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On the ontology of psychological attributes

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Abstract

Coherent interpretations of many claims about measurement in the psychological sciences depend on philosophically realist commitments regarding the psychological attributes purportedly being measured. However, what it means to be a realist regarding psychological attributes has not been clarified, and this may contribute to the reluctance of psychometricians and others to embrace realist positions. This paper attempts to clarify what a psychological attribute might believably be. Drawing on conceptual resources provided by Searle's (1992) biological naturalism, as well as other perspectives from the philosophies of mind and language, it is argued that psychological attributes can, in principle, be said to exist. On the realist perspective, the existence of an attribute is a necessary but insufficient condition for its measurability. However, existence is not the same as immutability or independence from human intentionality, and the role that humans play in creating psychological attributes cannot be ignored.

Keywords

Biological naturalism, constructs, latent variables, ontology, philosophy of mind, psychological attributes, psychological measurement, psychometrics

A great many educational and psychological tests claim to measure attributes of persons, ranging from *extraversion* to *emotional intelligence* to *knowledge of American cities*. But what sort of thing *is* a psychological attribute of a person? In particular, can psychological attributes be said to be *real* in some tractable sense of the word, and if so, precisely what does this mean?

These are not new questions, but they are both fundamental and insufficiently resolved. It would seem that having some understanding of the ontology of psychological attributes would be necessary prior to the development of measurement instruments and other empirical modes of study; put briefly, it is difficult to defend the coherence of scientific investigations if one lacks an account of what the investigations are *of*.

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The term "realism" is applied to a broad range of philosophical positions; they share in common a belief that at least some things exist independently of the mind. "Scientific realism" combines this belief with some version of the belief that our best scientific theories give (or at least aim to give) true or approximately true descriptions of both observable and unobservable aspects of a mind-independent world. Realism represents something of a default position amongst laypersons and working natural scientists (Devitt, 1991), and, following the collapse of logical positivism, has increasingly become a mainstream position among philosophers of science. Michell (e.g., 1999, 2005) has argued that the "classical" understanding of the concept of measurement—i.e., the discovery of ratios of magnitudes of quantity—is continuous with science more generally, in that measurement attempts to gain knowledge of facts about the natural world.

Recent work has shown that realist commitments underwrite a great deal of the logic of scientific investigations in the human sciences as well as the natural sciences. In particular, Borsboom and colleagues (Borsboom, 2005, 2008; Borsboom, Cramer, Kievit, Zand Scholten, & Franic, 2009; Borsboom, Mellenbergh, & van Heerdan, 2003, 2004) have argued that latent variable models, such as are employed in psychometric research and in applied settings such as educational testing, are semantically incoherent without realist assumptions, and Michell (1990, 1997, 1999, 2000, 2004, 2005, 2008, 2013) has argued that measurement requires the existence of independently existing, quantitatively structured attributes, and that in the psychological sciences key assumptions regarding these attributes are not regularly tested or even recognized.

However, it remains unclear precisely what it *means* to be a realist about psychological attributes. A great deal of both laypersons' and psychological scientists' vocabulary and intuitions regarding reality has been inherited from the physical sciences and physicalist philosophical orientations, in which existence is often understood as having mind-independent (i.e., objective) reality in space and time (e.g., Anderson, 1962). Prima facie, then, it seems obvious that attributes of the mind cannot be real, as they are clearly not mind-independent.

I will argue that this interpretation of realism is unnecessarily limited, and that conceptual resources provided by work in the philosophy of mind can be employed to develop a more sophisticated understanding of the ontology of psychological attributes. In particular, Searle's biological naturalism (e.g., Searle, 1992, 2004) describes how the mind is locatable in the natural world, and is readily extended to include the sorts of mental attributes that are commonly the targets of psychometric investigations. Using such resources, an account of the ontology of psychological attributes will be developed in a manner consistent with the core tenants of scientific realism.

This is not to say, however, that it is easy in practice to articulate what it means for any given psychological attribute to exist. In fact, it may be that few theories regarding the targets of educational and psychological measurement activities are sufficiently precise to permit that satisfactory accounts of their ontologies be given in the manner proposed here. Further, even when it is possible to give an account of an attribute's ontology in a manner sufficient to permit realist interpretations of measurement activities, this does not imply that the attribute is exhaustively understood either in terms of structure or function. Saying that something exists is not the same as saying that we know everything

about it, nor that it has successfully been measured, nor even that it is measurable in principle.

The structure of this paper is as follows. First, the concept of realism applied to psychological measurement is briefly introduced by way of a discussion of the conceptual challenges put forward by Michell (e.g., 1999) and others. Then, the concept of realism and the related concept of objectivity are considered in more detail, along with a collection of points concerning the nature of human consciousness and the role of language in organizing efforts to make sense of the natural world. Finally, these lines of discussion are brought together, and an account is given of how psychological attributes can be said to exist in the natural world, as intentionality-dependent emergent features of conscious beings.

Scientific realism

As noted previously, the term scientific realism is used to describe a broad range of positions, most of which hold that one aim of science is to provide true descriptions of reality. The realist view is sometimes further described as being composed of a set of basic metaphysical, semantic, and epistemological commitments. The metaphysical commitment is that there is a natural world, which exists in time and space regardless of what any conscious being thinks or perceives (and further, that there is only one such natural world, and thus that everything that is real is part of it). The semantic commitment is that scientific claims about the world are to be taken at face value, as describing the world as it truly is; that is, scientific claims can be construed literally as possessing truth-values. The epistemological commitment is that, so interpreted, true scientific claims constitute knowledge of the world.

Positions that deny at least one of the above commitments are described as antirealist. A full discussion of the many varieties of realism and antirealism is beyond the scope of this paper: however, two comments are needed.

First, it was said previously that an aim of science is to provide true descriptions of reality. This view is compatible with a range of shades of optimism regarding the extent to which science actually succeeds in this aim. Some realists (e.g., Lyons, 2005; also see van Fraassen, 1980) define scientific realism purely in terms of its aims, regardless of its success; thus, one could deny that science has ever actually produced true knowledge of the world, and even that it is ever likely to do so (using, for example, arguments from pessimistic meta-induction; Laudan, 1984; Putnam, 1978) and still subscribe to the semantic commitments of realism. Notably, although van Fraassen's (1980) constructive empiricism is, strictly, an antirealist theory in that it denies the epistemological commitment and recommends belief in only the observable phenomena referred to by theories, it subscribes to the semantic commitment of realism, and thus interprets theories in exactly the same way as realism. Broadly, the account of psychological attributes given in this paper is compatible with a range of shades of realism and, when combined with particular expressions of epistemic humility, may even be compatible with some antirealist theories such as van Fraassen's.

Second, a commitment to realism does not in itself entail the belief that the world consists of a fixed totality of mind-independent objects and their properties, nor that

there is one true and complete description of the way the world is. Modern accounts of realism, such as Putnam's recent (e.g., 1999) writings on pragmatic realism or natural realism, do not put conceptual relativity and pluralism at odds with realism; rather, they acknowledge that "to use a Wittgensteinian idiom, *seeing* is always *seeing as* and it is the interface between the world and the rich fabric of our concepts that jointly determines what we see" (Putnam, 1999, p. 10; cited in Baghramian, 2008, p. 30). Thus realism does not necessarily entail a correspondence view of truth, nor does it deny that our conceptual schemes, models, and linguistic frameworks actively shape our experience of the world and frame our knowledge of it.

Realism and psychological measurement

To the extent that "scientists see themselves as investigating independently existing natural systems and see their theories and hypotheses as attempts to capture something of the structure and ways of working of such systems" (Michell, 2005, p. 286), the common understanding of the act of scientific discovery is parasitic on all three of the aforementioned realist commitments. Thus, insofar as measurement is understood as an act of scientific discovery, the concept of measurement entails realism. That is, there must be something in the world to be measured in order for measurement to take place. More fully, to say that an attribute[1] exists is to say that instantiations of that attribute exist or could exist in spatiotemporally located objects. Even though attributes can be treated abstractly (insofar as incidental features of their instantiations can be ignored), they are not themselves abstract Platonic entities, located outside of time and space; rather, "universals exist only as instantiated features of spatiotemporally located things or systems" (Michell, 2005, p. 286; also see Anderson, 1962; Armstrong, 1997). Further, for these attributes to be measureable in a relevant population, there must differences in the attribute in that population. Michell argues that these differences must possess a quantitative structure for the attribute to be measurable;[2] others understand the concept of measurement as potentially applying to attributes with non-quantitative structures as well. For example, Borsboom (2008) uses the concept of measurement in reference to attributes with purely nominal differences, such as gender.

With these principles as starting points, Michell (1990, 1997, 1999, 2000, 2004, 2005, 2008, 2013) has explored how the understanding of measurement in psychology has become divorced from the classical view of measurement. He concludes that psychology and psychometrics have become "pathological sciences" using an argument with the following structure:

a. Social scientists claim to be able to measure (some) psychological attributes.
b. In this, they assume that these attributes are quantitatively structured.
c. However, nothing done in common psychometric practice provides a test of whether these attributes are truly quantitatively structured.
d. Thus, all claims to have measured psychological attributes are at best premature, and at worse false.
e. Instead of finding ways to empirically test the structure of psychological attributes, the social sciences have erected barriers that prevent the recognition of (and therefore appropriate responses to) b–d.

This argument depends on the understanding that, in order to be measurable, an attribute must exist and possess quantitative structure; it thus takes the measurability of attributes to be an empirical matter (i.e., dependent on the actual state of affairs in the world, and decidable only in light of relevant evidence) rather than an a priori matter (i.e., decidable independently of experience, as was held by the Pythagorean view). Michell (1999, ch. 3) defines quantitative structure with reference to the axioms of Hölder (1901), who gives an account of the conditions that must hold for a homomorphism to exist between ratios of magnitude of a quantity and the system of positive real numbers. Michell also develops in considerable detail the sorts of strategies that could be used to test for the presence of quantitative structure, particularly employing resources provided by advances in conjoint measurement (e.g., Krantz, Luce, Suppes, & Tversky, 1971). Absent from this discussion, however, and absent from Borsboom's (e.g., 2005) arguments in favor of realist interpretations of latent variables, is an account of the metaphysical conditions for or common-language interpretation of the existence of psychological attributes (apart from, in Michell's case, the conditions that must hold for it to possess quantitative structure). This touches on one possible reason why Michell's line of critique has largely failed to affect psychometric practice and the thinking of applied social scientists: the critique presupposes realism, and without a convincing account of what it means for a psychological attribute to be real, it is tempting for many social scientists to reject this premise out of hand, in favor of, for example, instrumentalist interpretations of measurement (e.g., the variables produced by the application of psychological tests and psychometric models are simply summaries of observed performances, or metaphorical devices for reasoning within specified narrative frameworks, or "black-box" devices useful for certain kinds of prediction and control, etc.).

Lurking in the background of this discussion is the confusion between metaphysics and epistemology that has long plagued discussions of psychological measurement and science more generally. Measurement itself, like scientific research in general, is an epistemic activity—that is, an attempt to gain knowledge about the world. However, a coherent account of how an epistemic activity works depends on an account of the metaphysics (i.e., the actual nature and structure) of the things investigated. The focus of this paper is on metaphysics (specifically, ontology, or manner of existence), rather than epistemology; in other words, the focus here is on what it means for a psychological attribute to exist, rather than on how scientists learn about them. The problem, common to much of philosophy, is that it is nearly impossible to discuss the former without reference to the latter; in fact, one of the most pernicious misunderstandings in 20th-century philosophy of science generally and psychological measurement specifically has been the confusion of these two ideas (related to the confusion of the evidence about a subject matter and the subject matter itself, or, more succinctly, the confusion of evidence and truth). Therefore, although this paper contains some discussion of measurement, as an epistemic activity, measurement is itself not the focus here; this paper seeks primarily to discuss ontology, and turns to epistemology only when it is helpful to facilitate this goal.

Objectivity

It is sometimes said that the goal of science is to gain objective knowledge, where "objective" means that the truth of the knowledge does not depend on the particular method of

observation, linguistic frame, or other idiosyncrasies of the observer (i.e., the *truth* is mind-independent). It is also sometimes said that the goal of science is to gain knowledge of an objective natural world, where "objective" means that the world itself exists independently of consciousness (i.e., the world is mind-independent).

Sometimes the distinction between these two statements is not recognized. Historically, one of the deep discomforts felt by many concerning the prospect of a science of cognition is that consciousness is essentially subjective, and thus seems beyond the domain of an activity focused on the acquisition of objective knowledge. This has led many to conclude either that psychological science is impossible, or that it can only be a science of observables. However, as Searle (1992) argues, this confuses objectivity of the existence of a thing (ontological objectivity) with objectivity about knowledge (epistemic objectivity).

According to Searle, a thing is ontologically objective if its existence does not depend on any conscious being's experience of it; the subject matter of physics constitutes the classic set of examples. On the other hand, a thing is ontologically subjective if its existence depends on consciousness. Were I to injure myself by stubbing my toe against the wall, the actual event of my toe striking the wall would be ontologically objective, as it is a fact of the physical world. The electrochemical action of my neurons, too, would be ontologically objective. However, the pain that I feel as a result exists only insofar as I feel it; its very existence depends on my experience of it. Another way to distinguish ontologically objective from subjective phenomena is to note that with objective phenomena, there is a distinction between appearance and reality (e.g., it could appear to an observer that I am injured, when really I am not), whereas with subjective phenomena, the appearance *is* the reality: if it appears to me that I am in pain, I am in pain. Epistemic objectivity, on the other hand, is a matter of whether the method of knowledge-acquisition about a thing is independent of the mind of the specific person acquiring the knowledge. Whether Rodin was a better artist than Renoir is epistemically subjective, whereas whether Mount Everest is higher than Mount Kilimanjaro is epistemically objective.

This account of objective versus epistemic objectivity and subjectivity implies that a caveat must be added to the formulation of scientific realism given earlier. It was stated before that a central claim in scientific realism is that at least one goal of science is to gain true knowledge about a natural world: this is a claim to epistemic objectivity, in that the truths we seek to learn about the world should not depend on the opinions or other idiosyncrasies of those doing the learning. This can obtain even though some of the subject matter of science is itself ontologically subjective: that is, it is possible to have epistemically objective accounts of ontologically subjective phenomena. On the scientific realist's view, this is a necessary precondition for psychological science to be possible at all.

In the case of pain, there are many epistemically objective observations one can make about a person, at the levels of (for example) neurophysiology (e.g., firing of C-fibers), skin physiology (e.g., galvanic skin response), involuntary behavior (e.g., some facial expressions), or voluntary behavior (e.g., self-reports expressed as ratings on a pain scale), each of which can facilitate the acquisition of knowledge about a person's pain, even though the existence of the pain itself is subjective to the person experiencing it. (As an aside, it may be worth noting that *felt pain* is a psychological attribute of a person,

just as surely as *knowledge of American cities*; it is more transient than attributes commonly studied by psychometricians, but there is nothing in the definition of an attribute that requires temporal stability—consider temperature or velocity as attributes of physical objects.) It could also be noted that, of the various possible kinds of observations just listed, it is the last—voluntary behavior—that is normally the focus of psychometricians, though again this is more an accident of history than a matter of logical necessity.

Emergence and levels of description

Perhaps the oldest and most significant question faced by philosophers of mind is that of how the mind fits in with the physical world. To state the problem very briefly, on the one hand, we have (roughly, since Newton) a scientific conception of the world that tells us that the world is ultimately physical (i.e., particles operating in fields of force, or, perhaps, strings, or points of mass-energy), and that all things in the world, including conscious beings, are ultimately nothing but such physical particles; on the other hand, we have our own first-person experience of consciousness, which seems to clearly tell us that we do have minds as well as bodies. Cartesian dualism (Descartes, 1911) held that the mental and the physical operated in different ontological realms, but this view is now generally accepted to be fatally flawed, most particularly in its inability to account for how mental events could affect the physical world and vice versa.

The most prominent alternative to dualism is physical monism, which holds that there is but one natural world, and that everything that exists does so in time and space. Under this perspective, the mind, if it exists, must somehow be part of the spatiotemporal world. There have been a number of attempts to explain how this could be the case. Many of these accounts make use of the notion of emergence, which, roughly, is the idea that a complex system can have novel properties that are in some sense irreducible to more basic truths about the components of the system. A classical example of an emergent property is liquidity (or solidity), which can characterize a system of molecules taken together, but cannot be said to characterize any of the individual molecules (or atoms, etc.) that make up the system.

An accompanying idea is that any single property or event usually has multiple levels of description: for example, we can say that the passage of electrons between electrodes causes the oxygenation of hydrocarbon molecules, and we can say that the spark plug firing causes an explosion in the car cylinder and the firing of the engine; in doing so we have not described two unique events nor two unique causes. We can also say that neurochemical events in my brain are causing biomechanical events in my fingers, and we can say that my conscious intention to type words is causing me to type words; again, under the theories of mind to be discussed further momentarily, we have not described two separate events or causes. The emergent facts at the more complex level of explanation are said to be "rooted in" or "realized in" the less complex level; here this simply means that while there may be novel (emergent) facts at certain levels of complexity, these facts are token-identical to some set of facts at more fundamental levels of description.

A second accompanying idea is that properties and events at higher levels of complexity can be multiply realized at lower levels of complexity; a classic example is the property of being a clock, which can be realized in myriad ways at the more componential

levels. A clock is defined as such in virtue of what it does, rather than what structure enables the doing.

When the concept of emergence is applied to consciousness, the basic idea is that consciousness is an emergent property of the brain (or neurophysiology more generally). Thus the mind is not something that exists in a separate realm of ontology from the physical world, but neither is it something that can be reductively explained in terms of physical particles in fields of force.

Davidson (1980) and others (e.g., Kim, 1993; Searle, 1992) sharpened up accounts of ontological emergence with the notion of "supervenience," which is defined to occur when there is an asymmetric dependency relationship between attributes of things: *A*-attributes supervene on *B*-attributes just in the case that no two things can differ in their *A*-attributes without also differing in their *B*-attributes. In the context of consciousness, the claim is that mental states supervene on physical states in the sense that there can be no change in a mental state without some change in a physical (neurophysiological) state. Supervenient attributes can be multiply realizable in the attributes they supervene upon, implying that the *same* difference in mental states need not correspond with the *same* difference in neural states across persons or occasions (that is, there is token-token but not necessarily type-type identity between mental and physical states). Thus my belief that Denver is the capital of Colorado corresponds to a certain neural state for me, and your belief that Denver is the capital of Colorado corresponds to a certain neural state for you, but these need not be the same neural states.

Supervenience, and contemporary notions of emergence more generally, are said to be compatible with causal but not explanatory reduction. That is, supervenience accounts of the mind are consistent with the idea that everything that exists does so in space and time and is ultimately composed of fundamental physical particles, but deny that the laws that govern these fundamental particles are sufficient to explain the behavior of more complex systems (such as the mind). Thus when we speak of consciousness and its predicates (such as psychological attributes) *existing*, we do mean that they exist in space and time, but we are focusing on emergent phenomena of a conscious organism taken as a whole, which cannot be exhaustively explained at any less-complex level of focus.

An additional complication is that, as was discussed in the previous section, the existence of some phenomena depends on the mind (i.e., the phenomena are ontologically subjective). Returning to the earlier examples of levels of description, claiming that my conscious intention to type words is causing me to type words is invoking an ontologically subjective phenomenon (i.e., my conscious intention) as part of a causal explanation. But these same ontologically subjective phenomena are realized in ontologically objective phenomena (i.e., neural events occurring in the brain, which are themselves composed, ultimately, of physical particles in fields of force). Thus, on Searle's account, "mental phenomena are caused by neurophysiological processes in the brain and are themselves features of the brain" (1992, p. 1). This is true in the same way that it is true that digestion is caused by biological processes and is itself a feature (process) of the body; both mental phenomena and digestion are causally but not explanatorily reducible to physical processes (with the important difference that mental phenomena, unlike digestion, are ontologically subjective). Searle refers to this supervenience-based account of consciousness as "biological naturalism" (e.g., Searle, 2004).

Intentionality and collective intentionality

In the philosophical literature, "intentionality" is defined as that state of the mind which is directed at or about something, and thus includes hopes, fears, desires, and beliefs, in addition to what are normally referred to as intentions (i.e., plans) in ordinary English.

Intentional mental facts can become social facts when intentional states are held by multiple individuals (see Searle, 1995, 2010). The fact that Denver is the capital of Colorado is itself a social (or "collectively intentional") fact, in that it is true because it is collectively recognized to be true. Marriages, football teams, presidents, universities, and money all exist because of collective intentionality, and are thus ontologically subjective. Again, ontological subjectivity is no barrier to epistemic objectivity, in that truths about any of these things can be ascertained independently of the particular opinions or observations of any particular observer.

The distinctions between ontologically objective facts (e.g., Denver is farther above sea level than Oslo), first-person ontologically subjective facts (e.g., I believe that Denver is the capital of Colorado), and social facts (e.g., Denver is the capital of Colorado) can be expressed in terms of emergence, as introduced in the previous section. That is, each of these statements is a fact by virtue of conditions described at a certain level of explanatory focus, and is explanatorily irreducible to facts at less complex levels of focus. Facts about beliefs are only facts relative to a conscious being taken as a whole and social facts are only facts relative to groups of conscious beings; these facts are not explanatorily reducible to facts about (for example) neurophysiology.

Natural kinds, pragmatism, and the role of language

The final source of conceptual vocabulary useful for this paper's purposes has to do with how language is used to organize experience of the world. Famously, Plato (*Phaedrus* 265d-266a) suggested that we "carve nature at its joints," an idea reflected in the more recent discussion of "natural kinds" (e.g., Quine, 1969; this could easily be generalized to "natural attributes" so as to not restrict the discussion to categories). For the present discussion, it will suffice to say that a natural kind or attribute is meant to represent a grouping or quality of things that does not depend on humans. It is sometimes held that scientific realism entails the discovery and study of natural kinds (e.g., Psillos, 1999), insofar as, once again, it is the intent of science to study a mind-independent natural world.

A classic example of a set of natural kinds is the set of chemical elements. It is commonly believed that the difference between lead and gold, for example, is a difference of natural kinds, in that it tracks something about the structure of nature, whereas the difference between precious metals and non-precious metals is not a difference of natural kinds, as what constitutes a precious metal depends on human intentionality.

It was argued earlier that the human mind, and human intentionality (both individual and collective) *are* parts of the natural world, just as surely as chemical elements, though at a different level of explanatory focus. What is classically meant by the term "natural kinds" is not just that the kind is natural, but that it is ontologically objective. However, again, ontological subjectivity is not a barrier to epistemic objectivity. The psychological

sciences focus on different levels of explanatory focus than do the physical sciences, and the attributes studied by the former need not correspond to natural kinds in the latter. What makes something a precious metal, analogously to what makes something money, depends on collective intentionality; roughly speaking, a precious metal is what it is because conscious beings believe it to be precious.

It may be the case that the designation "precious metal" is more vague than the designation "money," but, while resolving the vagueness of boundaries is important for epistemic purposes, vague boundaries in and of themselves do not invalidate a kind as real or natural. (As a classic example, it is uncontroversial that there are bald people and that there are people who are not bald, but the boundary between the two is vague.) Further, within specific contexts, more precise definitions are available, based on, for example, International Organization for Standardization currency codes.

There are many reasons why it may make sense to conceptually group parts of the natural world in one way or another. The term "cedar wood" refers to wood from many different conifer trees, but is a useful way to distinguish a certain kind of lumber. "Jade" refers to two different metamorphic rocks—jadeite and nephrite—but is a useful term in the context of jewelry-making. Additionally, many things are defined not in terms of their intrinsic structural features, but in terms of what they are capable of causing: for example, we say of something that it is a watch, or a car, or a poison, not by virtue of its specific structure but by virtue of what it is capable of doing. (This is related to the fact that a watch is multiply realizable in its components.) The fact that language is reactive to the contextual and pragmatic considerations of the users of a language does not mean that the things referred to by the language only exist within a linguistic frame; rather, it simply means that the way we organize our experience of the world (e.g., in terms of kinds, or attributes) is not intentionality-independent. There are a number of committed realists who endorse the idea that mind-independent properties can be conventionally grouped into kinds (e.g., Boyd, 1989; Chakravartty, 2007; Humphreys, 2004); this is also broadly consistent with Putnam's (e.g., 1999) more recent thinking about realism, in which he argues that the metaphor of language mirroring or mapping reality should be discarded in favor of the goal of having beliefs and language be "responsible" to reality.

Positions falling under the broad label of pragmatism are sometimes contrasted with realist positions, or are seen as alternatives that sidestep the realism/antirealism debates, in that they define truth in terms of is practical consequences or positive utility (e.g., Peirce, 1998). However, moderated versions of pragmatism are compatible with realism, as in the case of Putnam's writings: there will always be pragmatic and contextual reasons why a specific level of descriptive focus and a specific set of contrast classes are preferred in formulating explanations of a phenomenon, but this does not contradict the proposition that the explanation can successfully refer to the real world. Explaining the action of a car engine in terms of the firing of the spark plug causing an explosion in the cylinder is likely to be more useful for many purposes than explaining the same events in terms of the passage of electrons between electrodes causing the oxygenation of hydrocarbon molecules, but both explanations may successfully make reference to the real world.

In the psychological sciences and applied disciplines such as education, there are likely to be contextual and pragmatic reasons why specific types of accounts of person

attributes are desired. In some contexts it may be that the way in which linguistic terms are applied actually is meant to follow what is classically meant by the "joints of nature," or in other words, to delineate phenomena that are grouped for ontologically objective reasons; for example, biologically oriented psychologists may hypothesize genetically influenced physiological bases for attributes such as *extraversion* and *working memory capacity*. In other contexts, the application of linguistic terms follows the joints of a specific context and its unique needs; for example, the delineation of what constitutes *nursing competence* will necessarily depend on the circumstances and demands of the profession of nursing, which itself is not static. This does not contradict the idea that nursing competence exists; it only shows that it is not natural in the ontologically objective sense.

Psychological attributes

The ideas discussed up to this point in the paper provide conceptual tools with which a general account of the ontology of psychological attributes can be developed. Descriptions of the ontology of specific attributes will need to be developed on a case-by-case basis depending on what facts correspond to claims regarding instantiations of these attributes.[3] This said, at the most general level, psychological attributes can be said to exist as emergent features of conscious beings, and the delineation of what constitutes a specific attribute may be hypothesized to be determined by non-intentional (e.g., biological) nature, or it may be intentionality-relative.

Starting with the simplest case, there are those attributes of a person that involve only presently consciously experienced phenomena. Whether or not a person is in the state of being hungry, or in pain, or of holding the conscious thought that Denver is the capital of Colorado, are all (instantaneous) attributes of a person's psyche. In these cases the psychological attribute, like consciousness more generally, has an immediate first-person ontology—it exists insofar as it is experienced as existing. Given the thesis of biological naturalism discussed previously, any specific claim regarding a psychological attribute of a person corresponds to some set of claims about that person's neurophysiological state (though the details of the neurophysiology may be unknown): that is, it is true of me that my neurophysiology is in a certain state, and that state corresponds to the conscious thought that Denver is the capital of Colorado.

It is rare that consciously intentional states in the here and now are the targets of psychometric investigations. A second case, slightly less simple than the first, is when an attribute corresponds to something that could in principle become an intentional state, though it is not intentional here and now: this can be called a preintentional state. Knowledge of specific facts would generally fall into this category; it is a fact about me that I know (believe[4]) that Denver is the capital of Colorado, even when I am not consciously thinking about it—even when I am asleep. As with watches and poison, the attribute is defined in terms of what it is capable of doing, rather than what structure enables the doing: a claim that a person has the knowledge that Denver is the capital of Colorado is a claim that something is true about his or her neurophysiology, such that, under certain circumstances, he or she is capable of forming the intentional thought that

Denver is the capital of Colorado. The details of the neurophysiology may be (and nearly always are) incompletely known.

So far this discussion has focused roughly on what is often called declarative knowledge (e.g., Anderson, 1981), which is contrasted with procedural knowledge, which can be tacit, or nonconscious. Such knowledge cannot be cashed out in terms of intentional states, actual or possible. Here, as with preintentional knowledge, the knowledge is defined in terms of what it is capable of doing, the difference now being that it is not just capable of causing intentional states, but also of permitting specific behaviors. A claim that a person has knowledge of driving a car is a claim that something is true about his or her neurophysiology, such that he or she is capable of successfully performing the action of driving a car.

It may be interesting to note that procedural knowledge often starts off as declarative knowledge, implying that there is no metaphysical line between the two. When a person is first learning to play a guitar, he or she must consciously form the intentions to place the first finger on the first fret of the second string, followed by the middle finger on the second fret of the third string, followed by the ring finger on the third fret of the fifth string, whereas a more skilled guitarist can simply form the conscious intention to fret a C-major chord. Searle (1992) refers to this as intentionality rising to the level of background knowledge.

The examples given here involve knowledge and skill, but the logic applies to other psychological phenomena as well, such as moods, and mood-dispositional characteristics. Although moods are not normally described as intentional, they are nevertheless hypothesized to operate causally on intentional states and behaviors; dispositional characteristics, in turn, are hypothesized to operate causally on moods and other aspects of affect and cognition. Thus once again the attributes are defined in functional rather than structural terms.

In this section it has been acknowledged that the realization of attributes at the physical (neurophysiological) level of description may be incompletely known. Details at the psychological level of description (such as the causes and consequences of both within-person and between-person variation in the attribute) may be unknown as well. In general, the fact that the details of the structure of an attribute are unknown is not itself a barrier to scientific investigations of its role in functional systems, nor does it necessarily render statements about its existence meaningless. Anderson (1962) described such black-box functional terms as "empirical constructs," and gave the example that the concept of the gene, as a unit of inheritance, was originally a function without a structure, inferred only from observations about inheritance. Of course, the structural details were eventually filled in, which allowed the existence of genes to be confirmed independently of the phenomena they were postulated to explain. Progress in understanding psychological attributes will depend on structural details and causal mechanisms eventually being filled in as well (see Borsboom & Mellenbergh, 2007; Smith & Darlington, 1996); this could take place at multiple levels of explanation depending on contextualized and pragmatic concerns, as discussed previously.

Composite attributes

A general survey of the ontology of psychological attributes will not be complete without consideration of what are sometimes termed "composite" attributes, which are arguably

the ones most commonly encountered in educational research. A concept or term is a composite if it refers not to a single intentional state, preintentional state, or capacity, but to a (potentially large) set of such states. Thus the statement that a person has *knowledge of American cities* summarizes a collection of facts about more specific intentional or preintentional states. Again, the grouping of the more specific statements may follow from theoretical or pragmatic considerations.

Composites or summaries in general are not things that are said to exist on their own, apart from those things being composited or summarized. However, if the contents of a set are determined by collective intentionality (and are thus ontologically subjective), such as in the case of *precious metals* or *American cities*, then it could be said that composite cognitive attributes indexed to that set of things (such as knowledge about its contents) exist by virtue of the same set of intentional facts that determine the contents of the set. Knowledge about an individual fact such as *Denver is the capital of Colorado* exists as a preintentional state, as described previously; the composite of this piece of knowledge with all other pieces of knowledge that fall into the domain of *knowledge about American cities* is indexed to what counts as an American city, which itself is determined by a set of social facts. A more complex example of a composite cognitive attribute is *nursing competence*, wherein some large set of specific facts about intentional, preintentional, and/or nonintentional states (ranging from specific pieces of knowledge to general capacities to behave in certain ways) exists as a class in the sense that it is indexed to the profession of nursing, which itself exists by virtue of collective intentionality.

It is readily apparent from these descriptions that the precise contents of sets of facts indexed to collectively subjective phenomena will often be difficult to specify, especially insofar as there are competing interpretations of the phenomena in question. What it means to be a competent nurse is something that has changed over time, and varies from one cultural setting to another, and probably even varies from one hospital or ward to another. However, this lack of temporal and situational invariance does not mean that the attribute of nursing competence does not exist, any more than it means that nurses do not exist; rather, it simply means that nursing competence is indexed to a profession which is itself not context-invariant. This is but one example of how social concerns can complicate the precise definition of a cognitive attribute; readers familiar with (for example) the history of intelligence testing, or of the design of high-stakes educational assessments, will immediately recognize the intense difficulties of forming precise definitions of psychological attributes in sociopolitically charged environments.

As sticky as these issues can be, however, and as important as they are to the use and interpretation of test scores, it should be recognized that these issues are social rather than metaphysical. One reason why it can be difficult to see this is that the word “real” can sometimes take on sociopolitical overtones, as when, for example, “intelligence is real” is contrasted with “intelligence is socially constructed”; however, what is actually meant by the word “real” in this context is probably something more like “determined by ontologically objective (in this case, biological) forces,” which, as we have seen, is not the same thing. A possible second reason for the confusion is the commonly held intuition that “real” implies permanent and stable (i.e., temporal and situational invariance), which, as we have also seen, is not a necessary identification. Finally, although it seems

trivial to note that collective clarity regarding the components of a composite is a prerequisite for further discussion of the composite's ontology or its measurement, it may be that in many actual cases of purported measurement in the human sciences there is a lack of such clarity.[5]

The usefulness of composite attributes as devices for communication and understanding is in part limited by the degree of covariation in the relevant population among the things being composited. In the absence of perfect association, some amount of information is usually lost when communicating about composite attributes. For example, two individuals with the same overall amount[6] of *knowledge about American cities* (a composite attribute) could know different specific facts. In this sense levels of the composite cognitive attribute *knowledge about American cities* are multiply realizable at the level of specific cognitive facts. Though multiple realizability is not a barrier to existence, it may be a barrier to usefulness, insofar as interpretations are desired at the level of more specific facts. This is related to the familiar problem of grain size of psychological constructs; statements about *nursing competence*, for example, may be sufficiently specific for some purposes but not others.

Quantitivity

As discussed previously, Michell (e.g., 1999) maintains that psychological measurement requires not just that attributes exist, but that they possess quantitative structure. The issue of structure is important, and an adequate treatment of it is beyond the scope of this paper, but something should be said about the implications—or, rather, lack thereof—of the account of the ontology of variables given in this paper for the issue of attribute structure.

Briefly, although the realist view maintains that the existence of an attribute is a necessary condition for its possession of any sort of structure, it is clear that quantitative structure is not a necessary condition for existence, nor is it in any way implied by the sorts of hypotheses on psychological attributes discussed in this paper. Many attributes are simply binary: a belief or other intentional state, for example, may either be held, or not. A composite of any finite number of such binary states (or potentials-of-states) will also not be quantitative in Michell's (or Hölder's) sense. If measurement is understood as the act of finding out the value or position of an individual on an attribute (see Borsboom & Mellenbergh, 2007), then attempts to learn about such states (which could be as simple as asking someone to name the capital of Colorado) could be considered attempts at measurement; if measurement is understood more narrowly as requiring quantitative structure (as in Michell's writings), then such attempts cannot be considered instances of measurement. But whether or not they are called measurement, under the account of psychological attributes given here they can, in principle, be viewed as attempts to find out independently existing facts about the natural world, and thus, as consistent with scientific research (interpreted realistically) more generally.

The hypothesis that an attribute is quantitatively structured is, when present, separate from and in addition to the belief that the attribute exists and the hypothesis that variation in the attribute can explain variation in the observed outcomes of a measurement procedure. It is a curiosity of psychometrics and educational and psychological testing that,

when a psychological attribute is of interest, quantitivity often seems to be taken as a default hypothesis—arguably, such an ingrained default that it is not even recognized as being an empirical hypothesis (Michell, 1999).[7] On the account of psychological attributes given here, hypotheses on the structure and measurability of attributes can (and should) be conceptually decoupled from statements about their existence.

Discussion

Under a scientifically realist framework, a goal of science is to gain knowledge about the natural world. Clarity about the manner of existence of that which is being studied (the ontology) is logically prior to clarity about how we can come to know about it (the epistemology). This paper has examined the semantics of statements about the ontology of psychological attributes, and has argued that they can be said to exist, as first-person intentional phenomena or as structures with the ability to operate causally on such phenomena. Also, it has been argued that collective intentionality can shape the definitions of attributes, particularly those attributes that are composited out of more specific facts. This form of pragmatism is not in opposition to scientifically realistic interpretations of psychological attributes.

This paper has examined ontology in a general sense. The ontology of any specific attribute will need to be worked out carefully prior to attempts to gain knowledge about it. To be fair, the actual process of scientific discovery often works via "bootstrapping" between theory development and empirical study, so it is probably not reasonable to require absolute clarity regarding the ontology of an attribute prior to engaging in attempts to study it empirically; however, neither can questions regarding the ontology of attributes be indefinitely ceded over to the epistemology (e.g., by operationalizing the definition of an attribute as whatever happens to correspond to a statistical latent variable in a latent variable model). By giving general conditions for the clarity of statements regarding attributes with intentionality-dependent existence, I hope that this paper can contribute to more nuanced discussions of the nature of psychological attributes.

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Notes

1. Here, an attribute is understood as any characteristic possessed by an object, including both properties (e.g., mass) and relations (e.g., weight, which is a relation between mass and gravity).

2. Michell's insistence on quantitative structure as a prerequisite for measurability is closely tied to his realist conception of numbers (e.g., 1990). Numbers, on this view, are located in the real world and are not merely tools for representation (as is held by the representational theory of measurement); thus, measurement reports, such as "Andrew's weight is 90 kilograms," entail a commitment to the existence not just of Andrew and the attribute of weight, but also to the number 90, here taken as the ratio of the magnitude of Andrew's weight to the standard unit of a kilogram. Realism about numbers is not a necessary component of scientific realism more generally, nor is it a necessary component of the arguments developed in this paper.
3. This section attempts to give an account of what it means for specific instantiations of an attribute to exist (e.g., nursing competence of a given person). On an account such as Michell's (2005), described previously, this also provides the resources to say what it means for an attribute to exist in general (e.g., nursing competence).
4. Here knowledge is taken simply to mean a justified true belief.
5. A particularly pernicious misunderstanding regarding measurement activities is that they could help serve to clarify the meaning of a composite attribute. This is a special case of confusion regarding the distinction between signifier and signified (Slaney & Racine, 2013).
6. Though it is common to use quantity words such as "degree," "amount," or "level" in referring to psychological attributes in both common and scientific discourse, it is not meant here to imply that the structure of interindividual differences in the attribute must be quantitative. It may be that only partial orders are possible, in which case these words should be viewed as metaphorical.
7. Increasingly, there are exceptions to this, such as in applications of latent class models, including mixture models and models used for cognitive diagnostics and classification.

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