

NEUROPRAGMATISM, KNOWLEDGE, AND PRAGMATIC NATURALISM

JOHN R. SHOOK

Abstract: Neuropragmatism is a research program taking sciences about cognitive development and learning methods most seriously, in order to reevaluate and reformulate philosophical issues. Knowledge, consciousness, and reason are among the crucial philosophical issues directly affected. Pragmatism in general has allied with the science-affirming philosophy of naturalism. Naturalism is perennially tested by challenges questioning its ability to accommodate and account for knowledge, consciousness, and reason. Neuropragmatism is in a good position to evaluate those challenges. Some ways to defuse them are suggested here, along with recommendations about the specific kind of naturalism, a pluralistic and perspectival naturalism, that neuropragmatism should endorse.

Key words: pragmatism; neuropragmatism; neurophilosophy; naturalism; knowledge; consciousness; reason.

Pragmatism has never primarily been a theory of knowledge. From its inception by psychology-minded researchers also doing philosophy, it was designed to be, and still is, primarily a theory of developmental intelligence and experimental learning. Furthermore, pragmatism's approach to learning was never supposed to be a department of epistemology. When pragmatism states its consequent views about what can be learned, and hence about 'knowledge', 'truth', 'reality', and related matters, it speaks as its own philosophical system. Pragmatists did not fail to appreciate the powerful implications of their research for every field of philosophy. Surrounded by neo-Kantianisms, neo-Hegelianisms, revived Cartesianisms, metaphysical personalisms, and both materialistic and idealistic positivisms, pragmatism accelerated beyond them to keep pace with scientific research. Neuropragmatism is the continuation of that project, sustaining the rivalry with contemporary heirs to those past philosophical systems. Instead of concerning itself with knowers who happen to be human, pragmatism stays focused on learning accomplished by actual humans.

Pragmatism was set on a course to go it alone concerning knowledge if it had to. Nothing that another philosophy happened to regard as knowledge could dictate terms to pragmatism, which isn't about confirming, compromising, synthesizing, or adjudicating established philo-

sophical tenets. Where a pragmatist view of knowledge runs counter to any epistemic principle clutched firmly by a philosophical school, that discrepancy is a factor counting in favor of pragmatism, so far as it cares. Pre-scientific or non-scientific speculations about the functioning of cognitive reasoning and the methods of acquiring knowledge wouldn't be of much use, after all. The challenge to stay updated by current sciences is pragmatism's burden, and the question must be perennially asked, "Pragmatism, how do you know thyself?"

Undertaking neurophilosophy and checking up on the validity of pragmatism's core tenets is pursued in this spirit. Neuropragmatism is not just the application of neuroscience to pre-set pragmatist principles, but instead the reevaluation of pragmatism's foundations. Nor is neuropragmatism just the infusion of neuroscience into ongoing philosophical debates over traditional puzzles. Neuropragmatism is no adjunct or aspect of neurophilosophy—it would be its own complete neurophilosophy, and hence would radically reconfigure all of philosophy. Nothing philosophy thinks it knows is taken for granted. Pragmatism is effectively a way to ask how well philosophy really knows itself, and neuropragmatism likewise proposes to dramatically change how philosophy is done. Pragmatism, and hence neuropragmatism, knows nothing philosophical until it has confirmed something for itself.

Pragmatism has had a long-standing alliance with a flexible and generous naturalism, but even that alliance requires updating and re-checking. This essay on neuropragmatism is part of that inspection.

How does neuropragmatism deal with knowledge?

Because 'knowledge' and related issues must answer to correct understandings of learning, pragmatism departs widely from speculative philosophizing by effectively discarding 'knowledge', dismembering 'consciousness', and differentiating 'reason'. Pragmatism takes empirical inquiry most seriously, embodying the lesson that scientific progress breaks up some subject matter into its separate and manageable components, most of which (it turns out) had nothing in common with each other.

There is, for pragmatism, no singular thing as 'knowledge'. The endless philosophical debating over knowledge, questing for its essence and identifying its nature, has been predicated on the supposition that there must be one thing, knowledge, with its own identifying characteristics and criteria. Pragmatism doesn't take knowledge to be a naturally occurring kind or conceptually definable idea. Knowings occur naturally, as everything organic and human does, but there needn't be a core commonality to all of them. (Nor is there a singular scientific method used by all sciences, so far as pragmatism could ever tell, although basic inferential strategies get applied experimentally.) Good inquiries display general patterns, but nothing methodologically 'essential' characterizes all learnings from inquiry. Pragmatism really doesn't need 'knowledge' to exist, and it doesn't presume that it does. Similarly, pragmatism has always been suspicious about the existence of 'consciousness' as its own sort of thing. There have proven to be many sorts of 'consciousness', kinds of states of awareness, and various modes of sentience, and many more are probably awaiting scientific discovery. And that's just our human psychology. There is little reason to think that the awareness of animals far from our primate lineage is much like ours at all. There isn't one sort of stuff, this 'consciousness', distributed with more or less quantity and intensity across the animal

kingdom. What it is like to be a seal or a spider shouldn't be expected to have too much in common with our consciousness, especially because their distinctive subconscious processes (evolved for their peculiar habitats) heavily shape their sorts of awareness. As for 'reason', its days have clearly been numbered after the cognitive and brain sciences discriminated so many types of information processing and practical intelligence all going on simultaneously within the nervous system. The reasoning you explain to your friend to excuse your lateness is almost nothing like the reasoning that your cognitive centers for sociality are doing to form your words, and neither of those things are like the reasoning that your visual cortex is doing to track the significant features of your friend's face as she listens to you. Admitting how there must be many kinds of 'reason' is the first step towards sanity here. Abandoning a search for 'reason' open up the liberty to assign separate labels for specific sorts of neural activity responsible for distinctive brain functions and behavioral expressions.¹

Neuropragmatism exemplifies this radical epistemic pluralism inherent to the tradition of pragmatism: the empirical inquiry into types and modes of learning, and hence anything that has been associated with knowledge, consciousness, and reason (etc.), should be free to investigate and dissect these subjects without supervision from any established philosophical or ideological system. Based on contemporary research programs for human psychology and the brains sciences in particular, neuropragmatism views mentality, cognition, and intelligence in biological, dynamic, and purposive terms.² It endorses these three principles about learning in general (Solymosi and Shook 2013, 215: principles 4, 5, and 6).

(1) Cognitive systems are dynamically adaptive to organism-environment interactions, to deal with shifting conditions of situations as practical goals are pursued.

(2) Under pressures from dealing with the environment, the brain modifies its neural connections to improve practical performance. The measure of this neural learning is improved habitual efficiency at specific routine tasks.

(3) Complex cognitive processes are the work of the central and peripheral nervous systems' effectively coordinating behavior—between bodily systems (e.g., the endocrine and exocrine systems) and towards unified action of the organism—for reliably achieving variable goals in a changing environment.

Regarding knowledge, neuropragmatism specifically endorses this overall attitude towards locating the basis for human knowledge (*ibid.*, 219: principle 11):

Knowledge is the result of experimental problem solving. The epistemic criteria for knowledge is the technological test of practicality. Scientific knowledge is continuous with technology and ordinary practical skill. Much of human experience, most of morality, and all of knowledge are emergent features of social epistemic practices.

While speaking of 'knowledge' for brevity, no assumptions about any core or essence was intended. Experimental problem solving can be conducted in an endless variety of ways

¹ If something must be said about what could be in common with all those sorts of 'reasonings', this fits: they basically are more like abduction than either deduction or abduction (see Churchland 2012, 68–71).

² See examples by Hanna and Maiese (2009), and Stewart, Gapenne, and Di Paolo (2010). Many more citations to allied research are provided in Solymosi and Shook (2013).

for an innumerable number of purposes, and nothing like a shared set of criteria for learned knowledge could be helpfully presumed before inquiry nor usefully compiled after inquiry.

There are always better and worse ways to go about learning, at whatever level of cognitive processing learning is occurring, and the determination of the best (most workable) methods, among those tried so far, wouldn't be out of place after thorough investigations. Indeed, much of what presently enjoys the honorific label of 'knowledge' simply consists of those practical methods and established results of proven value. Whether a person knows what she claims to know depends on good performance determinable by the common standards relevant to that practice. The most important communal practices are often the purview of social institutions presiding over any knowledge claims about those practices. Whether one knows that 'criminal' conduct has occurred shall be determined by the relevant police and law courts, for example, and whether one knows what the weather shall be in three days' time shall be determined by the scientific weather bureaus. These examples are offered to provoke the thought that everyday knowledge is usually a complex, fallible, and limited matter, and expecting much more is laughable. The idea that there is no knowledge except what philosophers would independently certify is, of course, ludicrous. Where they uphold sound standards for knowledge, they display a wise allegiance to a form of established practical reason, not of their own design or making. This is no less true about deductive logic than monumental architecture. Neurophilosophy should explore how forms of practical reason are made possible by our cognitive learning systems exploring the world. If neurophilosophy thinks that philosophical principles about knowledge float untouchably up in the sky and then wonder how brains trapped inside skulls would go about imitating them, only disastrous epistemology and bad metaphysics can result.

Neuropragmatism would add to the tumult and confusion with a mistaken agenda of 'verifying' abstract principles of pragmatism with selective neuroscience. So let's repudiate that agenda. In fact, neuropragmatism should prove to be just as effective for dispatching outdated pragmatisms as well as non-pragmatist philosophies. Some varieties of pragmatism are only compatible with 'literary' psychology (what people like to say about their experiences) or with 'linguistic' sociology (what common parlance permits one to say about living). Cataloguing varieties of pragmatism over the past 140 years and classifying their divergences from current scientific psychology would be exhausting, even if enlightening for intellectual history. A blunter but faster tactic would identify what sort of philosophical system is most coherent with the direction of neuropragmatism. That system is likely some version of pragmatic naturalism. But appearances could suggest otherwise. The label of 'naturalism' sends one's thoughts in many directions. Reductivism, scientism, and nihilism immediately come to many people's minds. Does neuropragmatism rig matters in favor of naturalism by presuming that the sciences of the small (of neurons, synapses, molecules, electrons, etc.) dictate the 'real' energies of life? Or, perhaps worse, does neuropragmatism commandeer all of neurophilosophy by eliminating as unreal the 'hard' problems of perennial philosophy, such as the origin of consciousness and the normativity of reason?

Pragmatic naturalism should not and does not first presume reductive scientism in order to grow just the right neuropragmatism which returns the favor by "confirming" those generative roots. Quite the opposite. Neuropragmatism actually goes in a different direction that reductive scientism even as it takes the many sciences most seriously. The 'pragmatic'

modifier to naturalism indicates that only sound theories of learning should control what is taken to be knowledge(s) and hence what is regarded as real. Rather than uncomfortably narrowing down what can be taken as real, this pluralistic respect for any and all modes of learning, and hence the perspectival attitude taken towards knowledge(s) providing valid yet partial information about reality, sends pragmatic naturalism in a direction away from reductionism or eliminativism. The technical classification for the pragmatic naturalism most respectful towards learning is the Perspectival Pluralism variety of naturalism. Henceforth, we shall speak of ‘pragmatic’ naturalism to indicate this perspectival and pluralist kind of naturalism (see Shook 2011).

Neuropragmatism does contribute to the defense of naturalism against criticisms striking deeply at the coherence of any naturalistic theory of learning and reasoning. To strike so effectively, these criticisms arouse doubt whether even a pragmatic naturalism is compatible with any sort of knowledge at all. It is one thing for pragmatism to break up ‘knowledge’ into specific sorts of achieved learnings and then set aside the label of ‘knowledge’ as philosophically useless. It is quite another matter for pragmatism to threaten to obstruct the very possibility of anything that could be called knowledge according to all modes of learning. Why would knowledge in any thin distributive sense be impossible? The toughest criticisms accuse naturalism of somehow denying the reality of experience, the supposed source of all information for learning, and also the authority of reasoning, again broadly understood, as the supposedly generative process of increasing information. If any philosophical naturalism judges that experience is unreal or that reasoning lacks normative authority, then learning could not be possible, at least any sort of learning that naturalism would countenance.

Is neuropragmatism relevant to defending naturalism from these charges? Let’s examine each criticism in turn.

What does neuropragmatism think about experience?

All ‘evidence’ is at least experienced evidence, accessible to observation, measurement, comparison, and so forth. Unexperienced evidence could only mean anticipated and hoped-for evidence, not information ready for elucidation by, or comparison with, any theorizing. Let science say what it thinks is real; it had better not declare the senses false along the way, yet it seems that science must.

Naturalism contra experience: Naturalism relies on information from experience, but science cannot even explain how conscious experience is natural. The sciences can use observation to justify theories, but whether consciousness is entirely natural hasn’t been established, so naturalism is in the embarrassing position of relying on something that might not be natural.

It does the naturalist no good at all to think that discarding the term ‘experience’ as primitive and folk psychological avoids the force of this criticism. Wherever evidence arises for informative application by scientific methodologies, that evidence has to be cognitively noticed as meaningful. If the naturalist detests ‘experience’, that cognitive notice must nevertheless be very real. There is a reason why theories of learning have continued to use the term ‘experience’ colloquially, if not quite methodologically. (‘Experience’ in general gets methodi-

cally replaced by specific modes of experiencing, as well.) The field of attentive awareness accessible by an intelligent creature is learning's habitat. No external environment, by itself, causes learning unless and until the organism selectively senses/cognizes aspects of that environment—it is within that field of attentive awareness, by whatever name, that learning can grow. It is impossible to explain the learning behaviors and modified conduct of an animal without taking into account that attentive field in distinction to its physical environment in general. Deny the existence of that environing field, its 'environs' or 'Umwelt', for the organism, and learning becomes a mystery (consult for example Berthoz and Christen 2008).

Can science accept the existence of this experience field? The rivalry between the intellect and the senses is one of the oldest themes in philosophy. A fragment of Democritus from the 5th century BCE preserves his grasp of the problem; his atoms weren't like the things we observe, so the senses must lie about reality. As Galen reports, Democritus lets the senses reply to the intellect, "Wretched mind, do you take your evidence from us and then try to overthrow us? Our overthrow is your downfall" (as quoted in Hankinson 1995, 49.) No further fragment from Democritus reveals how he may have solved this problem, but the rest of Greek philosophy bequeathed the struggle down to us. This conflict between sensible features of our world and properties of theoretical entities must be premised on taking one or the other to be entirely and exclusively correct about true reality. Therefore, this conflict is defused by either denying that either one gets the sole 'truth' about reality, and/or finding that theoretical entities actually explain why we experience the observable qualities we do, in the ways we do. Naturalism can adopt both options, regardless of rationalistic notions from philosophy. For example, without science's theoretical knowledge of light we couldn't understand how the interactions of light with physical objects and the reception of light by our nervous systems makes our perception of colors comprehensible. Far from denying the 'reality' of color, our conception of 'color' is itself fruitfully expanded by science, and a broadly integrative naturalism agrees.³ The science of vision explains how and why we see the colors in the way we do, and it also explains why we don't see many other possible 'colors' beyond our narrow visible spectrum.

Since the non-naturalist wants to demonstrate naturalism's inadequacy, the non-naturalist quests for something essential in experience which naturalism can never accept. Therefore the ideal sort of debate, from the non-naturalist's perspective, is to argue over something like redness:

- (1) *Most people experience the redness of some things in the world.*
- (2) *Experiencing this redness is sufficient, for normal functioning people, to know that one is experiencing red objects, and hence to know that redness of objects exists.*
- (3) *Naturalism declares that redness does not exist, because colors are not among those things theorized by current physics. (No physics theory postulates 'redness' as a basic entity or property.)*
- (4) *The non-naturalist theory of mind-body dualism explains why people experience redness in their minds and can know redness that way.*

³ The debate between assigning colors an external or an internal reality is covered by Hardin (1988). Surmounting this externalist-internalist debate is explored by Thompson (2003). See also Cohen and Matthen (2010).

(5) People who know redness reasonably reject any theory or worldview that tells them that redness does not exist, as long as there is an alternative theory or worldview which explains how they can know that redness exists.

Conclusion: Naturalism is inadequate, and some kind of non-natural reality (such as the mind) for knowing colors is real.

Perhaps premise 2 is acceptable for perspectival naturalism, suitably understood. Premise 3 is false, because not all naturalisms must declare that redness does not exist. If redness is quite real where it is reliably experienced as real, in contexts where normally functioning cognitive processes detect redness, then naturalism shouldn't object to redness's reality in the external world, right where it is directly experienced as being. Naturalism is not forced towards ontological dualism, where only ghostly images are actually experienced in some 'inner' realm of 'private' consciousness. To avoid becoming what it is not, naturalism must reject such ideational dualism, and instead locate the qualitative features attended to by cognition as existing exactly where they appear in the enviroing world around us. Metaphysics does not give up so lightly, of course. Rationalist principles get applied to force a divorce between real external things and perceived things. Because neither neuropragmatism nor pragmatic naturalism in general need to be committed to those suspect rationalist principles, those metaphysical complaints can be answered satisfactorily (see Shook 2014, forthcoming).

Another strong version of this criticism about experience claims that naturalism must show how a person's 'subjective' experience or 'first-person' perspective is entirely reducible to 'objective' and 'third-person' knowledge.⁴ However, no pluralistic and perspectival naturalism follows reductivist or eliminativist orthodoxies. Naturalism at minimum only has to plausibly show how 'subjective' experience is an intelligible matter, so thoroughly respondent, coordinated, and interrelated with natural processes that nothing unnatural needs to be postulated to account for experience's features and functions. Non-naturalists busily identify features of self-consciousness which aren't among the things (or their properties) approved by certain scientific theories, and then inflate those features into an ontological realm of 'subjectivity' inscrutable by science and immune from naturalism. However, pragmatic naturalism doesn't demand simple identities, ontological reductions, or semantic translations, but only connecting interrelationships. If some 'subjective' feature is successfully explained by hypotheses about how that feature works, in terms that reference only those things (or their properties) described by scientific theories from relevant disciplines, then that subjective feature is naturally acceptable. Only bad science and bad metaphysics would demand that "only like can explain like" or "the parts must share in all the features of the whole." Successful explanations connect together two things that aren't the same, so that those things become jointly intelligible. Furthermore, scientific explanations break up matters presumed to be singular and uniform, such as 'self-awareness', 'the mind', 'intentionality', 'choice', and 'responsibility' into their discriminable components, or even disaggregate matters, only mistakenly taken to be the 'same' sort of thing. There really is no unified thing as 'intentionality', for example. Much of intentionality is actually involved with

⁴ Less-than-optimistic estimates of naturalism's success concerning subjectivity are made by Nagel (1986); Kim (2007); and Baker (2013).

applying specific modes of social cognition, such as symbolic comprehension or minding others' minds, whereas other sorts of cognitive attentiveness have only to do with perceptual pro-activeness or large motor control.⁵

If there is no need for a separate ontological realm of subjectivity, where is the 'subjective'? According to naturalism, since anything 'subjective' is localized by the physical situation of each brain, our 'subjectivity' consists of viewpoints. There would be special features of what is like to be the subjectivity produced by that brain, and those features wouldn't be obvious from another viewpoint on that brain (like neuroscience's viewpoint). Furthermore, according to pragmatic naturalism, it would be impossible that a person's access to subjective features could be just like access to information about external objects, since in the first case one is accessing what it is to be like an organic nervous system, while in the second case one is using that system to encounter things beyond the body. Only confusions could result from naively supposing that internal access could be anything like external access. An oft-heard "refutation" of naturalism says, "But it sure doesn't seem to a person that contemplation of inner experience is just like seeing what an organic brain is doing!" This challenge relies on that naive supposition that all cognitive access should work the same way. So does this challenge, "Naturalism is ridiculous, since all your examinations of nervous tissue from every angle would never bring a single subjective thought into view!" These sorts of objections can be set aside, since they presume what naturalism denies, that self-consciously accessing some of our cognitive processes should be just like cognizing features of external objects.

On the pragmatist proposal here, subjectivity's viewpoint and crucial cognitive functions like intentionality and purposive choice wouldn't be entirely reducible without remainder a scientific theory's theoretical entities. Pluralism about not just scientific theory but also causality is crucial.⁶ Just because physics and chemistry rely on mechanistic causality to understand the relations among very small parts, this doesn't mean that teleological causality can't be exemplified by a complex large whole.⁷ The metaphor of the machine, where the whole machine is designed to only display mechanistic powers, is a suggestive but ultimately inadequate model for the biological organism as a whole. Similarly, the metaphor of the map, where a whole map is used by a person to navigate an environment, is a suggestive but ultimately inadequate model for cortical processes. Just because every symbol on a representative map must itself be representational to the map user, that does not mean that every phase of neural activity must itself be 'representational', or processing representations. All the same, changing features of subjectivity must correlate somehow with dynamic brain processes as understood by relevant cognitive and neurosciences, lest the 'mental' float freely apart from the physical. Those sciences are confirming numerous correlations and coordinations at a pace faster than non-naturalism can think up resistant counter-examples.

⁵ On the phenomenal 'self', see Dennett (1991). On minds, see Shook (2012). On intentionality, consult Gallagher and Miyahara (2012). On choice and freedom, see Flanagan and Martin (2012). On responsibility, see Sinnott-Armstrong (2008).

⁶ An ally on this feature of pragmatic naturalism is Huw Price (2013).

⁷ The ontological tyranny of the smallest theoretical 'units' and their energies is overthrown most effectively by empirical considerations in Cartwright (1999).

Indeed, so much about consciousness and cognition is already scientifically understood that it is premature to bet against the brain sciences in the long run. However, phenomenological investigations are hardly rendered irrelevant; coordinating features of self-consciousness and self-knowledge with the work of the cognitive sciences will remain essential.⁸

Does neuropragmatism endorse supervenience?

Neuropragmatism doesn't expect the physicalist elimination or reduction of experience or consciousness. Does it instead expose naturalism to the risk of inflating 'mental' properties and powers into their own ontological matters? Naturalism must monitor the chances of potential overthrow from within, as well as from without.

According to reductive physicalism, the phenomenal world must be *ontologically* dependent: the dispositions/capacities/powers/laws/functionings which pertain to the entities and their properties as known by perfected physics are exhaustive. Nothing phenomenal is directly or indirectly responsible for doing anything over and above what the physical world does—a phenomenal entity cannot make any difference to anything phenomenal or to anything else. What strategies are available to the reductivist for establishing maximal ontological dependence? The notion of "supervenience" has become useful for the physicalist project. At the start of the article on "Supervenience" in the *Stanford Encyclopedia of Philosophy*, we read:

A set of properties *A* supervenes upon another set *B* just in case no two things can differ with respect to *A*-properties without also differing with respect to their *B*-properties. In slogan form, "there cannot be an *A*-difference without a *B*-difference" (<http://plato.stanford.edu/entries/supervenience/>).

This concept of supervenience includes a "directionality" from the "A-realm" to the "B-realm" which makes supervenience relevant to any eventual assertion of the ontological dependence of the A-realm upon the B-realm. Let *AsupB* stand for the assertion of supervenience as defined above. Might *BsupA* also be the case? Perhaps, but when supervenience is applied in debates over reductionism, the assertion of *AsupB* is typically accompanied by a tacit denial of *BsupA*. In these debates, the A-realm would be the phenomenal/mental realm while the B-realm would be the physical realm. If *both* *AsupB* and *BsupA* are the case, then A and B are plausibly connected in some way, perhaps directly to each other, or to some third sort of entity more ontologically basic than either A or B. But that result does not lead towards reductionism, since the physical realm would not have ontological priority. The reductivist, wanting to avoid any implication towards a mutual ontological dependence between mind and nature, or between mind/nature and some third realm, therefore uses supervenience only to assert *AsupB* (mind supervenes on matter) while denying *BsupA* (matter supervenes on mind).

⁸ Consult Gallagher and Zahavi (2012). Among broader pragmatic naturalisms, the founding text is Dewey (1925); see also Putnam (1999). Searle (1992) ably defended an emergent and social view of consciousness in.

The reductionist's use of supervenience to establish the ontological priority of the physical is highly problematic, and possibly even self-defeating. Interestingly, if the reductivist were to succeed in ontologically identifying some A with some B, not only must $AsupB$ but also $BsupA$ (by Leibniz's "Identity of Indiscernables" principle). In short, a genuine ontological identity necessarily entails two-way supervenience. This practically means that the reductivist's initial strategy of appealing to $AsupB$ while denying $BsupA$ is ultimately contradictory to the reductivist's final conclusion. The reductivist could reply that the initial denial of $BsupA$ is only an argumentative supposition which can be modified by subsequent philosophical and scientific progress. This reply is inadequate, however, because the success of the reductivist's supervenience strategy crucially depends on the firm denial of $BsupA$ until the final desired conclusion is reached. After all, the idealist is just as interested in establishing $AsupB$ as $BsupA$, and can follow the reductivist's strategy right to the end—when the reductivist announces the identity of the mental with the physical, the idealist will simply affirm $BsupA$ as well as $AsupB$ and announce the identity of the physical with the mental. Only a stalemate can result. Any successful supervenience strategy yields as much philosophical support for idealism as physicalism. The reductivist cannot reasonably establish the ontological priority of the physical by firmly denying $BsupA$ from the beginning, only to conclude $BsupA$ at the end. Since the mid-point of the 20th century, with no powerful idealist movement to confront, physicalists have not had to face up the contradictory nature of the supervenience strategy. But the contradiction looms nonetheless. Philosophers nowadays seem agreed that reduction requires supervenience; they don't seem to realize that any reductive identities require the two-way supervenience which the supervenience strategy must reject.

Many non-reductivists, wanting to avoid both physicalism and idealism, find some weak forms of supervenience plausible while staunchly resisting the stronger forms. Many non-reductivists admire "emergent naturalism" or "property dualism" to accept some sort of dependence of the mental on the physical while asserting that mental realities possess some kind of additional non-physical reality. This emergent naturalism shares the physicalist aim of prioritizing the physical—the realm of emergent properties and entities depend on the realm of physical properties, but not necessarily the other way around. Many friends of emergence notice this lingering physicalist bias, so they search for ways to make physical properties and entities dependent on the higher-level emergent realm as well. When a non-reductivist naturalist traces the *mutual* superveniences and dependencies between the mental and the physical, pluralistic naturalism results. Yet pluralistic naturalism is not any emergent naturalism, as we can see with some additional reflection.

The most basic form of supervenience used for the reductionist agenda is correlation supervenience, which begins to reign in autonomy for the mental. Dynamic supervenience and causal supervenience are also crucially important for emergent and reductive naturalisms. Only correlation and dynamic supervenience should be endorsed by perspectival/pragmatic naturalism.⁹

⁹ For a survey sympathetic to pluralism, the reader can begin with Horst (2007).

Correlation Supervenience: Each pattern of phenomenal properties or mental states (call this pattern A) is correlated with some pattern of physical properties or states (call that pattern B). Whenever A occurs, some B occurs too (and not necessarily the same B each time). Correlation supervenience is designed to entail that some physical B must exist in order for any mental A to exist. This correlation supervenience rules out, for example, a mental realm that could exist irrespective of whether any physical realm exists. Every variety of naturalism must accept correlation supervenience.

Dynamic Supervenience: Each change occurring in the phenomenal/mental realm (call this change A) is correlated with some change occurring in the physical realm (call that change B). Whenever A occurs, some B occurs too (and not necessarily the same B each time). Dynamic supervenience asserts that something physical must change in order for something phenomenal/mental to change. Neither correlation nor dynamic supervenience entails anything like a causal or ontological dependency, much less identity, but such dependencies become more plausible.

Causal Supervenience: Each causal relation A between two phenomenal/mental entities is correlated with some causal relation B between two physical entities. Whenever A occurs, some B occurs too (and not necessarily the same B each time). Causal supervenience is designed to heighten the plausibility that the mental realm is ontologically dependent on the physical realm.

Pluralistic and pragmatic naturalism, denies causal supervenience as a general principle, on the grounds that the many sciences in aggregate neither assume it nor confirm it. However, this naturalism should take advantage of whatever specific causal superveniences are scientifically discovered in order to uphold the interconnectedness of the entire natural realm. Where explanatory chasms open up and discontinuities appear to be ontological gaps, naturalism faces its downfall.

At the same time, pragmatic naturalism does not agree that only type of reality is 'physical' reality according to physics. That metaphysical claim (it is metaphysical, for no science is in a position to confirm it) can be expressed using the notion of global supervenience: everything supervenes on the physical. In the jargon of possible worlds, this global supervenience can be roughly expressed as follows:

For any two worlds having exactly the same physical structures, states, and processes (they are completely physically identical to each other), there cannot be any differences between them in any respect (they are completely identical in every phenomenal/mental/psychological way as well). The physical facts of a world completely determine all the facts in that world.

There are many complex problems involved with using supervenience to express the physicalist agenda, too many to be discussed here. Since many portions of the phenomenal/mental realm have so far resisted reduction by the supervenience strategy, various non-reductive naturalisms, including pragmatic naturalism in general and neuropragmatism in particular, can still flourish as compatible with the sciences. Pragmatic naturalism would not automatically infer the ontological priority of the physical just from dynamic or causal supervenience. Put another way, the perspectival and pluralistic attitude of pragmatic naturalism extends to causality: the kinds of causality, and their 'directions', can only be decided by the many sciences cooperating together, and not any single science dictating realities alone.

Does neuropragmatism naturalize reason?

Like the first challenge over experience, this challenge argues that reason may be unnatural unless science can prove otherwise. If reason is unnatural, then naturalism is incomplete and inadequate, and another philosophy able to explain reason would be superior.

Naturalism contra reason: Naturalism depends on scientific knowledge, and scientific theorizing relies on mathematical and logical tools. Science must use these systems of reasoning, yet those systems possess a normativity and validity unexplainable by science itself, and hence unexplainable by naturalism. Naturalism is critically incomplete without a scientific explanation for the tools of reason.

Science could not explain its own core systems of reasoning, this argument clarifies, since they are perfectly true and absolutely valid in a way unconfirmable by any amount of empirical inquiry and incompatible with the changeable nature of physical reality. Science and naturalism must presume the true validity of mathematics and logic, but that validity cannot fit into any naturalistic worldview. This complaint can be generalized to include not just mathematics and logic but valid reasoning and inferential believing in general, in all forms. If science must presume reason, without ever accounting for reason's validity, then naturalism is forever blocked from proclaiming its own validity, and thus naturalism collapses as an incomplete philosophy.

A tenet of neuropragmatism has been asserted to begin to deal with this sort of criticism over reason (Solymosi and Shook 2013, 219: principle 12):

What seem to be 'a priori' and necessary truths are only habits of cognition so habitually ingrained that our brains either use them unconsciously or our thinking predominantly relies on them without question. Evolution produced the infant human brain capable of speedily acquiring crucial functional habits because all humans need them, and additional functional habits are acquired when culture indoctrinates them into children. Habits are not unyielding reflexes; advanced learning is capable of questioning and amending any a priori truth through empirical inquiry and science. Because the a priori does not float freely from actual brain development, learning, and language, there is no logic-practice gap. Reason can be naturalized, because its processes and results can be shown to fit in the natural world of embodied and encultured humans.

Essentially, this strategy requires keeping 'rationality' distinct from 'reason'. Naturalism must claim that human rationality in general consists of its habitual regulation of our thought processes (as best it can) and hence over our actions (partial at best), sometimes culminating in the practices of scientific inquiry capable of producing reliable empirical knowledge—and that this overview of rationality is itself explainable by ongoing and future scientific inquiry into human cognition. That way, scientific knowledge, like all learning and knowledge, is securely in the natural world in a manner that the sciences can comprehend.

Additionally, naturalism does not also have to make room for 'reason' as part of nature. That is because, as philosophy should agree, reason isn't the sort of 'thing' that could have any sort of existence, or reality, or mode of being at all. Rationality, by contrast, can be embodied in intelligent organisms displaying habits of cognition and inference that more or less conform to the standards of reason, but pure reason (all those perfect truths of mathematics

and logic, for example) don't also have to exist. Not everything that people try to think about and imitate have to exist in themselves, so this naturalistic stance says. Metaphysical naturalisms resort to expanding "the natural" to include such platonic verities. Pragmatic naturalism refuses to do so, and can appeal to neuropragmatism to support this refusal.

Philosophical arguments over this matter go back millennia, so only the briefest sketch can be considered here. Does our ability to think about, and obey the authority of, a truth like " $2 + 2 = 4$ " or "P implies Q, and P is true, then Q is true" in turn tell us something about the reality grounding those truths? Perhaps pure truths cannot have any natural place in the world, so they have to have their own sort of reality.

Here is an analogy, to guide how we contemplate this problem about truths of reason and what makes them true. Think for a minute about a philosophical argument that the perfect tone of a middle C note must have its own permanent kind of non-natural reality. This middle C tone is real, over and above all physical manifestations in middle C sounds that have ever occurred and could ever occur everywhere in the universe, like Dizzie Gillespie hitting that middle C with his trumpet on June 16, 1966 (supposing he was playing or practicing that day). Further suppose that the argument goes like this. Many people have used their entirely natural musical abilities to produce a sound almost precisely like that middle C, and they can come extremely close quite often, at least the excellent musicians. Like mathematicians trying to draw a perfectly right-angle triangle with a ruler and pencil but never quite succeeding, musicians can approximate a perfect middle C over and over due to their trained musicality. Musicians know all too well that hitting the 'perfect' middle C at 261.626 Hz (even that precise figure remains an approximation) would be a matter of complete accident, but they don't have to care, since even a human ear with perfect pitch couldn't hear a miss of less than .00001%. In music, as in engineering, extremely close is going to be good enough. But, this argument runs, we have stumbled on an admission that this perfect middle C must really exist, otherwise we'd be left with no explanation for what it is that these musicians are aiming for. To try to hit a middle C and to think there's no such thing as middle C would be a mentally self-contradictory situation. Avoiding this irrational situation, the argument next says that this admittedly real middle C is almost never, if ever, made real in the natural world of imprecise and imperfect sounds, and therefore its reality must be non-natural. (Run the same argument again about drawing triangles, and next about adding 2 plus 2, and give it some thought.)

It is important to note that the force of this "unnatural middle C" argument cannot be avoided by saying that the true middle C wouldn't be in the actual performance of a musician, but it would be in a musician's imagination. The proponent of this argument would simply reply that the imagination would then be partly or entirely unnatural too, helpfully accounting for the human ability to at least think about things like right-angle triangles and perfect middle Cs, even if humans can't make them in the natural world. Naturalism shouldn't take refuge in anything like an imagination unlinked from the rest of the mind's regular habits of cognition. There's another way for naturalism to treat rationality as natural while reason is denied reality.

Ways to display rationality such as our acquired language use, our facility with conceptual definitions, and our trained habits of thinking seem normative and mandatory enough to us who must use them. We are encultured for using these tools of rationality, and

we have no alternative brains to swap in and out of our skulls to see what it is like to think quite differently. Habits of careful thinking instantiated by neurological processes of organic creatures such as ourselves have a place in the natural world, and they are good enough to permit most everything about human culture. Together these intelligent habits of (imperfect) thinking can fully account for the practical expertise behind clothing and agriculture, ordinary engineering, and even sophisticated practices like musicality and religiosity. Naturalism has no difficulty accommodating our human capacities for these cultural practices.

The mathematics and logic used by theoretical sciences seem harder to explain with naturalism. However, naturalism holds that these mathematical and logical techniques responsible for good theorizing by scientists are like the musical techniques responsible for good notes by musicians. Science doesn't need to utilize the perfect validity of pure reason, but only the good enough techniques of rationality practically achievable by the best scientific minds. Pure reason don't have any meaning or use for science until things like mathematical equations and logical axioms are assigned concrete meanings. Variables like X and Y in equations have to be assigned numbers that mean something about the world, like a quantified measurement or a natural constant. Placeholders like P and Q in logic have to be replaced by terms referring to real-world things and features. Scientific inquiries use practical formulas about the world, not abstract truths. Those practical formulas are essential for modeling what is going on the world, but precisely because modeling is involved, formulas only supply idealizations and approximations, selectively simplifying natural processes that appear to be far too complex and inscrutable in themselves. For example, predicting the exact motion of a single molecule in a flask is beyond calculation, yet the general effects of the motions of billions of molecules can be statistically modeled and approximately measured. The 'objectivity' towards which scientific theorizing strives is not anything like a 'vision' from no perspective in particular, or an accurate 'mirroring' of every possible detail.¹⁰

Distinguishing scientific formulas from purely mathematical equations does not restore a sharp analytic-synthetic dichotomy of the sort that W. V. Quine famously eroded. Rather, mathematical truths themselves concern conceptual models refined so abstractly from original empirical matters that only necessity, not possibility, obtains among the terms defining the models. There are, strictly speaking, no intrinsically 'analytic' or 'synthetic' terms or relations; their status is determined by how they are used. However, where a conceptual model uses only necessary relations, all reference to actual empirical worldly matters is lost. Even an abstract formula such as $E = mc^2$ does not assert strictly necessary relations among its terms—this equation asserts an empirical matter about the reliable convertibility between energy and mass, not their semantic equivalence. Furthermore, it is an

¹⁰ This view of scientific theorizing has long been advanced by the philosophical school of pragmatism; see for example Dewey (1938, chaps. 20–23). W. V. Quine's quasi-pragmatic "indispensability argument" takes the success of scientific theorizing to not only demonstrate the truth of applied mathematics, but to additionally justify the real existence of mathematical entities right along with the material entities known by science (see Quine 1980, 1–19). Against Quine, the alternative is to regard concrete mathematical formulas in science as separate matters apart from any purely abstract versions considered only by mathematics; unlike the former, the latter needn't be regarded realistically, since they do no real work in science (see Cartwright 1989; and Maddy 1997, 133–160; see also Galison and Daston 2007; and Pincock 2012).

empirical matter for science to decide which kinds of mathematical and logical systems shall receive development and application in the form of needed formulas within its theorizing. The establishment of novel mathematical systems such as calculus and novel logical systems for ‘quantum’ logic, and the explosion of interest in multi-valued and ‘fuzzy’ logical systems, are only the more prominent instances of a widespread phenomenon across the sciences over their entire histories (see overviews by Haack 1996; and Grattan-Guinness 2000).

Science isn’t responsible for mathematics and logic in themselves, and the sciences have the liberty to apply specific formulas of their own practical design to their separate fields of study. Of course, no science wants to deviate from mathematical and logical validity—any theorizing found to be in violation of sound calculation or inference must be corrected. However, in the course of scientific inquiry, innumerable versions and combinations of inferential formulas have been found to be useful, good enough to obtain confirmable results to precise degrees. Our earlier analogy about hitting middle C notes works well here. Like good musicians who use their instruments to produce excellent tones as they try to hit their musical notes, that production of sounds aims at precision but would not, and need not, actually achieve perfection. What works in scientific inquiry are practical, world-oriented formulas that actual human rationality by our natural brains is able to handle and utilize. These formulas, populating all the textbooks for all the fields and sub-fields of science, are only the best tools that we can practically manage with our limited and fallible rationality. Scientific formulas are not truths of perfect abstract reason, and despite their association with the idea of scientific ‘law’, the laws of science which must make reference to realities are only superficially like the laws of mathematics and logic which lack any such reference. The validity of science’s theoretical formulas ultimately does not depend on some abstractly pure ‘truth’ that they embody, but rather on their roles in producing well-confirmed theories. The notion that science rigidly follows abstract rules aiming at perfect truth couldn’t be right.

Naturalism is not incomplete concerning the tools of rationality applied within scientific practices of theorizing. Naturalism therefore appears to be able to capaciously handle all the intelligent cognitions sufficient for cultural practices, practical engineering, and even theoretical science.

The non-naturalist will hardly be satisfied with this response, focusing only more intently on reason’s perfect truths in themselves apart from scientific application: “What makes those pure mathematical and logical truths really true?” But this is very different question than the one raised by the criticism considered here. The criticism about science and rationality has been raised and satisfied. All the same, philosophy can consider this separate concern about pure necessary truths, since human cognitive habits don’t seem sufficiently perfectly rigid and unchangeable here. Where in any brain, or set of brains, is the organic basis for the perfect truths of abstract mathematics and axiological logic? Does two plus two equal four because most humans have thought so? That doesn’t sound right, since we would say that this truth remains true even if no sentient organisms existed. Even if we remind ourselves that we are organically compelled to say that, since our own brains would return with no other answer, we still can’t honestly admit otherwise. How could we approve any alteration, by ourselves or anything else, to the most unalterable truths we can think about? A philosopher like Descartes may say that he can imagine a god altering a truth of mathematics, but he isn’t also saying that he himself can approvingly conceive of an altered truth. The natural world

is admittedly a realm of flux and change, and no relationships stay the same forever—how could something changeable account for the rigidity of necessary truths?

The naturalist has four primary options: (1) figuring out what in the material world the basic terms and truths of mathematics and logic actually refer to; (2) denying that reason's necessary truths make reference to any sort of reality; (3) denying that such truths are really necessary; or (4) denying that such truths deserve the label of 'truth' in the first place. Neuropragmatism prefers option 2 over 1 because the contemplation of such truths do not, by themselves, function to guide conduct about anything. As far as the cognitive sciences would be able to tell, the 'truths' of reason only appear to be necessary because we rigidly take them to be so, by firmly treating their terms as unchanging for as long as we please. Refusing to alter the meaning of numbers and operations like addition and multiplication yields a rigid set of habits about doing algebra, and the way that we get the same answers every time we perform algebraic operations lends them a most necessary and realistic aspect (those results feel like discoveries, not creations). Indeed, option 3 looks plausible over 2 from an evolutionary standpoint, since we (collectively) are ultimately responsible for those cognitive habits, so we wouldn't quite feel calling them conventional—as they look so intuitively rigid in their use and no individuals could dispute them—yet we must admit that the meanings of terms and operations could drift in usage over generations and centuries, just as the linguistic meanings of all other words and sentences must. What we must regard as necessity is just our own inevitable perception of conventionality during short timespans, just as what we take to be the land's flatness is just an inevitable perception of the spherical earth at ground height. Resorting to option 4 may not be needed, but the pragmatic naturalist may resort to its additional conventionality. The third and fourth options place a heavy burden of proof on the mathematical realist, demanding a convincing demonstration that reason's truths must be forever independently aloof and perfectly unchanging, over and above our admitted capacity to have to imagine them to be so.¹¹

Setting aside mathematical realism as too problematic, the pragmatic naturalist can appeal to the three other options before having to confess that truths of reason must be unnatural and naturalism is incomplete. Without having to adjudicate here among the stances of formalism, realism, constructivism, cognitivism, intuitionism, empiricism (etc.), the naturalist can at least say that a non-naturalist position about reason's truths has much more convincing work to do before declaring naturalism incomplete.

However that philosophical debate over pure reason turns out, it still remains the case that naturalism's foundations in science are entirely secure, since the theoretical rationality utilized in science can be naturalized thanks to brain sciences investigating modes of cognitive processing. This is an extremely convenient result for pragmatic naturalism, which no longer confronts the specter of internal incoherence. Without presupposing the general validity of naturalism from the outset, the neuropragmatist assertion that human rationalities

¹¹ On the aftermath of Kant's views concerning mathematics and logic, see Coffa (1993). On constructivism, realism, and naturalism, see a pragmatist version by Kitcher (1984), and his updated views in his essays in Gonza lez (2011). See a similar version by Ernest 1998. An intriguing empiricist option is developed by Jenkins (2008). The term 'a priori' has been avoided here due to its multiple meanings; a helpful survey is Casullo (2003).

are comprehensible by the relevant sciences in turn supports the stability of pragmatic naturalism. From the broadest perspective on the overall implications to the neurophilosophy of the future, neuropragmatism, it culminates in a freshened pragmatic naturalism that “knows itself” even better than ever before.

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Department of Philosophy
 135 Park Hall
 College of Arts and Sciences
 The State University of New York at Buffalo
 Buffalo, NY 14260-4150
 E-mail: jshook@centerforinquiry.net