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Abstract

Materialism—the view that all of reality is wholly determined by the very, very small—and extreme nominalism—the view that properties, kinds, and qualities do not really exist—have been the dominant view in analytic philosophy for the last 100 years or so. Both views, however, have failed to provide adequate accounts for the possibility of intentionality and of knowledge. We must therefore look to alternatives. One well-tested alternative, the hylomorphism of Aristotle and the medieval scholastics, was rejected without being refuted and so deserves further examination. I will argue that Aristotelian hylomorphic provides a markedly superior account of knowledge, cognitive normativity, and intentionality.

Keywords (separated by '-')	Hylomorphism - Aristotelian metaphysics - Materialism - Nominalism - Knowledge - Epistemology - Ontology - Metaphysics - Intentionality - Normativity
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S.I.: MATERIALISM & METAPHYSICS

The ontological and epistemological superiority of hylomorphism

Robert C. Koons[1]

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Abstract Materialism—the view that all of reality is wholly determined by the very, very small—and extreme nominalism—the view that properties, kinds, and qualities do not really exist—have been the dominant view in analytic philosophy for the last 100 years or so. Both views, however, have failed to provide adequate accounts for the possibility of intentionality and of knowledge. We must therefore look to alternatives. One well-tested alternative, the hylomorphism of Aristotle and the medieval scholastics, was rejected without being refuted and so deserves further examination. I will argue that Aristotelian hylomorphic provides a markedly superior account of knowledge, cognitive normativity, and intentionality.

Keywords Hylomorphism · Aristotelian metaphysics · Materialism · Nominalism · Knowledge · Epistemology · Ontology · Metaphysics · Intentionality · Normativity

In Sect. 1, I define the crucial terms 'materialism', 'extreme nominalism', 'hylomorphism', and 'dualism'. I then argue, in Sect. 2, that the phenomenon of human intentionality is either metaphysically fundamental or ontologically dependent on cognitive normativity. In Sect. 3, I demonstrate the similar dependency of knowledge,

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especially a priori and inferential knowledge, on cognitive normativity. Hence, both human intentionality and human knowledge are either metaphysically fundamental or depend on a metaphysically prior form of normativity at the level of cognition. In Sect. 4 I argue that only biological teleology can provide such a ground for human intentionality and knowledge. This leaves just options: (1) a form of substance dualism, (2) bio-teleology as a fundamental feature of the world (Aristotelian hylomorphism), or (3) the reduction of bio-teleology to the microphysical via the mechanism of natural selection. I refute (in Sect. 5) the third alternative: the materialistic reduction of bio-teleology to natural selection.

I then give, in Sect. 6, a brief sketch of the hylomorphic account of teleology, together with some reasons to prefer such an account to substance dualism. I conclude (in Sect. 7) with a defense of the scientific viability of the Aristotelian account.

1 Defining terms: 'materialism', 'extreme nominalism', 'hylomorphism'

The term 'materialism' has covered a variety of theses and programs. It has quite a long history, dating back at least to Aristotle's objections to the 'earlier thinkers' who overemphasize the 'material element' in Book Alpha of his *Metaphysics*. It is relatively easy to identify a chain of paradigmatic materialists: Democritus, Empedocles, Lucretius, Hobbes, d'Holbach, Vogt, Büchner, Feuerbach, Marx, J. C. C. Smart, David Lewis and David Armstrong. What they all have in common is the view that all mental and social phenomena are ultimately to be explained in terms of the motions and interactions of very small and mindless things. Materialism entails the affirmation of at least three central theses (Koons 2010):

(1.1) Everything that exists and has causal efficacy or a discoverable nature can be located within space and time. Nature forms a causally and explanatorily closed system.

(1.2) All genuine causal explanation has as its ultimate basis (its complete metaphysical *ground*) the spatial and kinematic arrangement of some fundamental particles (or arbitrarily small and homogenous bits of matter) with specific intrinsic natures. All genuine explanation is wholly "bottom-up".

(1.3) These intrinsic natures of the fundamental material things (whether particles or homogeneous bits) are non-intentional and non-normative. The intentional and normative are either non-existent or ontologically reducible to the non-intentional and non-teleological.

Given these three principles, the materialist ensures a relatively simple and homogeneous backing for all genuine causal explanation, and this foundation is independent of and prior to all intentionality and normativity. Understanding the world consist simply in decomposing all complex phenomena into their constituent parts and uncovering the sub-rational causal powers of those parts. These parts and their causal powers are of a relatively familiar and unproblematic sort, harboring no mysteries of merely intentional existence or impenetrable subjectivity.

Nominalism is the thesis that there are no shareable properties (or universals) among the world's fundamental entities. *Extreme* nominalism also denies the existence of *particularized* properties (accidents, modes, or tropes). Hence, extreme nominalism

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denies the fundamentality of all properties, whether universal or particular. Extreme nominalism also entails the denial of the fundamental existence of causal powers, since a power is a kind of property. Hence, extreme nominalists must follow Hume to some extent, either denying the reality of causation altogether or relying on some neo-Humean reduction of causation to regularities in the spatiotemporal distribution of qualitatively similar regions.

Materialists and extreme nominalists thus share a commitment concerning causation: they both deny the existence of fundamental powers at the level of organisms and other macroscopic entities. Extreme nominalists deny the fundamental existence of causal powers altogether, while materialists must at the very least limit the existence of fundamental causal powers to the microscopic realm, below the level of life and human intentionality. In both cases, a kind of ontological supremacy of the microphysical obtains: for materialists, because the microphysical exhausts the realm of fundamental causal powers, and for extreme nominalists, because all causal facts are ultimately grounded in spatiotemporal patterns of resemblance, which are in turn ultimately grounded in the microscopic distribution of such resemblances. For this reason, both materialists and extreme nominalists must embrace either a complete elimination of human intentionality, normativity, and bio-teleology from the world, or else endorse a form of microphysical reduction of both normativity and teleology.

In this paper I will consider two alternatives to such intentional anti-realism (both eliminative and reductive): namely, dualism and hylomorphism.[1] The dualist accepts the total bottom-up determination of the material world by the microphysical but then adds non-physical agencies to the world, while the hylomorphist denies total bottom-up determination in the first place. Thus, the dualist must add new fundamental forces or energies, in the form of vital forces or mind/body interactions, while the hylomorphist can accept a causally closed material world, universally governed by a few physical forces. The hylomorphist simply denies that all fundamental causal powers are to be found at the microphysical level. Instead, some material organisms (human beings) bear fundamental causal powers of a fundamentally bio-teleological and rational-intentional kind.

The term 'hylomorphism' refers to Aristotle's conception of matter ('hyle') and form ('morphe'). For present purposes, we can focus on the two corresponding modes of "causation": bottom-up metaphysical grounding ("material causation") and top-down metaphysical grounding ("formal causation"). Hylomorphists are committed to the existence of certain composite material entities ("substances") in which the nature of the whole is partly (but not wholly) grounded in autonomous facts about its parts, and in which the natures of the parts are partly grounded in autonomous facts about the whole. The postulation of top-down grounding is what distinguishes the hylomorphist from both the physicalist and the substance dualist (whether the immaterial substances are minds or organic souls). Thanks to this top-down grounding,

[1] As will be clear below, by 'hylomorphism' I mean what I have called 'staunch hylomorphism' (Koons 2014), as opposed to the 'faint-hearted' hylomorphism represented by the work of Fine (1999), Johnston (2006), and Koslicki (2008), and discussed by Williams (1986). My fellow staunch hylomorphists include Scaltsas (1994), Rea (2011), Marmodoro (2013), and Jaworski (2016). Staunch hylomorphism combines a sparse theory of fundamental entities and material composition, a sparse theory of properties, and a robustly non-Humean theory of causal powers.

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there can be fundamental causal powers at the level of whole organisms, powers that can be essentially biological and rational (thus contradicting principles 2 and 3 of physicalism), while (in contrast to dualism) the material domain remains causally closed and complete (embracing principle 1 of physicalism).[2]

Is hylomorphism, so defined, committed to the idea that the soul or mind is the "form of the body", as Aristotle put it? Yes, so long as 'soul' and 'form' are understood with sufficient flexibility. We can think of the soul as some holistic fact about a composite living thing that grounds (in the way of top-down, formal causation) the facts about the spatial relationships and causal powers of the chemical and physical components of the organism, enabling those parts to contribute appropriately to the functioning of the whole. Perception and rational thought provide many of the cases in which such formal causation and holistic functioning are most plausible, and so the association of the soul with the active and passive powers of consciousness and thought is an appropriate one.

2 Intentionality depends on normativity

Primitive intentionality is not available to either the materialist or the extreme nominalist. It is available to the dualist and the hylomorphist. The materialist or extreme nominalist must either deny intentionality altogether or reduce it to some microphysical phenomenon. Elimination of intentionality is neither plausible nor coherently defensible, since to affirm any proposition is implicitly to concede the reality of intentionality.

The only plausible reductionist account of intentionality is Ramsey-style functionalism. A functionalist account of intentional states proceeds by starting with a set of "functional" laws connecting the intentional states with each other and with the relevant sensory inputs and behavioral outputs. These functional laws must specify the predictable transitions among the states. To begin with, the language of the set of laws includes explicitly intentional language, specifying the intentional states in terms of their modalities (e.g., belief, desire, intention) and their propositional or predicational content. The reduction to the microphysical is achieved by "Ramseyfying" the laws, i.e., by conjoining the laws together into a single formula, replacing each intentional designation of a state with a different variable, and then adding a string of existential quantifiers to the beginning of the formula. The resulting "Ramsey" formula states that there exist a set of state-types $x_1, x_2, \ldots, x_n$ that stand in the right causal relations to each other and to the physically specified inputs and outputs. According to the functionalist reduction, a material entity is in an *intentional* state of type s_k (corresponding to variable v_k in the Ramsey formula) just in case it in a *microphysically specifiable* state p_k that, together with physical states $p_1, p_2, \ldots, p_{k-1}, p_{k+1}, \ldots, p_n$ constitute an n-tuple of states that jointly verify the open Ramsey formula, with p_j playing the role specified by variable v_j.

[2] The form of grounding that I have in mind follows closely the work of Fine (2012) and Rosen (2010). On these views, grounding is fundamentally a relation between facts. I will also assume that the existence of the grounding fact necessitates what it grounds, and that grounding is an asymmetric relation.

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Functionalism is essentially a sophisticated descendant of the "logical behaviorism" of the early twentieth century. Intentional states are identified with physical states that connect patterns of possible sensory inputs with patterns of possible behavioral outputs in the right way.

Pruss and I have argued that functionalism cannot succeed without relying upon cognitive normativity (Koons and Pruss 2017). The normativity I have in mind is simply that involved in distinguishing between the proper functioning and malfunctioning of those biological faculties involved in representation, reasoning, planning, and execution of plans. Normativity of this kind applies to all creatures that exhibit genuine intentionality, however low in the evolutionary scale.

The functional laws that make up the Ramsey formula for a functionalist reduction must somehow capture the pattern of transitions from internal states and inputs to new internal states plus behavior outputs. These laws must be expressed in the form of some sort of conditional (where system x is either the whole believing and intending individual, or some functional sub-system of the individual):

(2.1) If the system x were in internal state S_n and in input state I_m at time t, then x would at time $t + 1$ be in internal state S_k and output state O_j.

It is obvious that the conditionals like 2.1 cannot be interpreted as *material* conditionals, simply because the material conditionals would be satisfied by any system that never actually receives the inputs (since material conditionals are true whenever their antecedents are false). Thus, the moon would count as being a potentially intentional system, just one that never actually got to think about anything.

We can also dispose of interpretations of (2.1) that employ the usual semantics for the subjunctive or counterfactual conditional. We can do so by simply applying the usual objections to conditional accounts of dispositions. We can imagine, for instance, that the individual human being has strapped to her a bomb that explodes if system x is in internal state S_n and receives input I_m at time t, but that in fact this condition does not obtain. Then, the subjunctive conditional (2.1) would be false, as would probabilistic versions of (2.1) specifying the conditional transition-probabilities. Yet having such a bomb that never goes off strapped to one, while unfortunate, does not deprive one of intentionality.

What if the antecedents of the conditionals are strengthened to include the claim that the whole system survives until the next relevant time? Here we borrow an idea from Harry Frankfurt: the introduction of a purely hypothetical neural-manipulator (Frankfurt 1969). In Frankfurt's thought experiment, the neuro-manipulator wants the subject to follow a certain script. The manipulator continuously monitors the internal state of the subject, and, if the subject were to show signs of being about to deviate from the script, then the manipulator would intervene internally, causing the subject to continue to follow the script. Frankfurt asks us to imagine that, in actual fact, the subject *spontaneously* follows the manipulator's script, and as a consequence, the manipulator never has to intervene. In such a case, the subject acts freely, even though the subject could not have acted differently.

Frankfurt introduced such a thought experiment to challenge the idea that freedom of the will requires alternative possibilities. Pruss and I use it to show that the existence of mental states is independent of the truth of conditionals like (2.1), which link the internal states to inputs, outputs and each other. It is obvious that the presence

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of an inactive manipulator cannot deprive the subject of intentionality. However, the manipulator's presence would be sufficient to falsify all of the non-material conditionals (like 2.1) and all of the usual conditional probabilities linking the states. If the manipulator's script says that at time $t + 1$ the subject is to be in state S_n, then that would happen no matter what state the subject were in at time t.

Again, it won't do to say that the conditionals like (2.1) must hold on the assumption of no external interference [as in Smith (2007)]. For we can always replace an external intervener by an *internal* one—say, an odd disorder of the auditory center of the brain that causes it to monitor the rest of the brain and to intervene counterfactually (in a way that would mimic the action of the external neuro-manipulator).

The trouble with a reductionist version of functionalism [as modeled by conditionals like (2.1)] can be seen without resort to recherché thought experiments, since cognitive malfunctioning is surely possible as a result of injury or illness. The theory to be Ramseyfied cannot plausibly incorporate the effects of every possible injury or illness, since there are no limits to the complexity of the sort of phenomenon that might constitute an injury or illness. Injury can prevent nearly all behavior—so much so, as to make the remaining behavioral dispositions so non-specific as to fail to distinguish one internal state from another. Consider, for example, locked-in syndrome, as depicted in the movie *The Diving-Bell and the Butterfly*. Therefore, the true psychological theory must contain postulates that specify the *normal* connections among states. Cases like these, as well as Frankfurt-like manipulator cases, demonstrate that the simple form of functionalism provides accounts that fail to be necessary for genuine intentionality.

We can also see that such functionalist accounts also fail to be sufficient for intentionality. John Searle's famous example of the Chinese Room can establish this (Searle 1980). Suppose that the supposed functional definition of intentionality [in the form of a large number of conditionals like (2.1)] were realized by the billion-plus members of a giant factory in China, each of whom passes unintelligible signals to specific recipients according to an unintelligible rule book. Such a vast assemblage of bureaucratic functionaries, with no one having any understanding of the meaning or import of any of the signals, cannot constitute a single thinker or reasoner, precisely because there is nothing in the operation of the factory that marks out certain conditions as states of *disease*, *injury*, or *malfunction* of the whole.

Consequently, a viable form of functionalism must include *normality* conditions:

(2.2) System x has essential nature E of such a kind that, If the system x were in internal state S_n and in input state I_m at time t, **and is otherwise at time t in a relevantly (i.e., cognitively) normal condition for something of essence E**, then x would at time $t + 1$ be in internal state S_k and output state O_j.

The functionalist reduction of intentionality to microphysical states cannot succeed without the presence of facts about cognitive normativity. However, such fundamental normativity is not available to the materialist or the extreme nominalist. Therefore, the reduction of the intentional to the microphysical cannot succeed without an independent reduction of the normative to the same microphysical basis.

In contrast, hylomorphism provides for normativity at the fundamental level in the form of bio-teleology. Living organisms, including human beings, have fundamental causal powers that are not grounded in the powers and spatial relations of their microphysical parts. These ungrounded causal powers include (in the case of human

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beings and other rational animals) rational, cognitive powers, powers to form beliefs and intentions and to generate external behavior in accordance with rational norms.

An Aristotelian can give a straightforward account of normativity: a substance is supposed to produce E on occasions of C if and only if its nature includes a C-to-E power (one might also prefer more active terms like "tendency" or "striving"). Deviations from the norm require the action of some external or internal interference with the exercise of these causal powers. Causal powers are, in Aristotle's account, defeasible and subject to various forms of blockage and interference. In some cases, one power is overridden or blocked by another power. In other cases, some of the necessary conditions for the exercise of a causal power (which form part of the normal environment for the power-bearers) are missing, depriving the bearer of the use of that power. Aristotelian hylomorphists can appeal to such interference—in the form of disease, damage, confusion, or distraction—as the cause of the deviations from cognitive and rational norms, while relying on the presence of the power itself as the metaphysical ground of the norm's causal relevance.

Functionalism can then be put in an Aristotelian mode, referring to the presence of cognitive powers to produce outputs and internal states (including other powers). The result would be a non-reductive and non-physicalist version of functionalism (Bealer 2010), since the form of the theory would rule out the intentional states' realizers being merely physical states of constituent particles.

(2.3) System x's essential nature E confers upon it **the power**, when in in internal state S_n, to produce output state O_j and internal state S_k in immediate response to input state I_m.

Such an Aristotelian functionalist account, since it is not committed to any sort of microphysical reductionism, is consistent with intentional states as metaphysically primitive. For example, an intentional state could actually incorporate the properties that it is about as literal, ontological constituents. See the next section for details.

3 Knowledge depends on normativity

Knowledge is inherently normative. A non-normative 'epistemology' (such as Quine's naturalized epistemology) is merely a branch of empirical psychology and abandons any attempt to answer the unavoidable questions of epistemology, such as: what does rationality require in respect of our opinions and affirmations?

Epistemological notions such as *knowledge*, *justification*, and *rationality* are all normative in essence. If the price of materialism were the utter disavowal of all epistemology, this price would be unacceptably high, as Kim (1988) has argued.

This dependency of knowledge on cognitive normativity is especially clear in the cases of a priori knowledge and of inferential knowledge. Facts about cognitive normativity are needed as the metaphysical ground of all a priori or "conceptual" knowledge. Thinking in accordance with such cognitive norms is both necessary and sufficient for such a priori knowledge, including all of our knowledge of logic, mathematics, and ontology.

The possibility of inferential knowledge is also partly grounded in the real existence of cognitive norms, both in the case of deductive and inductive reasoning. Logical

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deduction confers new knowledge only when it conforms to logically valid rules. Similarly, inductive inference, including all inferring of theory from data, must conform to principles that reliably lead to theoretical truth in normal circumstances.

Both materialism and extreme nominalism depend on the existence of a priori and highly theoretical knowledge. Rea (2002) has pointed out that materialism is by definition committed to the real existence of material entities of some kind. However, to know that material objects of certain kinds exist, one must know the relevant modal facts about what kinds of transformations those material objects can and cannot survive. That is, one must know a great deal about the metaphysical essence of material objects, a matter of extremely theoretical inference or purely a priori intuition.

Similarly, the extreme nominalists' arguments against causal powers require extensive knowledge about metaphysical necessity and contingency. For example, Hume claims to know that whatever is conceivable is really possible, and this claim is central to his argument that there is no such thing as causal necessity. Since both materialism and extreme nominalism are metaphysical theories, their defenders do not have the option of rejecting both theoretical and a priori knowledge.

Conformity to norms means more than simply extensional equivalence—more than simply doing what the norms demand. True conformity requires that one thinks as one does *because* doing so satisfies the cognitive norms. One's thinking must be in some sense *guided* by the norms (Lewis 1947, Chapter 3). Merely coincidental concurrence with the norms is not sufficient. This can be seen by considering Gettier-like counterexamples to the sufficiency of mere concurrence with norms [compare Gettier (1973)]. Consider, for example, someone (let's call him 'Smith') who infers the Pythagorean theorem from the axioms of Euclid in a series of steps, each of which concurs with some logically valid rule. Suppose that Smith does not draw these inferences because they obviously follow with logical validity from their premises but simply because the inference has been licensed by some in-fact unreliable source, like *I Ching* sticks or a *Ouija* board. In such a case, knowledge is not transferred from the axioms to the theorems, even though each step concurs with the relevant norm. The concurrence is accidental, and so there is an element of dumb luck in Smith's reaching the right conclusion, an element that deprives him of knowledge.

We can build a similar case involving inference to the best scientific theory.[3] If Jones infers Newton's laws of motions from Kepler's laws, but does so because the inference has been licensed by the oracle at Delphi, then Jones does not thereby acquire knowledge. I assume that the correct norms for theoretical inference are reliably truth-promoting, at least under normal circumstances. A practice that is only accidentally truth-promoting is not knowledge-generating, since reliability of method is a necessary condition of knowledge.

We can also deploy Alvin Plantinga's evolutionary argument against naturalism here (Plantinga 1993, Chapter 12; see also Beilby 2002; Koons 2016). If there were no reliable (causal or constitutive) connection between our cognitive processes and

[3] I also argued in Koons (2000) that materialism cannot explain the reliability of our inferences to the simplest or most elegant hypothesis in fundamental physics, since materialism excludes the possibility that such simplicity is a non-accidental, projectible feature of the laws.

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the cognitive norms, any concurrence between the two would be merely coincidental. Such a lack of connection would constitute what John Pollock labeled an 'undercutting defeater' (Pollock 1986) to any of our a priori or inferred beliefs, because our discovery of this lack of connection would give us grounds for assigning a low or inscrutable probability to the normative propriety and the veridicality of those beliefs. The mere existence of such a defeater, even if we were never to become aware of it, would suffice to deprive our beliefs of the status of knowledge, since it would entail a lack of rational stability and security to our beliefs with respect to new information.

Thus, for knowledge to be possible, it is not enough for cognitive norms merely to exist, nor for our actual a priori beliefs and inferences to concur with those norms. There must also be some reliable *connection*—either causal or constitutive—between those norms and our practices.

For dualists and hylomorphists, such a connection is unproblematic, since they can treat intentional states as incorporating the properties making up their intentional objects as literal parts of those states. The property of being a triangle, for example, could be an ontological constituent—in a fundamental, irreducible way—of each belief about triangles (see Bengson 2016). When a thought about triangles triggers another thought about angles or line segment lengths, the mathematical property of triangularity becomes literally part of the causal history of the new belief. Just as the property of triangularity confers certain causal powers on physical objects that are triangular, so can that some property confer corresponding, isomorphic causal powers on thoughts of triangles, enabling our inferences to mirror in a non-coincidental way the necessities and constraints of real-world geometry. The same model can be applied to our knowledge of the laws of nature or the principles of modality or ontology.

Thus, for Aristotelians, the very properties that occur in the objects of thought are actually incorporated (either as universals or as tropes) into our intentional states, literally and fundamentally. As Aristotle states in *De Anima*, book 3 (431b22): "The intellect is in a certain sense all things." τὰ ὄντα πώς ἐστιν πάντα. Brentano's thesis of the "intentional inexistence" of entities within the mind followed Aristotle's lead. When incorporated into an object of thought, a property occurs in the absence of an appropriate bare particular or material substrate. In thought, substantial properties qualify mental *acts* or *processes* rather than substances. They are bundled together with mental-act properties (like thought, belief, or desire), instead of with the substrate of a material thing. For this to work, the relevant mental acts must in themselves be featureless in the relevant respects, i.e., mere potentialities for bearing a certain intentional content (components of what Aristotle termed the "passive intellect").

This intentional realism of the hylomorphic project ensures that cognitive normativity can play its part in the causal structure of the world. A human thought about a natural property P confers causal powers on the thinker to form further thoughts and intentions about P that reflect P's own intrinsic nature, via P's actual presence in the thought. When these cognitive powers are not blocked or interfered with, the human thinker naturally and non-coincidentally conforms to the relevant cognitive norms, which are inherently truth-preserving and truth-promoting.

Such an Aristotelian intentional realism requires some kind of realism about properties (universals, tropes), since minds and their mental processes do not typically

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much resemble their intentional objects *as a whole*. I don't become froggy by thinking of frogs or starry by thinking of stars. The Aristotelian form of intentional realism is also inconsistent with materialism, since there are no microphysical relations that combine systems of particles with remotely instantiated or uninstantiated macroscopic properties, while our thoughts are not limited to properties that are instantiated nearby or even to ones that are instantiated anywhere.

Consequently, materialists and extreme nominalists must find some other avenue for connecting the human mind with the norms of cognition. There are only two possible ways for them to do so: via human conventions, or via natural selection. I will attempt to close down both of these avenues in the following two sections.

4 What grounds cognitive normativity?

Materialists and extreme nominalists have the burden of a reductive explanation both of the existence and the efficacy of cognitive norms. The mere existence of cognitive norms, as in G. E. Moore's thesis that moral norms exist in a Platonic heaven or "third realm", causally and constitutively isolated from the microphysical world, is not sufficient. As we have seen, such a thesis of causal and compositional isolation of the normative realm renders all a priori and all inferential knowledge impossible by making it vulnerable to undercutting defeaters.

There are only two possible sources for cognitive normativity that are available to materialists and extreme nominalists: social convention and natural selection. However, we can rule out the first, on the ground that social convention requires intentionality, and intentionality cannot be wholly prior to cognitive normativity (as we saw in Sect. 2).

(4.1) Some intentionality is ontologically prior to all social conventions, practices, attitudes, preferences, etc. (since the existence of social conventions, practices, etc. depends on certain beliefs and intentions on the part of the participants).

(4.2) Some normativity is not ontologically posterior to any intentionality (since, as we've seen, any functional definition of intentionality must incorporate reference to conditions of cognitive normality).

(4.3) Ontological priority is transitive and irreflexive.

Therefore:

(4.4) No social conventions, practices, attitudes or preferences are ontologically prior to all normativity.

Thesis (4.1) is clearly true, I think. Only intentional states or practices incorporating such intentional states are capable of projecting or constructing normative facts. Brute behavior, described in physical terms, does not such thing. The argument turns, then, on the plausibility of thesis 4.2: the inherent normativity involved in all intentionality, a thesis that was demonstrated in the preceding section.

Hence, normativity cannot be posterior to intentionality. This applies to social constructionism, to linguistic constructionism of the sort recently defended by Searle (2003), to David Lewis's "best interpretation" theory of intentional content (Lewis 1974), and to the normative naturalism of Boyd (1988).

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5 Is teleology reducible?

The only alternative remaining for the materialist or the extreme nominalist is to ground cognitive normativity in biological teleology, and then to reduce teleology to the microphysical domain via natural selection.

In contrast, hylomorphism represents an all-out realism about bio-teleology. Teleological statements in biology are both literally true and indefinable in non-teleological terms. Anti-realism about any matter in philosophy takes one of two forms: reductive or eliminative. According to a reductive account of teleology, teleology is a real phenomenon, but it is in reality identical to or wholly constituted by certain non-teleological facts. The world is fundamentally non-teleological, but certain complex facts about that non-teleological world can be fittingly described in teleological language or using teleological concepts.

Ruth Garrett Millikan has developed a reductive account of biological teleology in considerable detail (in *Language, Thought and Other Biological Categories*, Millikan 1984). Here is a simplified version of her definition, which will be a paradigm of such accounts of normativity:

(5.1) A thing x is supposed to produce E in circumstances I if and only (i) x belongs to a reproductive family R in which some feature C occurs non-accidentally with finite frequency (between 0 and 1), (ii) there has been a positive correlation between having feature C in R and producing E in circumstances I, and (iii) this positive correlation has been in part causally responsible for the successful survival and proliferation of family R (including x itself).[4]

I will raise five objections to this reductionist project.

5.1 Objection 1: the definability of reproduction

Can *reproduction* be defined naturalistically and without reference to function or teleology? Complex organisms (especially ones that reproduce sexually) never produce exact physical duplicates of themselves. Conversely, since everything is similar to everything else in some respect, every cause could be said to be "reproducing" itself in each of its effects. Real reproduction involves the successful copying of the *essential* features of a thing. For living organisms, these essential features consist almost entirely of biological functions. Hence, we cannot identify cases of biological reproduction without first being able to identify the biological functions of things. Yet Millikan's account requires us to put the reproductive cart before the functional horse.

[4] Millikan (1984, p. 28). Millikan's actual definition requires that C be a "Normal" or reproductively established characteristic of R. Instead of requiring that C be positively correlated in R with the function F, she requires only that the positive correlation hold in some set S which includes x's ancestors, together with "other things not having C." Her exact wording of clause (3) is:

> One among the legitimate explanations that can be given of the fact that x exists makes reference to the fact that C correlated positively with F [i.e., the function of producing E in circumstances I] over S, either directly causing reproduction of x or explaining why R was proliferated and hence why x exists.

None of these variations would make any difference to our objection.

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Therefore, evolution itself presupposes a strong form of teleology in the very idea of *reproduction*.

Richard Dawkins has suggested that we think of organisms as mere "robots" that our DNA molecules have "designed" for reproducing themselves. In fact, DNA molecules never succeed in producing perfect physical duplicates of themselves, and even if they did, the mere physical duplication of the molecule would not constitute reproduction. Suppose, for example, that an extrinsic billionaire builds a chemical factory that does nothing but fill barrels with copies of his own genome, launching them into deep space. No one would think that such a man had succeeded in procreating trillions of descendants. A DNA molecule counts as a copy of one of one's genes only when it is successfully fulfilling the function of a gene within a living organism, indeed, within a living organism of the appropriate teleologically defined kind.

5.2 Objection 2: natural selection cannot explain our conformity to cognitive norms

Since natural selection is interested only in reproductive fitness, and there is no plausible linkage between reliable mathematical intuition about infinite systems (like arithmetic), reliable scientific intuition about plausible theories, or reliable philosophical intuitions about de re modality and modality, on the one hand, and the reproductive fitness of our ancestors in the remote past, on the other, we have good grounds for doubting whether the human brain is a reliable instrument for detecting such mathematical, scientific, or philosophical truths (see, for example, Street 2009; Schechter 2010; Korman 2014). For example, as long as the inconsistencies in our mathematical beliefs do not reveal themselves in the sort of simple situations encountered regularly by primitive human beings, mistaken intuitions of logical consistency would be biologically harmless.

The Millikanian reductionist cannot ward off a Plantinga-style defeater for our modal knowledge about logical, scientific, and metaphysical possibility. Natural selection could very easily have resulted in a brain that is bound by constraints of conceivability that do not correspond to any logical or metaphysical necessity. In fact, it almost certainly has done so: inconceivability is, in general, a fallible guide to absolute impossibility. Thus, the objective probability that any given constraint of conceivability does correspond to a logical necessity is low or inscrutable, resulting in a defeater of our modal beliefs.

5.3 Objection 3: inability to account for fine-grained intentional content

I argued [in Koons (2010)] that the Millikanian reductionist faces a dilemma with respect to intentional content. In order for human intentionality to be sufficiently fine-grained, teleology must also make extremely fine distinctions between what nature is selecting. The reductionists' account of natural selection depends on a prior commitment to a theory of causation, since nature selects what contributes causally to reproduction. Theories of causation come in two varieties: neo-Humean or counterfactual accounts, and anti-Humean, causal-powers theories.

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On Humean, counterfactual account of causation, natural selection is too coarse-grained. As Fodor has argued (Fodor 1990, p. 73):

> …appeals to mechanism of selection won't decide between cases of *reliably equivalent* content ascriptions; i.e., they won't decide between any pair of equivalent content ascriptions where the equivalence is counterfactual supporting. To put this in the formal mode, the context: *was selected for representing things as F* is transparent to the substitution of predicates reliably coextensive with *F*…. In consequence, evolutionary theory offers us no contexts that are as intensional as 'believes that…' If this is right, then it's a conclusive reason to doubt that appeals to evolutionary teleology can reconstruct the intentionality of mental states.

If N is a norm, A is a property involved in N, and property A and B are nearly co-extensive in relevant situations across nearby worlds, then N^* will also count as a norm, where N^* results from replacing A with B in N. The Humean account of normativity falls into the grip of what Fodor has called the 'error problem' or the 'disjunction problem': 'such theories can't distinguish between a true token of a symbol that means something that's disjunctive and a false token of a symbol that means something that's not' (Fodor 1990, p. 59).

However, if the reductionist embraces a causal-powers theory, then selection is sufficiently fine-grained, but a materialist must deny that macroscopic features can be causally efficacious at all, with the result that nature cannot select macroscopic features, nor dispositions that relate to macroscopic features, like sense perception or behavioral dispositions. Materialists must hold that all fundamental causal powers are located exclusively at the microscopic level, and so too all genuine selection must be limited to that same level. This would destroy the possibility of human intentionality, with its ineliminable reference to macroscopically perceivable and manipulable features.

5.4 Objection 4: possible selection of irrational thoughts

If natural selection constitutes the very essence of teleology and therefore of cognitive normativity, then it should be impossible for nature to select for irrational cognitive habits. However, this seems obviously wrong. All we have to do is imagine a scenario in which an environment selects for some form of blatant irrationality. For example, suppose that one intelligent species, A, evolves in an ecological niche already occupied by a different intelligent species, B, with a peculiar predilection for a particular logical fallacy, such as affirming the consequent or wishful thinking. In such an environment, members of A survive because they reason badly in the relevant way. Consequently, the Millikanian reductionist must count the fallacy as conforming to the relevant cognitive norms. But cognitive normativity cannot be plastic in this way.

5.5 Objection 5: a counter-example in the form of a thought experiment

This is an objection that was raised by Alexander Pruss and me in our 2017 paper, "Must Functionalists be Aristotelians?" (Koons and Pruss 2017) What does it mean

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for a particular disposition to *cause* or to *contribute to* a particular instance of *R*-reproduction? We must require that the disposition be part of a *contrastive* explanation of the reproduction: part of a minimal explanation of why in this instance reproduction or survival occurred, as opposed to not occurring. The use of contrastive explanation fits standard biological practice, which identifies adaptations with the results of natural selection, and selection is inherently contrastive in nature.

Say that a region R of spacetime is *impotent* provided that nothing in R can affect what happens in spacetime outside R. Consider first the following principle:

(5.2) Suppose worlds w_1 and w_2 are exact physical duplicates, except in an impotent region R of spacetime. Then w_1 contains an instance of intentionality outside of R if and only if w_2 contains an exactly similar instance outside of R.

Imagine a world w_1 which contains a planet much like earth, where history looks pretty much like it looks on earth, and which also contains a great grazing ground (GGG), which is an infinite "impotent" region. Moreover, by a strange law of nature, or maybe the activity of some quirky aliens, whenever an organism on earth is about to die, it is instantaneously teleported to the GGG, and a fake corpse, which is an exact duplicate of what its real corpse would have been, is instantaneously put in its place on Earth. (We will call it "Earth" for convenience but we shan't worry about its numerical identity with our world's Earth.) Moreover, the organism dies as soon as it arrives in the GGG.

Our world's earth has organisms with real intentionality, and the Earth in w_1 has a history that is just about the same. The only difference is that in w_1 all the deaths of organisms occur not on Earth but in the GGG, because they get transported there before death. But this does not affect any selective facts. Thus, the evolutionary theorist of normativity should say that the situation in w_1's Earth is similar enough to that on our Earth that we should say that w_1's Earth contains organisms with exactly the same intentionality.

The hard work is now done. For imagine a world that is exactly like w_1 outside of the GGG, but inside the GGG, immortal aliens rescue each organism on arrival, fixing it so it doesn't die and becomes once more capable of reproduction. Furthermore, they do the same for the organism's descendants in the GGG. The GGG is a place of infinite (at least potentially) resources, with everybody having immortality and reproduction.

Now in w_2, there is no natural selection at all: nobody ever dies or ceases to reproduce. Thus, by Millikan's definition (5.1) there is no bio-teleology and hence no cognitive normativity and no human intentionality in w_2—all the Earthly critters are functionless zombies. But, by principle (5.2), there must be instances of intentionality outside the GGG in w_2, because w_2 is an exact duplicate of w_1 outside of the GGG. Hence we have absurdity.

Suppose our evolutionary theorist of teleology denies (5.2). Then we have the following absurdity: it is up to the aliens in the GGG to determine whether or not there are instances of teleology (including cases of intentionality) outside the GGG, by deciding whether to rescue the almost dead organisms that pop into the GGG. But how can beings in an impotent region bring about that there is or is not intentionality outside that region? That would be worse than magic (magic is presumably causal).

In the GGG story with post-transportation rescue, there is no natural selection, but surely there is intentionality. This shows that not only are Millikan-type stories

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insufficient for reductionist purposes, but *no* story on which the normativity of mental functioning is grounded in facts of natural selection has a chance of succeeding.

6 The hylomorphic account of cognitive normativity, intentionality, and knowledge

Aristotelians never faced the problem of 'naturalizing' intentionality that has so bedeviled modern philosophers. What we must do is reverse engineer the Aristotelian solution to the problem, re-discovering the elements that are essential to locating all of human intentionality (including our capacity for science) within the natural world.

The fundamental difference between Aristotelian and modern materialist metaphysics lies in their differing conceptions of causation. Aristotle argued that we must understand change in terms of action, action in terms of causal powers, and powers in terms of essences or natures of things. As we have seen, it is a robust conception of causal powers that is needed to ground normativity in nature. Moreover, causal powers are inherently teleological. To have the power to produce E in circumstances C is to have the C-to-E transition as one of one's natural functions. Indeed, as George Molnar has pointed out (Molnar 2003), the ontology of causal powers builds intentionality into the very foundations of natural things. To have a power is to be in a kind of intentional state, one that is in a real sense "about" the effects one is pre-disposed to produce.

When later medieval thinkers like John Duns Scotus and William of Ockham began to remove the teleological element from their accounts of sub-rational and inorganic nature, they did so on the basis of a misunderstanding of what natural teleology really amounts to on the conception of Aristotle and Aristotelians like Avicenna or Thomas Aquinas. Aristotle did not suppose that non-living or non-sentient entities were somehow consciously pursuing some end, nor did he think that the postulation of real teleology required by definition the introduction of a conscious designer or user of the teleologically ordered system. The mere possession causal powers, in the full-blooded Aristotelian sense, suffices for teleology.

The first response of many modern philosophers, in the aftermath of the abandonment of the Aristotelian framework, was to embrace some form of dualism as the basis for intentionality and knowledge, Descartes's being the paradigm example. There are at least four advantages of Aristotelian hylomorphism over dualism.

First, dualists must either introduce a new fundamental force, a kind of *vis vitalis* or *vis mentalis*, or else postulate frequent violations of the law of the conservation of energy. Hylomorphism is, in contrast, much more theoretically conservative. Biological forms do not exercise a unique kind of fundamental force: instead, they work entirely through the forces exerted by the body's microscopic parts.

For hylomorphists, the causal agency of whole organisms does not require that the organism's parts deviate from the trajectories determined by local forces. All that is required is that the casual powers of the microscopic particles, once they become incorporated into a living organism, become metaphysically *grounded in* the biological form of the whole, in such a way that their continued existence and their persistent causal powers are explained, metaphysically speaking, by the persistence of the whole organism, and not vice versa. The microscopic particles lose the autonomous causal

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powers that they enjoy in "the wild" and gain in their place powers that are ontologically subordinated to the causal powers of the whole organism. Causal powers are individuated by the character of their exercise—that is, by the character of the outcomes they naturally produce. A teleological or functional difference corresponds to such a difference in outcomes. Hence, powers are individuated by their intrinsic *teleological character*: the very same power cannot be intrinsically ordered at different times to different ends. Consequently, even if the causal powers of the particles are similar (from the limited perspective of the microscopic scale) to the powers of the particles of the same kind in the wild, the powers are numerically distinct when they contribute to the intrinsic, bio-teleologically ordered activities of the whole organism. [For more details, see Koons (2014, pp. 17–23).]

In addition, for hylomorphists, the microscopic particles that make up composite substances do not have fundamental spatial locations and spatiotemporal trajectories on their own. It is the facts about the chemical and biological forms of wholes that ground the locations and trajectories of microparticles (insofar as they exist at all), thereby determining how the fundamental forces and energies of the particles are deployed. Quantum particles and fields, for instance, do not have the stable asymmetric shapes and orientations of molecules as studied in chemistry (see Hendry 2010). Properties like location, orientation, and trajectory are metaphysically grounded phenomena, which appear for the first time at a macroscopic scale (see Sect. 7). None of this hylomorphic grounding of spatial attributes requires new forces or energies: instead, it is ontologically prior to the action of such forces or energies.

Second, dualism faces what Jaegwon Kim has called 'the pairing problem' (Kim 2007, pp. 78–79, 85–86). The dualists' picture of the world is complicated by the need to tie wholly non-spatial minds tied to spatial material objects. This isn't an insuperable problem, but it is a cost relative to hylomorphism, according to which it is the form of whole substances that determines the spatial distribution of its parts.

Third, dualism must account for the apparent embodiment of advanced mental activity in the brain. This requires the ad hoc postulation of causal connections between souls and bodies, as opposed to hylomorphism's locating of different kinds of mental activity in the fundamental powers of specific, spatially located organic structures.

Finally, dualism necessarily involves an apparent misattribution of causal powers to the soul, both sensory and behavioral. For the dualist, souls can directly perceive only brain states and can only directly effect the stimulation of neural synapses. In contrast, hylomorphists can postulate powers of a much more familiar sort: the power of organisms to perceive shapes, colors, sounds, and other sensible qualities in their environment, and their power to move their heads, limbs, and torsos in pursuit of their aims.

7 Hylomorphism, bio-teleology, and quantum holism

For quite some time, biology continued to be explicitly and unapologetically teleological in character (Toepfer 2012), but over time biologists came more and more to emulate modern physics and to seek to find a place for living things within a purely quantitative and bottom-up explanatory picture (see, for example, Madrell 1998). This

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indisputably led to great advances in biochemistry, from the synthesis of urea to the discovery and mapping of DNA. In my view, the reduction of living things to chemistry should be thought of as an undoubtedly useful fiction—not, however, as literally true. But in fact, most biologists have taken exactly the opposite view: treating physical reductionism as the sober truth, and the teleological element in biology as a mere "heuristic", a useful fiction.

The eventual acceptance of Darwin's theory of evolution seemed to many to clinch the matter, since Darwin could be taken as a way of explaining how it is that things seem to have purposes and functions, even though they are in reality mere concrescences of matter, driven into repeating patterns by physical and chemical forces alone. T. H. Huxley made the point with his characteristic bluntness:

> That which struck the present writer most forcibly on his first perusal of the 'Origin of Species' was the conviction that Teleology, as commonly understood, had received its deathblow at Mr. Darwin's hands. For the teleological argument runs thus: an organ or organism (A) is precisely fitted to perform a function or purpose (B); therefore it was specially constructed to perform that function.[5]

Huxley and many others took Darwin's theory as a way of explaining the apparent fitness of organs for purposes without appealing to the purposes themselves.

The famous twentieth century biologist J. B. S. Haldane is supposed to have quipped, "Teleology is like a mistress to a biologist: he cannot live without her but he's unwilling to be seen with her in public."

Haldane's witticism points to an important fact: teleological language and concepts are ubiquitous and ineliminable in biology. If we suppose that they are merely 'heuristic', we have to ask, heuristic for what? To what further discoveries do teleological models lead? Only to still more teleological knowledge. It would be crazy to suppose that all of biology is merely a fiction, useful only as a tool for additional chemical and physical discoveries. In fact, physics and chemistry can do quite well on their own: they stand in no need of biology. Biology exists for its own sake, and biological inquiry never escape from the teleological domain.

Fundamental biological teleology requires two things: a causal powers metaphysics, and metaphysically fundamental powers at the level of organs and organisms. The arguments in Sects. 2–5 give us good reason to attribute fundamental causal powers of a sentient and rational sort to whole human organisms. Given the importance and success of biology, it is reasonable to extend this attribution to all living things. Thus, reproduction, nutrition, metabolism, growth, development, sensation, perception, and behavioral responsivity are all plausible candidates for explanation in terms of causal powers that are fundamental. That is, such powers are not to be identified with the mere conglomeration of the powers of the constituent particles and fields but instead have a fundamental reality and activity of their own.[6]

This appearance of new, ungrounded powers at the macroscopic, biological scale should be unsurprising, given the fact that, according to our most recent quantum

[5] From "Criticism on 'The Origin of Species'", *Natural History Review*, 1864, p. 7.

[6] In a recent article (Koons 2014), I have developed an account of how such fundamental causal powers of composite substances could be realized in a world like ours.

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mechanical models, we see new and irreducible phenomena at the mesoscopic scale in solid-state physics and chemistry. Mesoscopic systems, like ferromagnets, superconductors, and convection cells, all exhibit dynamical behavior, in the form of spontaneous symmetry breaking, stable geometrical structure, and thermodynamic irreversibility, each of which are irreducible to the microstates of the constituent particles: irreducible not just in practice but in principle, since it can be proven that microscopic models for N particles—no matter how large N is—cannot account for these observable features.[7] For hylomorphists, it is the substantial forms of mesoscopic systems that determine that particles in these cases collaborate as though they were continuously distributed in space.

Had we known in the seventeenth century what we know now about the microphysical realm, Aristotelian metaphysics would never have been abandoned. A reconsideration of the hylomorphic framework is long overdue.

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[7] See Anderson (1972), Sewell (1985, pp. 3–9), Morrison (2006).

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