EUROPEAN JOURNAL OF PRAGMATISM AND AMERICAN PHILOSOPHY

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Neuropragmatism: A Neurophilosophical Manifesto

Abstract. Over the past three decades, cognitive science has been making a turn towards pragmatism. Here we outline steps towards completing this turn. As a handful of cognitive scientists and philosophers have been arguing more recently, the insights of William James, John Dewey, and George Herbert Mead are not only being re-discovered, they are also proving rather prescient in light of growing research. The new field of *neuropragmatism* aims to take these insights seriously and further into new directions for both pragmatism and cognitive science. In this manifesto, a brief history of the relationship between classical pragmatism and the sciences of life and mind is offered as a background for twelve proposed theses of neuropragmatism. These theses serve as general guidelines for further philosophical and scientific research. To illustrate the possibilities and consequences of this neuropragmatic framework, neuropragmatist views on traditional questions of philosophy of mind, such as the mind-body relationship, are situated among other leading philosophical perspectives, like enactive, embodied, and embedded theories of cognition and mentation. Such views, however, when taken from a neuropragmatist perspecitve, have significant consequences for the philosophical project of reconciliation between what Wilfrid Sellars called the scientific and manifest images of humanity. The difference in conceptions of experience and subesequently science are crucial for understanding the difference between Sellarsian neurophilosophy and neuropragmatism, as well as how to reach rapprochement between the sciences and the humanities.

> The question of the integration of mind-body in action is the most practical of all questions we can ask of our civilization. It is not just a speculative question; it is a demand: a demand that the labor of multitudes now too predominantly physical in character be inspirited by purpose and emotion and informed by knowledge and understanding. It is a demand that what now pass for highly intellectual and spiritual functions shall be integrated with the ultimate conditions and means of all achievement, namely the physical, and thereby accomplish something beyond themselves. Until this integration is effected in the only place where it can be carried out, in action itself, we shall continue to live in a society in which a soulless and heartless materialism is compensated for by soulful but futile and unnatural idealism and spiritualism.
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> John Dewey (1927/LW3: 29–30)

Neurophilosophical pragmatism, or *neuropragmatism*, is a scientifically informed treatment of cognition, knowledge, the body-mind relation, agency, socialization, and further issues about these basic matters. Neuropragmatism is capable of grappling with philosophical questions arising at many levels, from synapse to society. There is much at stake, as the opening Dewey quotation claims. With its firm grounding in science, neuropragma-

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tism may be the best equipped philosophy for dealing productively with the challenges facing our culture, as developments in neuroscience and neurotechnology bring about both better means for dealing with problems, old and new, and ways of creating new problems, today and tomorrow.

The amazing progress of the behavioral and brain sciences have confirmed many of pragmatism's core claims, culminating in a resurgence of neopragmatism and then its fresh flowering in neuropragmatism. The recovery of the concept of dynamic embodied and embedded cognition and the renewed appreciation for the brain's systems as evolved functions have together carried many researchers towards the tenets of neuropragmatism. Scholars bold enough to draw conclusions about the nature of mind, the dynamic nature of human knowledge, and the practical criteria for judging epistemic success unite the cognitive strands of neuropragmatism. Searching for such a comprehensive reunion of science and philosophy should not be disdained. In the words of the editors of a recent book on embodied cognitive science,

> We need to put together conceptual analyses of the notions of representation, computation, emergence, embodiment, and the like, with empirical work that allows us to bring together ecological, dynamic, interactive, situated, and embodied approaches to the scientific study of cognition. (Calvo and Gomila 2008: 15)

Neuropragmatism offers a philosophical intersection for coordinating this pluralistic effort. The prefix '

neuro' does not portend a reductionistic agenda is intended by the term neuropragmatism. Quite the opposite: the anti-reductionistic, pluralistic, and interdisciplinary tradition of pragmatism remains securely at the heart of neuropragmatism. All the same, a philosophical position on cognition and mind must cohere with the best neuroscience available.

We begin with a brief history of pragmatism and the sciences of life and mind. From this history, we update pragmatism in this neurophilosophical form by introducing twelve theses of neuropragmatism. These theses emphasize the connections between pragmatism and the sciences of life and mind, and propose research programs for engaging scientific researchers as well as for navigating the consequences of research for the larger public.

Classical Pragmatism and Neuropragmatism

Pragmatism has from its origins formulated philosophical theories about culture, intelligence, and knowledge in ways that respect biology, anthropology, and cognitive science. Classical pragmatism was the original American cognitive science and neurophilosophy. Charles Peirce, William James, John Dewey, and George Herbert Mead were all experimental psychologists who tried to reform philosophy in light of evolutionary biology, experimental psychology, and brain science. Indeed, most of the early American psychologists and sociologists had strong pragmatist leanings. Pragmatism is vitally interested in entirely naturalistic accounts of intelligence and agency, so that all other fields of philosophy from epistemology to ethics can be reformed in turn. By integrating science and philosophy together, pragmatism prevents both scientism and speculation from inflating debilitating dualisms.

Pragmatism has always viewed itself as essential to a complete and consistent naturalistic worldview. Any naturalism has to explain how rationality, intelligence, and science are possible within the natural world. Pragmatism has serious opponents not interested in ad-

vancing naturalism. At the turn of the 20th century, major philosophical options were few: common sense empiricisms; neo-Kantian rationalisms; phenomenologies; and neo-Hegelian idealisms. Common sense empiricism sought pure sensory impressions or sense data: ideas that carry information about nature untainted by any thought, so that cognition simply combines and rearranges that original information into knowledge systems. Neo-Kantian rationalisms, noticing empiricism's deep problems, postulated non-empirical rational principles to account for scientific knowledge. However, such rationalism fed into anti-naturalism and dualism, as did the phenomenologies that prioritized qualitative experience over nature or biology. Reconciling empiricism and rationalism by adding historicism, neo-Hegelian cultural psychologies stumbled onto the way that knowledge gradually grows from the interfusion of evidence and reasoning in social contexts. John Dewey and George Herbert Mead further naturalized this cultural historicism by incorporating Darwinian evolution and experimental psychology (Cook 1993, Popp 2007). They proposed a pragmatic naturalism in opposition to naïve empiricism, static representationalism, reductive materialism, methodological individualism, and animal behaviorism. To accomplish this pragmatic naturalism, pragmatists explored metaphysical issues such as radical empiricism and direct perception, teleological accounts of living systems, non-reductive emergent naturalisms, and perspectival and process ontologies. Not surprisingly, neurophilosophers and especially neuropragmatists have been gradually re-engaging these wider issues.

Pragmatism went into eclipse in philosophy departments by the 1930s due to analytic and linguistic philosophy along with imports from European positivism. Yet pragmatic ideas continued to flourish in the social sciences from psychology and linguistics to sociology and anthropology. The neopragmatism of the 1970s and 80s, especially in the hands of Richard Rorty, was well known for its linguistic and epistemic conventionalism, but not for its congruence with the latest brain science. Hilary Putnam's meaning externalism and pragmatic realism (Putnam 1999) also helped to make actual human cognition relevant to philosophical debates. Some philosophers inspired by W. V. Quine's kind of naturalism (which sustained the Deweyan point that cognitions and knowings must be natural events amenable to scientific study) demanded continuities between science and philosophy and pulled analytic philosophy back from pure rationalism (e.g. Dennett 1991). As the new cognitive and brain sciences emerged in the 1980s and 1990s, they had benefited from the seeds of pragmatism and began to sow their own; and when analytic philosophy began to take the brain seriously once again, it encountered these pragmatic ideas. Rationalist analytic philosophers, strong AI proponents, and excessively cognitivist researchers rebelled against such pragmatism. For example, Jerry Fodor has called pragmatism "the defining catastrophe of analytic philosophy of language and philosophy of mind" (2003: 73–74). However, some analytic philosophers have been returning to parts of pragmatism in various ways, driven by respect for science and its discoveries.

Recognition that pragmatism was receiving much re-confirmation in the brain sciences was noticed in the 1990s by scholars such as Mark Johnson (1987, 1993, 2007) and the late Francisco Varela (1991). Neuroscientists like Jay Schulkin have also recognized pragmatist themes (Schulkin 2000, 2004, 2006, 2009, 2011, and 2012). A younger generation fluent in both classical pragmatism and the latest neuroscience was in the best position to take stock of matters, such as Anthony Chemero, W. Teed Rockwell, and Tibor Solymosi. Solymosi recently coined the term "neuropragmatism" (2011a). From its grounding in the current behavioral and brain sciences, neuropragmatism confirms many core views of traditional pragmatism. Neuropragmatism continues to reform philosophical views about such things as the mind-body relation, the function of intelligence, the nature of knowledge and truth,

the nature of voluntary agency and responsibility, the function of social morality, and the ethical ways for dealing with new technologies. Along the way, it distinguishes itself from other neuroscientifically-based philosophical outlooks.

Twelve Theses of Neuropragmatism

This section offers twelve theses of an ambitious neuropragmatism that deals with core philosophical issues. The first three are grounded in biology and anthropology. Many theoretical views across cognitive science and neuroscience regard them as foundational.

1. Animals are goal-oriented organisms, and their nervous systems function to sustain life in arious practical ways.

2. Cognition in all its manifestions (viz., intelligence, mind, or consciousness) is embodied and not explicable apart from that bodily context.

3. Human cognition in all its modes should primarily be studied and comprehended in terms of its practical service for the ways that humans live.

Neuropragmatism emphasizes four additional theses, supported by behavioral and brain sciences, which enlarge the significance of the first three.

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

5. 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.

6. 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.

7. Human intelligence has so many cultural features for facilitating cooperative aims that it should primarily be studied and evaluated largely in terms of its service for socio-cultural goals.

Five more theses of neuropragmatism remain to be mentioned, but we pause here for some elaboration of the first seven theses.

Neuropragmatism is tightly allied with theories of neuroplasticity, the vast unconscious, reason-emotion-volition integration, embodied cognition, and the extended mind. All these theories have prototypes in the works of classical pragmatists. Combating any philosophy of mind that depicts mind as fundamentally passive, receptive, representational, cognitivist, or mechanistic, the classical pragmatists sought to understand the mind in its biological medium. All of the nervous systems in all of their functionings for living must be taken into account. William James lent scientific respectability to the notion that the fringes and margins of consciousness extend deep down into entirely unconscious emotional and intuitive

cognition. The pragmatists affirmed that cognition is basically about applying learned habits to ongoing situations demanding immediate active responses from the organism. Since the environment is never the same, cognition therefore depends on continuous learning, which is the dynamic development of specific habits through the nervous systems' modifications, as the brain's neurons grow or modify their interconnections as the organism perceptually manages its situated experiences of interacting with its world (see James's statement of the brain's plasticity in James 1890, chap 4). Also recognizing how centers of the brain are typically involved in many kinds of coordinated tasks, the classical pragmatists resisted the notion that each part of the brain deals only with narrow tasks or specific sorts of representations. As integrated phases within the continuity of brain processes, the traditional schema of perception, reasoning, emotion, and will cannot be mechanically separate and only temporally related in a series leading to action. Sensation, thought, feeling, and volition are interfused; they are discriminable but not separable aspects of the continuous flow of neural activity (Gazzaniga 1992, Damasio 1994, 1999).

Neuropragmatism continues pragmatism's emphasis on the way that human cognition is not just geared with the world but tightly interwoven into the organism's interactions with the environment, forming an organic whole. This fusion makes it impossible to draw a definitive line between the world beyond the skin of an organism and where cognition begins. Although the brain is obviously the locus of cognition, it does not necessarily follow that only brain events suffice to account for all the functions and features of cognition. William James's notion of radical empiricism depends on treating mind and world holistically, and John Dewey's empirical naturalism finds mind embodied and embedded in organism-environment transactions. In a chapter of Dewey's 1925 *Experience and Nature*, entitled "Nature, Life and Body-Mind", he writes,

> Every "mind" that we are empirically acquainted with is found in connection with some organized body. Every such body exists in a natural medium to which it sustains some adaptive connection... The natural medium is thus one which contains similar and conjunctive forms. At every point and stage, accordingly, a living organism and its life processes involve a world or nature temporally and spatially "external" to itself but "internal" to its functions. (Dewey 1925/LW1: 212)

The organism's effective coordination of modifying its environment (natural and social) exemplifies cognition. Pragmatism has always refused to treat neurons (and any other brain cells such as glia which may modulate brain activity) as the exclusive place where cognitive meaning is enacted – neurons are essential to, but not entirely constitutive of, cognition. Neuroscience properly studies the interrelated processes of brain activity, but cognitive neuroscience cannot help explain the processes of learning and knowing by referencing brain activity alone in isolation from any context. Philosophy, for its part, will be unable to show how to integrate body and mind if knowledge is examined quite apart from any bodily context. Pragmatism's resistance to atomistic and reductivist naturalisms is nowhere more evident than in its treatment of experience and mind as dynamic, systemic, contextual, ecological, and social.

Biology cannot study life with utter disregard for the environment; nervous systems qua biological systems must not be studied any differently. The same goes doubly for the functions in which such systems take part, such as cognition. Cognition, therefore, is not to be solely done within the head in the end but is rather understood in terms of life and living within environments. Grounding mind in biology takes life seriously. What are the existen-

tial truths of life? As Michael Schwartz and Osborne Wiggins describe life, there cannot be any firm or fixed divisions between organic bodies and their environment. Schwartz and Wiggins offer the following existential truths about life:

> 1) Being vs. non-being: Always threatened by non-being, the organism must constantly reassert its being through its own activity.
>
> 2) World-relatedness vs. self-enclosure: Living beings are both enclosed with themselves, defined by the boundaries that separate them from their environment, while they are also ceaselessly reaching out to their environment and engaging in transactions with it.
>
> 3) Dependence vs. independence: Living beings are both dependent on the material components that constitute them at any given moment and independent of any particular groupings of these components over time. (Schwartz and Wiggins 2010)

What is true of life is also true of mind: mind cannot be comprehended except through what it does, and what mind does is transcend itself by ceaselessly modifying its lived environment. By studying those modes of modification the mind is studied, and nowhere else. At no time does an organism's activities or cognition deal with some 'external world' that can be specified independently from the organism. An organism can neither perceive nor interact with 'the world at large', but only confront its own 'life-world' that it can experience and modify. There is no point to first specifying what the external world is like and then asking how an organism cognizes that world. Neuropragmatism, like classical pragmatism before it, studies cognition as it actually transforms the lived environment. The organism's environment is not the same as the external world. Jacob von Uexküll used the term *Umwelt* for the 'life-world' that a species tries to grapple with. Dewey's conception of 'experience' as doing-undergoing, Heidegger's use of *Erlebnis*, and Richard Lewontin's environmental constructivism similarly point to this conception of the available life-world within which cognition does its work (see von Uexküll 1926, Lewontin 1985, Godfrey-Smith 1998, Thompson 2007, Berthoz and Christen 2009).

In a basic sense, the sciences all realize how cognition is localizable to organic bodies dealing with their environments, and that cognition cannot be spiritually or Platonically independent from organic matter. Pragmatism, and neuropragmatism, tend to agree with recent theories about 'embodied cognition' that offer more specific implications of this organic embodiment for humanity. As Margaret Wilson expresses embodied cognition's claims (Wilson 2002), cognition is situated by taking place in the context of a real-world environment, and inherently involves perception and action. Wilson recounts the ways that cognition is for action. The function of the mind is to guide action, and things, such as perception and memory, must be understood in terms of their contribution to situation-appropriate behavior. Cognition must be understood in terms of how it functions under the pressure of real-time interaction with the environment.

The invention of symbolic representation and written language takes advantage of the way that cognition specializes in dealing with transactions with deliberately modified aspects of the environment. Human cognition can off-load cognitive work onto the symbolic environment so that it holds or even manipulates information for us. We harvest that information on a need-to-know basis. That makes the environment part of the cognitive system. The information flow between brain, body, and world is so dense and continuous that, for scientists studying the nature of cognitive activity, the often used term 'mind/brain' is not a

sufficiently meaningful unit of analysis. The production of cognitive activity does not come from any such "mind/brain" alone but rather is a dynamic nexus of brain, body and the environmental situation. These interactions become part of our cognitive systems. Our thinking, decision making, and future are all impacted by our environmental transactions.

These core views of neuropragmatism and (non-representational) embodied cognitive science can be extended to form judgments on classical philosophical problems about the mind-body relation, the natural basis for the highest cognitive functions, and the cultural origin of creative reasoning. For human cognition, managing the lived environment is not just biological but social as well. We must regularly manage each other and our institutions. Distinctively human cognition is from birth (and perhaps before birth) a matter of brains cognizing together in concert. For humans, experience is culture –cognizing the environment is thoroughly shaped by the transmitted modes of cultural activities engaging human nervous system.

Additional theses of neuropragmatism, together distinguishing it from most other neurophilosophies, suggest ways to handle these issues.

8. Cartesian materialism still pervades too much psychology and philosophy of mind by demanding strict localization of rationality, prioritization of self-consciousness's powers, and the quest for perfect representational knowledge of a fixed external world. The brain exhibits much dedicated modular architecture, but massive parallel and networked processing is dominant. The brain is not hierarchical, but more democratic. Nerve centers across the brains are intricately interconnected with each other, so most any part of the brain has some direct or indirect systemic link to every other part of the brain. There is no inner Cartesian theater where all information is gathered and simultaneously experienced; experience at best displays rough continuities. There is no executive command center giving orders to the rest of the brain; deliberation at best guides habitual motor action. Ordinary cognition does not primarily aim at static representation in general but at dynamic adequacy in specific situations.

9. The most sophisticated modes of human cognition are developments and assemblages of lower-level cognitive processes. These complex modes of thought, seemingly far from mere matter or biology, remain embodied and functional for practical success. Higher self-conscious cognitive processes (reflection, inference, hypothesis testing) are socially invented and taught capacities to attentively focus on ways to generalize practical habits for flexible use. These higher social capacities serve to coordinate group cooperative practices where some creativity is needed to maintain efficiency in the face of unstable conditions. Among these social practices are linguistic communication, symbolic representation, and logical inference. As our notion of the "self" is bound up with these capacities, the self must be another socially constructed artifact of culture.

10. Imagination and memory[1] add a contemplative 'space' where techniques can be experimentally attempted on related problems. Even pure imagination, conceptual play, and aesthetic contemplation are creative capacities existing to refine practice, even though we can also perform them in isolation from practical concerns. These creative modes permitted, among

1 We anticipate further advances in not only in the neuroscience of memory but in cultural evolution to provide further insights into the nature of how it is individual humans remember within their situated cultures. Our claim here is simply that the information provided by memory (however memory works) works with imagination (which is not a faculty but a dynamical process that operates across brain, body, and world). See Johnson 1987, 1993, 2007, Shusterman 2008, and Bywater 2010.

other things, the fixation of concepts and select relations among concepts, leading to reasoning. The most complex modes of rational thinking (i.e., logic, scientific method) are refined developments from integrating component cognitive processes. Such things as logic, science, and all sophisticated modes of creative intelligence are culturally-designed and educationally-transmitted technologies.

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. All a priori, conceptual, and linguistic truths are internal to a social epistemic practice, and cannot be directly or simply used to criticize some other practice. Because no a priori conceptual rigidity can dictate terms of empirical adequacy, only the practical adequacy of a knowledge system is relevant to its validity. For example, no folk belief system rules over any scientific field, and scientific fields should respect pluralism and seek coherence, not unity. By avoiding epistemic dualism and reductivist monism, both epistemology and ethics can be naturalized, by showing how they fit in the natural world of encultured humans.

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.

These twelve theses of neuropragmatism permit it to offer an ambitious neurophilosophy. Having stated these core theses of neuropragmatism, we may step back and survey wider intersections of neuroscience and philosophy. To establish itself as a fully legitimate neurophilosophy with a claim to some leadership role, neuropragmatism's mode of dealing with the mind must be scrutinized.

Neuropragmatism and the Mind

Leaving behind reductionism and eliminativism, pragmatism has always sought ways to show how to avoid dualism and representationalism. The Cartesian claim that mind and body have entirely different properties is demonstrably false. Lingering claims that consciousness has unnatural properties similarly rest on philosophical confusions and ignorance of brain science. Mental activity, conscious and unconscious, is a natural process involving the nervous system – as such it is entirely open to scientific inquiry.

Neurophilosophy and neuropragmatism can show how to coordinate the functionalities of thought with the functionalities of nervous systems. Examples include: thinking and nerve activity both have temporal durations; they are both found in localized living centers rather than diffused through all of nature; they both consist of relational continuities rather than atomic accumulations; they are both dynamic rather than static; they both display

growth and decay; they both function in attending to practical dealings with the environment; they both primarily aim at maintaining the organism's well-being. Even the most 'subjective' parts of consciousness, such as the feelings and qualia noticeable in self-consciousness, are aspects of the dynamically functional flow of thought. No pragmatism would seek to 'reduce' felt qualia to nervous activity or anything else to prove that they are natural. The old metaphysical formula demanding identity of all properties for genuine identity was rejected early on by pragmatism and is no longer taken seriously beyond armchair philosophy. For science, functional identity is quite sufficient: where two phenomena are strongly correlated and display the same functionalities, the two phenomena are rightly regarded as the same natural process observed from different perspectives. Qualitative feelings happen where nervous systems achieve certain degrees of complexity in their transaction with their respective bodies. Subjectivity need not be treated as anything spookily "unnatural." The mysteriousness of subjectivity quite vanishes. Subjectivity and perspective are precisely what would be naturally expected when specific brains generate specific experiences. You have a very different perspective from anyone else, because you are directly experiencing through your unique nexus of your brain, body, and world, and not from mine or any other's nexus.

The lived experience of cognition reflects its neurological basis. Unscientific philosophies point to features of experience or thought allegedly lacking dynamic functionality or integration with action. Worse, anti-naturalistic philosophies further claim that scientific naturalism can never integrate them with energetic matter. However, neurological investigations (much less any sound phenomenology, such as that of pragmatists) have not been able to confirm such static and aloof features of consciousness. Interestingly, such supposedly 'pure' or 'inert' parts of experience (sense data, intense qualia, and the like) are actually detectable by those seeking them only after the most intense cognitive effort to distill them from the ordinary flow of active experience. There simply is no avoiding dynamic and creative cognition. Consciousness is intensely qualitative, to be sure, precisely because the brain puts so much work into that phase of experience. Theories of mind comfortable with taking purity, passivity, receptivity, or representation as basic modes of cognition must be rejected as incompatible with neuroscience. All the same, neuroscience is at liberty to develop specialized theories about micro and macro brain systems, borrowing and modifying terms as it may require. No folk psychology or linguistic conventionalism can dictate terms of scientific inquiry into the nexus of brain, body, and world. The dream of the unity of science having dissipated, teleological and intentional terms can be legitimate features of successful empirical studies at every level from the social to the synaptic (although mechanistic causality seems to dominate at molecular levels). Indeed, the choice between teleological and mechanistic modes of explanation may not be forced. Some naturalisms, like Dewey's, propose that mechanism is visible in teleological systems when analyzed closely enough, but it only means that teleology requires mechanistic parts even while no mechanistic explanation could ever suffice for the whole. After all, wholes typically have genuine powers and properties that no aggregate of parts could have. This is not duplication of causal powers, as reductionists fret, but only the recognition of compatible kinds of causal powers at different scales and systems of nature. The pluralistic stance of pragmatism and neuropragmatism is hospitable to continuities of terminology and causality at multiple levels of brain science.

Higher human cognition can occasionally achieve sustained reflective passivity, open receptivity to experience, and sophisticated representations of the so-called external world. Neuropragmatism cannot deny that humans can do these things. Yet it must undertake ex-

planations for their existence without permitting them to assume any fundamental role in ordinary cognition. Neuropragmatism tends to favor the idea that sophisticated symbolic capacities of human intelligence are the scaffolding on which the extended mind of linguistic sociality operates. Basic cognition is not symbolic or representational; but human societies design their environments in ways that offload cognitive work onto the manipulation of external symbols. Rationalism in general makes it difficult to account for cognition and knowledge in any natural terms. Cartesianism was the height of presumptive rationalism by taking our most sophisticated forms of communication (replete with analytic meanings and necessary truths) as essential to all consciousness and cognition. Later representationalisms sustained this obsession with static symbols, rendering it difficult to naturalistically explain even how children acquire linguistic competence.

Neither static nor computational representation characterizes ordinary cognition. Reliance on representation leads to a postulation of foundational perceptions. However, experience is not 'built up' from purer building blocks of direct information from nature. Connectionism comes closer to dynamical and distributed cognition but may still contain aspects or elements of representationalism. Neuropragmatism, like other neurophilosophies, takes close notice of the way that the brain rapidly merges diverse streams of stimuli from all sources in order to guide effective action in the lived moment. All cognitive processes (and hence all conscious experiences too) are fusings of information about external sensations, motor control processes, and internal feedback from the body. There is no pure sensation, no pure will, and no pure feeling. There are no dichotomies between sensation, emotion, and reason – these aspects of cognition work together as they guide behavior. Even in the simplest case of behavior, these fusions are evident. Simplistic associationism is inadequate because organic circuits create new wholes that are not merely sums or sequences of their parts. In a genuine organic circuit of perception, action, and consequence (e.g., the child's reaching for a flame, only to learn that fire painfully burns), the meaning of the perception includes the prior action done to gain that perception (e.g., the turning of the gaze towards an object); the meaning of the action includes both a desire (e.g., to touch that object) and more perception (e.g., to guide the reaching); and the meaning of the consequences of the touching includes the guided action of touching (e.g., the felt pain is not just felt pain, but the pain of touching that object). The next time the child sees the flame, he sees a *hot* flame, and when he reaches for that flame, he *reaches for a painful touch*. From now on, for that child, an idea of touching that flame simultaneously contains the idea of pain (this sort of example is discussed in James 1890 and Dewey 1896/EW5).

In general, most of the meaning in perceiving things consists of anticipations of potential reactions upon dealing with those things (Rizzolatti and Sinigaglia 2008; Iacoboni 2008). Organic circuits result in holistic organic wholes of experience. Experience is thoroughly imbued with prospective values of action. That is why we directly experience meanings and values in the world around us. If meanings or values were only interior mental states, then our experience of an external object would be stereoscopic, a sort of double perception. We would observe the external object as a meaningless material thing, and simultaneously observe it as a useful object to be employed, as if one 'eye' saw the world as it is in itself, while another 'eye' saw objects as meaningful and valuable. Does lived experience ever seem like this? Hardly – we immediately and directly observe significant, meaningful, and valuable objects without any double 'vision' or contrast between an external world and an internal world. Meanings and values are where they appear to be: embodied in the things that we know how to use. Meanings and values are instances of achieved practical knowledge through learning. Knowledge is built up from our experimental attempts to

productively manage our deliberate modifications to the environment. Static representationalism, correspondence theories of knowledge, and Cartesian materialism are not viable theories of mind and intelligence. Neuropragmatism allies easily with theories of active perception (Hurley 1998, Noë 2005, Pred 2005); somaesthetics (Shusterman 2008); naturalizing intention (Grammont et al. 2010); ecological psychology (Gibson 1986, Heft 2001); ecological cybernetics (Bateson 1972, Hoffmeyer, ed. 2008); social cognition and social epistemology (Fuller 1988, Wilson 2004); neurosociology (Franks 2010); extended mind (Clark 1997, 2008; Noë 2009; Menary 2010); neurophenomenology (Varela, et al. 1991, Petitot, et al. 1999, Gallagher 2005, Thompson 2007), and radical embodied cognitive science (Chemero 2009). Even aspects of connectionism and dynamic systems theory may contribute to the proper synthesis of these positions (Bechtel and Abrahamsen 2002), provided excessive representationalism is avoided (Freeman 2001, Rockwell 2005).

To ask, "Is mind just in the brain?" is problematic. 'Mind' is ambiguous: it can refer to the localized centers of cognitive processing, or it can refer to the networked channels of meaningful information. Localized mind is where brains act; philosophical options are common substantial cause, or dual aspect monism, or outright ontological identity. Networked mind is wherever brains are coordinating action through communication, and therefore much of intelligence is an emergent feature of human communities modifying environments. Mind is dependent on brains, and cognitive functions are brain functions, either of single or multiple brains. Neurons are all about systemic communication, across synapses and across the room. Many cognitive functions (and all higher cognitive functions) only operate through people – viz., social organisms with nervous systems – in communication with each other about the common environment. Human psychology must be social and ecological.

The 'theory of mind' ways of trying to explain how humans try to understand each other's beliefs and motivations take matters exactly backwards. We do not really start from our own concepts of what constitute the mental life and tentatively test them against the empirical data of others' behaviors. For babies could never do any such thing. To presume so is to believe as if each baby was born a positivistic scientist or a cultural anthropologist. Infant brains do respond to others' behaviors, like displays of emotion, but they respond not with thought but with deed. Because feelings are intimately connected with behaviors (through such things as systems of mirror neurons), it is the joint behaviors that build up the mind. The baby is doing the same things as the adult, not thinking the same things as the adult. The pragmatist always looks to the social behaviors underlying cognition. After all, how could the developing infant brain be using complex concepts so soon to interpret adult behaviors? Rationalists might suppose that they are, but babies do not need such refinements so soon (and given the diversity of cultures, it is a good thing that babies do not need them – for the diversity of cultures shows that they do not have them).

Generally, first we comprehend the minds of others by living with them in infancy and childhood, and then we gradually apply cognitive categories to our own developing modes of experience. Babies are born individuated but not as individual selves. Babies do not start out as solipsists, intimately acquainted with their private mental states while ignorant of those of others. It is not enough merely to have a consciousness of passing mental states – higher human cognition about individual minds is far more than just being awake and aware of one's environment. Sustained mental individuality is far more complex than having passing mental states. Put another way, a child gradually learns how to treat people as having mental individuality right along with her own growing sense of mental individuality. A child only gradually develops the notion that she has an internal mental life, distinguish-

able from her absorption in her environment, by participating in the living cognition of the community around her. For example, knowing what beliefs are, and knowing that one has beliefs as distinguished from the beliefs of others, is a far more sophisticated ability than merely having transient beliefs. Individuality is an emergent social category, not a biological or metaphysical category – no one is born as an individual self. Like every other role, one learns how to be an individual only within a community (and that is why different cultures apply differing notions of individuality). The way that even babies have personalities is not a refutation, but a confirmation of this social theory of the self, since the growing infant learns how to be treated as an individual by being treated in ways particular to her personality (and only later on will she realize that she has a personality). Although there are numerous broad continuities between animal and human cognition (Fetzer 2005, Hoffmeyer 2008), as would be expected given evolution, human cognition displays some notable discontinuities from animal mind because we are now so intensely cultured animals. By taking higher cognition and self-conciousness, like all human communication, as fundamentally social, neuropragmatism is aligned with Peircean semiotics (Peirce 1991, Sebeok 2001), the social mind (Valsiner and van der Veer 2000), symbolic interactionism (Blumer 1969), developmental consciousness (Bogdan 2010), and biosemiotics (Barbieri 2008).

Cognition and culture are thoroughly natural. The biological evolution of the human species, and the cultural evolution of complex human associations, suffice to explain all features of cognition.[2] The two modes of evolution are not disjunctive – no form of cognition is independent from either mode, although most complex forms of human cognition are primarily cultural in origin and function. Nothing spiritual or supernatural is needed to account for mind. The highest modes of human cognition aim at social competence, technological expertise, and knowledge of reality. Culture educates members of society into various forms of responsible intelligence and expects their satisfactory use for group goals. These cognitive modes amount to technological skill and ultimately answer to pragmatic criteria of success set by societies. Basically, culture is technology. Social learning and teaching was the first technology, and all else followed (Sterelny 2012). All epistemology must be social and technological; no philosophical theory of reason, knowledge, or truth can float freely apart from learning's origins in education and experimentation, or avoid answerability to practical social justification within cultural contexts.

Objectivity aiming at warranted truth is possible through commonly accepted social standards of responsible practices for dealing with the environment. Both society and nature provide the empirical checks on postulated theories. Because we are an evolved species, and social epistemology and reason can be naturalized, there is sufficient reason to be critical realists: we can be confident that cognition tracks the general features of nature, and confident that science is gradually becoming more reliable about tracking the fine details of natural processes. We do not have to worry that human knowledge may be wildly incorrect or ignorant about the environment. Nature is not some mysterious 'thing in itself'. For we can explore and understand nature, with much thanks to our cultural activities that have grown from natural processes for getting about in nature in the first place.

2 Our position does not here depend on which of the various theories of cultural evolution prevail. We are sympathetic with the approach Philip Kitcher has taken to the evolution of ethics and culture. In *The Ethical Project* (2012), he takes up a Darwinian perspective to culture without necessarily tying the evolutionary success of cultural practices to their genetic or reproductive success. See Kitcher 2012: 104-110; Kitcher 2003; Godfrey-Smith 2009: 147–164; and Sterelny 2012. Kitcher and Godfrey-Smith have both claimed affinities with classical pragmatism, especially Dewey's.

The role of reason and the problem of 'free will' need to be dramatically re-thought. The 'decisions' that occur during conscious deliberation are not some sort of instantaneous moments, or detached initiators of voluntary conduct, or products of emotionally detached rationality. Conscious monitoring of conduct is thoroughly interfused with ongoing motor control of muscles and internal and external sensory feedback. Agency consists of a capacity to creatively refine control over habitual practice by judging observed success, so both frontal and motor cortex regions are simultaneously and interrelatedly involved. Conscious deliberation is therefore broadly distributed across the cortex, and not just some 'after the fact' reporting of what some unconscious processing does entirely on its own. Proposals that consciousness does no work guiding conduct must postulate both epiphenomenalism and epicognitivism. Epiphenomenalism declares consciousness to be real but powerless, an after-the-fact ghostly spectator on the life of the brain. Epicognitivism offers a cortical basis (some call it the 'interpreter') for epiphenomenalism, but its postulation of a surplus brain center that does no real work clashes with evolution. Brain centers that generate consciousness must have an efficacious role in conduct (as James argued in 1890). This conclusion does not mean that consciousness as such has its own natural causal powers (there is no route back to dualism or Cartesian materialism here), but only that consciousness of higher cognitive efficacy is no illusion, but an accurate report. Indeed, for pragmatic naturalism, holding that consciousness is a real aspect of the natural efficacies of higher brain cognition can make sense.

Reflective deliberation is therefore no illusion or irrelevant luxury either: it is a useful imaginative function for specialized human cognition for problem solving. Responsibility in turn is the degree to which one can successfully use reflective deliberation to guide conduct in socially appropriate ways. As philosophers from John Locke to John Dewey (1932) and Daniel Dennett (2003) have argued, our capacities for practical deliberation, normative conduct, and degrees of moral freedom naturally grow together and remain culturally fused together. The intense degree of human sociality accounts for the way our species encourages normative conduct using normative moral responsibility in addition to the older primate emotional motivations of love, kindness, and charity. However, the intense sociality of human life requires the thoughtful management and adjustment of multiple social roles and responsibilities, in turn requiring dynamic moral problem solving about what to do from situation to situation. Moral concepts such as responsibility, freedom, autonomy, and blame have distinctive functional roles in creatively sustaining the community life of human societies.

Neuropragmatism and Neurophilosophy: Conflict Over Image

William James was among the first philosophers to take brain science and what is now called embodied cognition to be highly relevant for all core philosophical issues, as his monumental *The Principles of Psychology* illustrates. The pragmatist force of James's vision of all of nature's interrelated processes, including mind, is carried on through John Dewey's philosophy. As Dewey wrote,

> To see the organism *in* nature, the nervous system in the organism, the brain in the nervous system, the cortex in the brain is the answer to the problems which haunt philosophy. And when thus seen they will be seen to be *in*, not as marbles are in a box but as events are in history, in a moving, growing never finished process. (Dewey 1925/LW1: 224)

This statement is clearly a statement of neurophilosophy and supplies what the authors endorse as the neuropragmatist's motto (see Solymosi 2011a). It goes all the way from synapse to society; from cortex to culture. While many neurophilosophers today may appreciate Dewey's bold claim here, it is worth noting that the standard orthodoxy of most neurophilosophers is inadequately pragmatic and overly Sellarsian or positivistic. That is, their understanding of experience, and thus science, is simplistic. According to the neurophilosophical orthodoxy, the main concern for philosophy is the reconciliation of two opposing views of humanity, the scientific on the one hand and the manifest or humanistic on the other. The job of philosophy is to navigate the rapprochement of these two views.

While there is some disagreement on the nature of this reconciliation –generally understood, the conflict's most popular solutions have been eliminativism and constructivism– the neuropragmatist solution to the conflict is to reconstruct the philosophical notion of science's aims and results that leads to competition between the two images in the first place. This conflict, however, is not merely a theoretical problem for philosophers. It has manifested itself socially in the academy as the two cultures described by C. P. Snow (1959). There is a desperate need for rapprochement of some sort, as there are real life consequences across the life sciences and out beyond the ivory tower into areas like public policy.

Despite great similarities between mainstream neurophilosophy and neuropragmatism, there is a crucial difference between them.[3] This difference resides in the different conceptions of experience. This difference subsequently sets up distinct conceptions of science, and therefore different resolutions to the conflict between the scientific image and the humanistic or manifest image.

The philosophical project of *rapprochement* is taken up in various ways by the many philosophical traditions. The specific differences between mainstream neurophilosophy and neuropragmatism come down to how the problem is articulated and thus how it is solved in light of that articulation. Generally speaking, however, the conflict is a genuine one felt by most parties. The concern is that the scientific image ultimately shows the humanistic one to be illusory, thereby bringing into serious doubt genuinely human concerns about dignity, freedom, responsibility, and living a good and meaningful life. Science, it is feared, will rob us of our humanity.

For mainstream neurophilosophers, like Paul and Patricia Churchland, Owen Flanagan, and Daniel Dennett, their conception of science differs in significant respects from the neuropragmatists' view. Moreover, the conception of cultural tradition, what Wilfrid Sellars influentially called the manifest image, similarly differs between neurphilosophy and neuropragmatism. The main distinction is the difference in how each position conceives of experience, and subsequently of science. Patricia Churchland (1986: 302–303; and 2002: 107–112) articulates the problem in terms of scientific theory versus folk theory, and then, as she often does in the latter work, refers to Quine and his pragmatism. The neuropragmatism we advance here is similar to this branch of neopragmatism but, as will become clearer, stands in stark contrast to the conception of science based on an inadequate conception of experience. The Churchlands (1998: 25ff) continue this discussion in terms of folk psychology versus scientific psychology, and mention the origins of these ideas in Sellars (*ibid*: 4ff). Paul Churchland further distances himself from pragmatism in his recent book (2012: 128ff; see Rockwell 2011 for a strong treatment of Churchland's previous pragmatist leanings). Flanagan's recent statement of his philosophical project is in these terms but

3 For a more extensive discussion of the differences in reaching rapprochement between neurophilosophical reconciliation and neuropragmatic reconstruction, particularly with regard to the neuroscience of freedom, see Solymosi 2011b.

with a greater pluralism, extending the Sellarsian dyad to a sextet (see 2007: 5ff). Dennett (2008) is also a clear and accessible statement of the problem, even as he has unwittingly affirmed most of the neuropragmatist materials for its solution.

While both positions see the manifest or humanist image developing first and providing the framework out of which science and its image develop, mainstream neurophilosophers see the two images as competing with each other for the truth. The truth of science is taken as value-free and objective, whereas the truth of the manifest image is value-laden and subjective. Notice that this conflict is yet another version of mind-body dualism, in which the properties of each, science and culture, are mutually exclusive. Sellars articulates the question that philosophy faces as this: "How, then, are we to evaluate the conflicting claims of the manifest image and the scientific image thus provisionally interpreted to constitute *the* true and, in principle, *complete* account of man-in-the-world?" (Sellars 1963: 25)

This conflict is generated for mainstream neurophilosophy largely due to residues of logical positivism, which is based on a Humean conception of experience. Like Descartes's rationalistic view of the soul, Hume's empiricism fits the model of the spectator theory of mind that Dewey criticized. Today we recognize such a view as Cartesian materialism. While neurophilosophers like the Churchlands, Dennett, and Flanagan would balk at being called Cartesian materialists, they succumb to the modified account of it (as described by Rockwell 2005). It may not be that there is one specific place in the brain where experience all comes together, but they suppose that there is a specific space delimiting experience: the brain itself.

The neuropragmatist denies this limited range of experience or mentation. Recall the neuropragmatist's motto: that the problems of philosophy are generated from the failure to recognize the dynamic processes embedded within larger processes; that the cortex is in the brain, the brain in the nervous system, the nervous system in the organism, and the organism in nature; that, moreover, each of these 'things' are not simple or static substances but dynamic and growing processes. When thus seen, we are better speaking not of mind as a noun but of mind as a verb: an organism does not have a mind, rather an organism minds. Indeed, our scientific activity should not be inquiring into the mind but into the process of minding. Mentation goes beyond the cranium, suspended in a cultural medium of communicating humans. Neuropragmatism would not achieve the naturalization of consciousness and mentality by limiting it to a single brain, ignoring how human brains become distinctively human only when wired together. If other neurophilosophers cannot see the 'wires' of sight and sound that is because a too narrow scientism has rendered those into meaningless physical entities already. One might as well do that to all the signaling wires of the nervous system and be done with meaning altogether. Avoiding that eliminative dead end, the only alternative is to take seriously the way that both the phenomenology of lived human experience and the physicality of brains interacting with each other and the environment exist in natural spaces much larger than the confines of any cranium taken singly. It seems like we are directly experiencing the external world because we really are. The unsurprising fact that complex natural systems of brains and environments can be distorted and deceived into illusions and hallucinations no more proves that consciousness is all in one's head than hacking a computer network proves that the world wide web is all in one's computer.

Even where some mainstream neurophilosophers would not deny that experience and intelligence are partially social, they have not dealt with the full implications of viewing humans and all their cognitive products as encultured. Another problematic residual as-

pect of Humean experience in logical positivism is the maintenance of the fact/value dichotomy (Putnam 2002). This issue, too, is complex as each of the aforementioned neurophilosophers have held varying views throughout their careers. Regardless, this dichotomy fits the general pattern that neuropragmatism seeks to eliminate. Among the reasons mainstream neurophilosophers have such difficulty in their efforts to reconcile the manifest image with the scientific image is the question of what to do with value (or mentality) in an ontology of value-free facts (or bodies)? Eliminativism is one strategy; constructivism is another. The former fails to keep the sacred aspect of the manifest image, which many find a dissatisfying, if not a terrifying proposal. The latter is left making qualifications upon qualifications about what is meant by manifest terms like consciousness in ways that end up making their readers wonder whether consciousness is real or illusory. This too is unsatisfying.

The residues of ordinary language philosophy and the 'linguistic turn', which is based on a neo-Kantian view of cultural mind, have not helped matters. By encouraging some philosophers to suppose that they have privileged access to analytic truths grounded in enlanguaged culture, a battle arose between linguistic a priorists and neurophilosophers over who had the right to dictate the nature of the self. This battle only sustained the dualistic terms of the debate into the late twentieth century, as neurophilosophers felt pushed into viewing culture as a competitor to the scientific image of humanity. Ironically, humanists fearful of scientism have only perpetuated the worry over an inhuman theory of self which an improved cognitive neuroscience would prevent.

Neuropragmatism evades these problems of dualism by integrating science and culture. Neuropragmatism conceives of science (like all modes of intelligence) as an inherently evaluative and thus value-laden method that provides provisional instrumental truths as guides to practical action in the world – not a method of justifying static propositions that objectively mirror or correspondingly represent the non-human external world. This difference between conceptions of science is central to understanding the difference between neurophilosophical reconciliation and neuropragmatic reconstruction. In his articulation of the conflict between science and common sense (i.e. the humanist or manifest image), Dewey argues that the subject-matter of both science and common sense is one and the same. The subject-matter is experience, conceived as the dynamic interaction of organism and environment: "Things interacting in certain ways *are* experience" (Dewey 1925/LW1: 12); experience is "the manifestation of the interaction of organism and environment" or simply "an interaction of organism and environment" (Dewey 1939, 531). What distinguishes science from common sense is the mode of inquiry, specifically the experimental method developed into the sophisticated technological and industrial affair that produces the most secure knowledge humanity has about the world to date.

Dewey argues that common sense is concerned first and foremost with "practical uses and enjoyments" of our existential situation, "with 'the ordinary affairs of life', in the broad sense of life" (Dewey 1938/LW1: 71–72, 69). Another important point Dewey makes about common sense is that it is not static and fixed but always changing in response to the dynamic environment. We see this progression in the history of the humanities, broadly speaking, from myth to mythology to dogma and scripture to Chaucer and Shakespeare through to contemporary poetry, novels, films, and so forth. In one way or another, these affairs are concerned with our everyday lives, not as isolated events but as living experiences, as social interactions with each other in a world, actual and imagined. Through them we see how life could be lived and could be experienced (Bywater 2010). They not only affect our consciousnesses but bring about qualities in both familiar and novel ways so as to en-

courage or admonish specific ways of life. They are at the heart of our moral lives. In abstracting beyond the particulars of common sense, Sellars and others end up stopping or freezing a dynamic living process. Snapshots have their place, surely, but to take the snapshot for the whole is to lose out on the entirety and the richness of life.

Science develops out of the same subject matter as common sense, with a concern for practical affairs of ordinary everyday life. When wholly successful, the results and the methods developed by science feedback into the commonsense world "in a way that enormously refines, expands and liberates the contents and agencies at the disposal of common sense" (Dewey 1938/LW12: 72). Unfortunately, Dewey notes, this feedback has not been nearly as successful as it needs to be, never amounting to more than providing new tools for upholding tradition, yet never fully critiquing tradition. This is due in part to the tendency of the practitioners and outside observers of science to finalize the results and methods of science. Sellars does this in setting up the opposition between the manifest and scientific images as though they both could be *the* complete and *the* final word on matters. Dewey describes the dissolution of the problem of reconciliation when we see that "[s]cientific subject-matter is intermediate, not final and complete in itself" (ibid, 72). Science is a provisional and ongoing cultural technology, one of the most humanistic endeavors humans undertake.

Taken and frozen at any intermediate stage, however, the products of scientific inquiry seem to be isolated objects, set apart from the situations in which they were originally encountered. As science progresses, it becomes ever-more removed from practical affairs as its proximate goal is to develop knowledge for its own sake – not to be developed within the lived-in environment of ordinary life. This is not its only goal: the products of science are empowering when properly integrated into the humanities and ongoing cultural life. Science, when seen as just a phase within the interaction of organisms with their environments in the process of life, has consequences and applications outside of itself, in the commonsensical world, with which the humanities are primarily concerned. The neuropragmatist conception of experience thus seeks to establish and cultivate the continuities between science and the humanities, between the scientific image and the manifest images, to improve the richness of living experience in a never-ending process of growth –just as the neuropragmatist motto implies.[4]

Conclusion

Pragmatism started off at a time of significant scientific and technological change. The industrial and Darwinian revolutions, as well as the American Civil War, brought about both a sense of crisis and a vision of hope for what humans could do should they work together toward a common goal. Today we are still wrestling with the consequences of Darwinism and industrialization. Yet we have further difficulties with which to wrestle than the classical pragmatists. For among the consequences of Darwinism and industrialization is a globalized information society that has the means of yielding both life-saving, life-improving medical care and the willful creation of biological warfare as well as the inadvertent diseases effected by industrial life and life in an information society. The successful scientific models that inspired the classical pragmatists were those of physics, chemistry,

4 Central to this continuity between science and common sense is Dewey's principle of continuity. The neuropragmatist motto from Dewey, quoted at the start of this section, is one expression of this principle. For Dewey's mature statements on the postulate of continuity, see Dewey 1938/LW12: 26 and 30–31. See Johnson 2007: 122–123; Popp 2007; and Solymosi 2011a: 352ff.

and early biology. Neo-Darwinian models of life and the impressive rise of the cognitive and behavioral neurosciences[5] provide new inspiration, new tools, new hopes –and new challenges.

The consequences of these new sciences for our understanding of ourselves and our world are not only undeniable and promising; they are also more threatening. Physics provided a cultural transformation in how we alter our environments and generate energy. But it did not seem to threaten our moral, spiritual, and intellectual lives with any significant conceptual change. Indeed, the changes were seen initially as liberating, until much more recently. With physics, the moral threats came from increased pollution of our environment, and, with the Bomb, the very real possibility of mutually assured destruction. Chemistry likewise gave us new materials and fuels as well as chemical warfare and new means of substance abuse. Biology similarly brought benefits and dangers, from longer life spans to biological warfare. But biology brought with it a renewed sense of crisis for the human self-conception. Physics may have displaced the center of the universe from the Earth, but the belief in Cartesian dualism left the human soul seemingly intact. Biology, especially after Darwin, opened "the gates of the garden of life" to experimental methods (Dewey 1910: 7). Now opened, the challenge to pragmatism is the threat science, especially the neurosciences, poses to our cherished ideals. For the challenge is not only to bring the products of neuroscientific inquiry to bear on morals and politics, as so many researches are eager to do today, the challenge is to use such data in order to bring the experimental method and attitude toward morals and politics as well.

The more we learn about how the most complex product of evolution of which we know – the human nervous system – the more is at stake. To what ends we use this constantly growing trove of information is a greater concern than any specific scientific question itself. Neuropragmatism is the philosophy best suited for guiding humanity through this new intellectual and moral terrain.

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5 We hasten to add the role of computer and information sciences both in advancing our understanding of biology and neuroscience and in significantly modifying our everyday lives. Without the shared questions about the nature of mentation, we would never have had the insights raised by the Turing Test, nor the application of those insights to biological phenomena. Furthermore, the further application of computer and information sciences to everyday life have, unfortunately, brought about a rise in disease that comes with a more sedentary lifestyle made possible by greater ease of communication.

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