, the problem of emergence does not even arise.

5. Hylomorphism and the Problem of Mental Causation

Consider now the problem of mental causation. It too is a problem facing emergentists; though Kim (1993: Essay 17) has shown it is also a problem facing nonreductive physicalists. The following claims seem jointly inconsistent, yet it is difficult to see which we should reject:

1. Actions have mental causes.
2. Actions have physical causes.
3. Mental causes and physical causes are distinct.
4. An action does not have more than one cause.

Given the commitments of their theory, emergentists cannot reject (1), the claim rejected by eliminative physicalists and epiphenomenalists, nor can they reject (3), the claim rejected by reductive physicalists. Yet rejecting claim (2) appears to commit them to claiming that physical laws are violated every time we act, and rejecting claim (4) appears to commit them to claiming that actions are overdetermined—that each has both a sufficient physical cause and a sufficient mental one. Both implications are awkward for reasons that are well rehearsed in the literature (Jaworski 2011: 169–76).

Hylomorphists seem initially to be in the same boat as emergentists. Because they endorse the existence of emergent properties with the characteristics described earlier, they cannot reject (1) or (3), nor can they reject (2) because, as we've seen, they are committed to the idea that higher-level behavior never violates lower-level physical laws. Are they thus commit-
...and rejecting (4), and accepting the overdetermination of actions? No, say hylomorphists, they are not. The reason, they argue, is that there is an equivocation on the term “cause.”

According to hylomorphists, emergentists face a problem with mental causation because they implicitly assume there is only one kind of causal relation—the kind that can be described by physics. Emergent powers, emergentists suppose, are like emergent forces, so if mental states are to influence behavior, they must do so in the way physical things do.1 Consequently, if the mental causes of actions do not exclude physical causes, as the denial of (2) would have it, they and the physical causes of actions must together overdetermine their effects. But hylomorphists reject the assumption that there is only one kind of causal relation. The term “cause,” they say, is equivocal; it can be used to refer to many different kinds of explanatory relations. Once we clarify how it is used in (1)–(4), we see either that those claims are all true but consistent, or else that one of them is false but its falsity does not have the awkward consequences it is alleged to have.

One way of giving content to the idea that there are different kinds of explanatory relations is to view explanations as answers to certain kinds of questions. Aristotle defended an account of causation and explanation along these lines. A cause (aition), he said, was an answer to the question dia tis: Why? or On account of what? (Physics 194b 16–20). Bas van Fraassen has made a similar claim: “An explanation,” he says, “is an answer to a why-question” (1980: 134). Elsewhere I’ve developed this idea not just with regard to why-questions but also how-questions since many how-questions are requests for explanation (Jaworski 2009). How-questions of mechanism are an example. They request what some philosophers of neuroscience call mechanistic explanations (Bechtel 2007)—the kinds of explanations yielded by the method of functional analysis described earlier. They explain how a system is able to perform an activity by describing how the activities of its subsystems contribute to that activity.

Mechanistic explanations are distinct from other explanations of living behavior including explanations that appeal to people’s reasons. This point was made by Plato in a famous passage from the Phaedo in which Socrates describes his experience reading Anaxagoras:

I saw [Anaxagoras] neither appealing to thought, nor citing any of the causes responsible for the ordering of things . . . To me it seemed exactly the same as someone saying that Socrates does everything he does with thought, and then in stating the causes of each thing I do were to say that I am sitting here now because . . . my body is composed of bones and sinews [and] the sinews . . . contract and relax . . . [and] the contracting and relaxing of the sinews somehow enables me to bend my limbs now, and this is the cause of my sitting here . . . But to call such things causes is most absurd. If someone were to say that without having bones, and sinews . . . I would not be able to do what I believe best, that would be true. But to say that I do what I do because of such . . . but not on account of choosing what I believe best—that would be an extremely careless way of speaking.

According to Socrates, the problem with Anaxagoras’s account of human action is not that it misunderstands the physiological mechanisms at work in human action, but that it assumes a description of these mechanisms is relevant to answering the questions about human behavior Socrates has in mind. Those questions, Socrates thinks, can only be answered by appeal to reasons: thoughts and choices aimed at what is best.

Suppose that Socrates is right—and not just Socrates, but Davidson (1970), Dretske (1988), and many other philosophers. Suppose that there are, as an empirical matter of fact, at least two different ways of explaining human behavior: a way that appeals to reasons, and a way that appeals to physiological mechanisms. Because hylomorphists understand causes and causal relations by appeal to explanatory factors and explanatory relations, they take these two kinds of explanation to correspond to two kinds of causation. Beliefs and desires cause or contribute to actions in one kind of way—they rationalize actions, let us say—and neural events cause or contribute to actions in a different kind of way—they trigger the muscular subsystems involved in actions. This distinction among kinds of causal relations enables hylomorphists to solve the problem of mental causation in an attractive way.

Because the term “cause” is used in different ways, say hylomorphists, claims (1), (2), and (3) must be rewritten:

1. Actions are rationalized by beliefs, desires, and other mental states.
2. Muscular contractions are triggered by events in the nervous system.
3. Rationalizing causes and physiological triggers are distinct.

These claims are jointly consistent, and hylomorphists can endorse all three. What do hylomorphists make of claim (4), the claim that rules out an action having multiple causes? On its face, they say, it is false, but its falsity does not have any awkward consequences. It would be awkward if denying (4) implied that actions were overdetermined, but because reasons and physiological mechanisms contribute to actions in different ways, they cannot be overdetermining causes of actions. By analogy, because blood-alcohol levels and shallow roadway gradings contribute to crashes in different ways,
they are not overdetermining causes of crashes. Overdetermination in the relevant sense implies that the overdetermining causes contribute to their effects in the same way, but that is not the case here. According to hylomorphists, human behavior is a highly structured phenomenon that comprises a complex range of causal factors. Explanations that appeal to reasons and explanations that appeal to physiological mechanisms pick out causal factors of different sorts; they answer requests for different kinds of information, just as explanations that appeal to roadways grading and explanations that appeal to blood-alcohol levels provide different kinds of information about car crashes. There is thus no threat of actions being overdetermined by reasons and physiological triggers.

Given the triggering/rationalizing distinction, say hylomorphists, claim (4) can be true only if it is rewritten. Here are two possible ways of doing so:

4' An action does not have more than one rationalizing cause.
4'' An action does not have more than one physiological trigger.

Hylomorphists are free to endorse both claims, and also to reject them. Either way, they argue, they succeed in solving the problem, for (4') and (4'') are both consistent with (1')–(3'), and so are the denials of (4') and (4''). So whether hylomorphists endorse (4') and (4'') or deny either, they end up solving the problem.

Consider now an objection to the hylomorphic solution (Jaworski 2011: 348–52). It claims that hylomorphists provide no solution at all, for they are forced either to deny that rationalizing causes exercise any real control over human behavior, or to concede that rationalizing causes and physiological triggers overdetermine actions. Why? The reason, says the objection, is that a thing's properties are metaphysically necessitated or determined by the properties of its parts. Your properties, for instance, including your psychological properties are determined by the properties of your organic parts such as your brain. Furthermore, the properties of your brain are determined by the properties of the molecules that compose it; their properties are determined by the properties of the atoms that compose them, and so on. Ultimately, then, the properties of everything are determined by the properties of fundamental physical particles since these are the basic constituents of everything. Now if everything is determined by what happens at a fundamental physical level, then beliefs, desires, and other mental states do not really contribute to an explanation of what people do; the real explanation for human behavior and everything else is given by fundamental physics. Beliefs, desires, and other mental states might rationalize actions, as hylomorphists claim, but these rationalizations cannot have any real causal import, for they do not have explanatory import, and on a hylomorphic view, causes are explanatory factors. Hylomorphists could try to respond by attributing real causal import to rationalizations, but if they do this, they commit themselves to the idea that actions are overdetermined by the rationalizations and the lower-level determining factors. Consequently, says the objection, hylomorphism does no better vis-à-vis the problem of mental causation than its competitors.

Hylomorphists respond that this objection is based on two false assumptions—or more precisely, two assumptions they reject, namely that there are not many different kinds of causal relations, and that structure is not a basic explanatory principle. As a result, they say, the objection begs the question against them. It does not prove that their solution fails; it rather assumes it from the outset. Let us consider this response in detail.

The objection's first tendentious assumption, say hylomorphists, is that higher-level and lower-level causes—reasons and triggers, in this case—compete to occupy a single causal role. Exponents of the objection assume that higher-level and lower-level causes would have to explain their effects in the same ways, and consequently that higher- and lower-level causes would either have to exclude each other from occupying a single causal role (the role of being the one and only cause of higher-level behavior), or else would have to share that role and be redundant overdetermining causes of higher-level behavior. We have seen, however, that hylomorphists reject this understanding of causes and causal relations in favor of causal pluralism. There is not a single causal role that rationalizing causes and triggers compete to occupy, they say. Actions are complex multistucture phenomena; each comprises many levels of structural complexity and many different causal factors. Consequently, explaining an action completely would require a description of a broad range of social and environmental factors as well as subactivities and substructures at every level with causes at each level contributing to an explanation of the action in different ways. Typically, however, we are not interested in explaining actions completely. We instead focus on some kinds of explanatory factors to the exclusion of others. In pedestrian contexts, for instance, we are typically interested in the rational structure of people's behavior; we focus on their reasons for doing this or that. In neuroscientific contexts, by contrast, we are not interested in people's reasons, but in the neural substructures that enable rational behavior to occur. Because causes of the foregoing sorts—rational and neuroscientific—contribute to people's behavior in different ways, they do not compete to occupy a single explanatory role; they instead play different noncompeting roles in explaining a complex phenomenon. The objection assumes at the outset that this kind of causal pluralism is false, that human intentional actions are not complex multistucture phenomena that...
comprise many different kinds of causes and causal relations. As a result, say hylomorphists, the objection begs the question against them. Moreover, since hylomorphists take their causal pluralism to be grounded in our best empirical explanations of why and how things operate as they do, they urge their opponents to show that the empirical data do not support the pluralistic view.

The objection’s second tendentious assumption, say hylomorphists, is that all of a thing’s properties are metaphysically determined by the properties of its parts. Let us call this the lower-level determination thesis. Determination is a type of necessitation relation. We can think about it roughly as a relation that conjoins supervenience with explanation: if F-things determine G-things, then necessarily F-twins must be G-twins, and something’s F-properties explain its G-properties (cf. Kim 2005: 17ff.). According to exponents of lower-level determination, if Alexander is composed of lower-level components with lower-level properties $F_1, \ldots, F_n$, then Alexander is guaranteed to have certain higher-level properties precisely because his lower-level components have $F_1, \ldots, F_n$. Because all of Alexander’s properties are explained by lower-level conditions, exponents of this view think that it undermines the explanatory status of higher-level properties.

Hylomorphists are committed to rejecting the lower-level determination thesis. The reason is that lower-level determination is incompatible with the claim that structure is a basic explanatory principle. According to hylomorphists, it might be plausible to endorse something like lower-level determination when it comes to what William Wimsatt (1985) calls aggregative properties such as mass. It is plausible to suppose that, say, an organism’s mass is determined by the masses of its fundamental physical constituents. But not all properties are like this. Some depend not just on the particles or materials that compose a thing, say hylomorphists, but on the way those particles or materials are structured or organized. To deny this in favor of a lower-level determination thesis that covers all properties is to deny at the outset that hylomorphism is true. The objection thus begs the question against hylomorphism in a second way.

Why suppose that hylomorphists are right about structure? I indicated earlier that they take the explanatory basicness of structure to provide the best explanation for the success of empirical explanations that appeal to structure (Section 1; cf. Jaworski 2011: 296–303). In addition, anti-individualist arguments (e.g. Burge 2007) provide independent reasons to doubt lower-level determination.

Anti-individualist arguments suggest that actions, perceptions, and thoughts are not determined by the intrinsic physical states of an individual organism—by, say, the properties of its parts—since thinking, perceiving, and acting depend on social and environmental conditions in addition to physiological ones. Gabriel and Xavier might be physically indistinguishable from each other—they might have all the same intrinsic physical properties—and yet differ from each other mentally on account of having different histories and inhabiting different environments. Arguments for anti-individualism thus suggest that the lower-level determination thesis described above is false, that exponents of lower-level determination must take into account not only an organism’s parts, but the lower-level conditions that constitute its environment as well.

In response, exponents of lower-level determination could say two things. First, they could expand the lower-level determination thesis to include the lower-level conditions that constitute an organism’s environment. Second, in defense of lower-level determination theses in general, they could appeal to widespread intuitions about the plausibility of supervenience. According to many philosophers, it is plausible to suppose that higher-level properties supervene in some sense on lower-level properties—that lower-level twins must be higher-level twins, or equivalently, that any higher-level difference must be traceable to a lower-level difference. If higher-level properties supervene on lower-level properties, exponents of lower-level determination can argue that the best explanation for this supervenience is that lower-level properties determine higher-level ones. If lower-level conditions determine higher-level conditions, then indistinguishable lower-level conditions will yield indistinguishable higher-level conditions. Consequently, lower-level twins are guaranteed to be higher-level twins. Hence, say proponents of lower-level determination, the supervenience of higher-level conditions on a suitable base of lower-level conditions provides us with good reason to believe that some version of the lower-level determination thesis is true.

Hylomorphists can argue in response that their view is compatible with a broad variety of supervenience relations, and as a result lower-level determination does not in fact provide an obviously superior explanation for supervenience relations. Hylomorphists are free to claim that, say, mental differences supervene on broader social and environmental differences, and that social and environmental differences supervene in turn on lower-level physical differences. Consider an example. Imagine two scenarios: in Scenario A, Alexander believes that there are eight planets in our solar system, and in Scenario B, he believes that there are nine. Hylomorphists are free to claim that this mental difference depends on some social or environmental difference in the two circumstances. It is plausible to suppose, for instance, that differences in beliefs about the planets depend on receiving a certain kind of education, and so Alexander’s belief in Scenario A must be due to something in his education (a lecture on astronomy, say), that is missing from Scenario B. Hylomorphists are free to claim that this social and environmental difference depends in turn on lower-level physical differences. If
the lecture occurs in Scenario A but not in Scenario B, then in one scenario but not the other, the speaker's utterances will vibrate the air molecules that eventually impinge on Alexander's eardrums. Without some sort of lower-level physical differences between the two scenarios, there could not be social and environmental differences, and without these social and environmental differences, there could not be any mental differences. Hylomorphists are free to claim, therefore, that mental differences depend on lower-level physical differences; that mental properties, and higher-level properties in general, supervene on lower-level physical properties.

According to hylomorphists, then, higher-level conditions are not determined by lower-level conditions; they merely depend on lower-level conditions, and different higher-level conditions depend on different lower-level ones. Having a belief that there are eight planets requires lower-level conditions different from having a belief that there are nine. Consequently, Alexander's beliefs about the number of planets cannot differ in Scenarios A and B unless those scenarios differ physically. It is by no means obvious, say hylomorphists, that this is a weaker explanation for supervenience than lower-level determination. At the very least, exponents of lower-level determination must show that their explanation is superior in order to support this part of their objection.

According to hylomorphists, therefore, the objection to their view is based on assumptions about causation and structure that they reject. It represents not an independently warranted argument against their view so much as an alternative approach to mental causation. That approach, they say, is responsible for generating the problem of mental causation in the first place—something amply illustrated by the line of reasoning the objection follows. Part of what makes their own approach so attractive by contrast, hylomorphists insist, is that it avoids generating problems of this sort.

I've provided a rough sketch of a hylomorphic view of powers and structures and explained how it can solve problems that confront similar theories. There is obviously a great deal more to be said, but I hope I've said enough to encourage you to keep structure in mind.

Notes

1. Another argument to this effect appeals to intertheoretic identities: if theory TA is reducible to theory TB, then TB can take over all the descriptive and explanatory jobs of TA, but this kind of takeover requires that entities postulated by TA be identical to entities postulated by TB (Sklar 1967; Schaffner 1967; Causey 1977: Chapter 4; Jaworski 2011: 123–4). According to structure nonreductivists, however, structural and nonstructural discourse are not related in straightforward ways that would allow us to identify structures with nonstructural things. Consequently, nonstructural discourse cannot take over the descriptive and explanatory roles of structural discourse, and hence structural discourse is not reducible to nonstructural discourse.

2. Structure realism is very different from Ladyman and Ross's (2007) structural realism. Their view rejects common-sense things, and takes a stance on the empirical contents of physics. Structure realism does neither.

3. The view biologists like Mayr call “organicism” is implied by hylomorphism, but is less general since it concerns the structures postulated by biology specifically, not those that might be postulated by other special sciences.

4. For Aristotle's view see Physics, Book II, Chapters 1–3, and On the Soul, as well as Nussbaum and Putnam 1992. For Aquinas's view see Summa Theologica IA, Questions 70, 86, and Leftow 2001; for more on Leibniz see Garber 1985 and Smith 2002, and see Merleau Poncy (2002) for his view.

5. The view I have in mind is not committed to a specific account of fundamental physical entities. It does not claim that they are Epe eidemological stuffs, but is happy to leave it to physicists to determine what they are.

6. I nevertheless take this to be compatible with structure being a component of something in a different sense. Koslicki (2008) endorses a view along these lines.

7. Nagel's original account did not require that bridge principles be identity statements, but many critics argued forcefully to the contrary: see references in footnote 1.


9. Remember that the role of the environment: instrumental and constitutive. Roughly, an instrumental understanding takes something's activities to be definable independently of the environment. It takes the activity proper to be bounded by or definable in terms of something's physiological mechanisms alone. An activity-like writing, for instance, includes no more than the operations of the various physiological mechanisms involved in moving a writing implement. A constitutive understanding, by contrast, takes features of the environment to be essential to characterizing the activity itself; something's activities are defined in part by elements of its environment. The activity of writing, for instance, is defined in part by a writing implement; the latter is part of what constitutes the activity of writing, and because of that the activity is not spatially bounded by the physiological mechanisms in involves. I favor a constitutive understanding of the environment for the kinds of reasons advanced by Clark and Chalmers (1998) and Clark (2008).

10. Kim's (1993) exclusion argument is a version of the problem that takes (2) and (4) as non-negotiable starting points.

11. Consider Roger Sperry: "...the atoms on our planet are primarily moved around not by atomic or subatomic laws and forces, as quantum physics would have it, but rather by the laws and forces of classical physics, of biology, geology, meteorology, even sociology, politics, and the like" (1984: 201). See McLaughlin (1992) for more on this point.

References


