6—Is Nature Habit-forming?

John Pickering[1]

Abstract
The term "habit" as used in ordinary speech means a wide range of things. However, as used by C. S. Peirce, "habit" is generalized to such an extent that it seems to require a radical change in our worldview. Such a change is sketched by reviewing some developments in philosophy, physics, and the life sciences that seem to question the axioms of their disciplines in significantly similar ways. Panpsychism is once more being given serious consideration. Physicists are groping towards a phenomenological treatment of time. Biologists are turning towards a systems view, and psychologists are developing theories of cognition that do not separate mind from the body. These developments are brought together with Peirce's radical notion of habit, Whitehead's organic metaphysics, Gibson's theory of affordance, and biosemiotics, which blends Peirce's treatment of signs with the rational biology of Uexküll. The result is an organic worldview with intrinsic ethical entailments.

Keywords
panpsychism, phenomenology, rational biology, embodiment, Whitehead, process, organic metaphysics, affordances, biosemiotics, Aldo Leopold.

The Oddity of Habit Talk

What kinds of things can acquire habits? We know from direct experience that people acquire habits and it doesn't sound at all odd to say so. Nor does it sound particularly odd to talk about animals acquiring habits. In classic studies of learning carried out at the end of the nineteenth century, Edward Thorndike, a psychologist concerned with animal learning, provided a demonstration of how it happens. An animal, usually a cat, was placed in a cage locked by a simple mechanism but could see and smell food outside, such as a piece of fish in the cat's case. Initially, the cat would explore the cage without a specific aim. It might, for instance, play with a bit of wood dangling on a string, as cats do. But this bit of wood was actually part of the unlocking mechanism. So eventually the unlocking mechanism would operate by chance allowing the cat to get out of the cage and eat the fish. Over about twenty repetitions of this process, the cats needed less and less time to escape, and their actions appeared to become more goal-directed. This preservation and improvement of chance events with positive outcomes can stand as a model for how habits in the usual sense of the word are acquired.

But habit can be used in wider senses too. We say plants have habits, and although there what's meant are characteristic patterns of growth not acquired by an individual organism in one

[1] *Warwick University, U.K.* Email: j.a.pickering@warwick.ac.uk

lifetime but by a species over the course of evolution. Nonetheless, habit used in this way bears a fairly straightforward relationship to what habit means when applied to people and other animals, namely, a typical way that an organism acts.

But around that point on the continuum between living and non-living things, which is broadly a scale of complexity, it becomes increasingly odd to talk of habits. Organs can be described as behaving in ways that seem responsive to conditions. For example, when a digestive system adapts to a particular diet, or the liver adapts to prolonged alcohol use this could just about be described as the system or organ acquiring a habit. But the adaptations are to conditions created by what a person habitually eats or drinks. It's in this latter sense that "habit" feels most natural to use. It would be odd to use it to describe adaptations of the body and its organs since they're better seen as adjustments to habits at a higher behavioral level.

When it comes to matter organized at less complex levels than bodily systems or organs, the term habit doesn't seem appropriate at all. It would sound particularly odd to describe sodium and chlorine as being "in the habit" of forming ionic bonds. Scare quotes would be mandatory from here on down the living-to-non-living, or complex-to-simple, continuum. It would sound even odder to say that bodies are in the habit of attracting each other according to Newton's law of gravity. That light travels at the speed it does is a fundamental and constant property of the physical world and to describe it as having the habit of doing so would sound absurd.

And yet, as used by Charles Sanders Peirce, "habit" appears to mean something very much like this. Peirce proposed that what we call the "laws of nature" are not primordial, necessary features of the cosmos. Instead he suggested they had evolved and, hence, were contingent, had a history and so could be called habits in some extended sense. Moreover, since habits can be acquired, modified, and discarded, he held that nature is open to change. Rather than having to obey ineluctable laws, the cosmos sports, producing spontaneous variations whose causes are untraceable. He said this and related things in various places and for reasons that changed as his ideas developed. But one persistent underlying reason was his rejection of mechanistic determinism. The cosmos in his view is not enclosed within a prison of mechanism, but is open and able to produce true novelty.

In advancing this at the end of the nineteenth century, when confidence in a mechanistic world view was at a high point, he was swimming against a strong tide. Herbert Spencer and Thomas Huxley had made the theory of evolution into a materialist metaphysic. Ernst Haeckel had announced that mechanistic reduction would not only solve the riddle of the universe but also, almost in passing as it were, show how mental life belonged in it: "The great abstract law of mechanical causality … now rules the entire universe, as it does the mind of man…" (Haeckel [1900] 2013: 336).

Peirce's "Guess at the riddle" was very different: "… all things have a tendency to take habits. For atoms and their parts, molecules and groups of molecules, and in short every conceivable

real object, there is a greater probability of acting as on a former like occasion than otherwise. This tendency itself constitutes a regularity, and is continually on the increase. In looking back into the past we are looking toward periods when it was a less and less decided tendency. But its own essential nature is to grow. It is a generalizing tendency; it causes actions in the future to follow some generalization of past actions; and this tendency is itself something capable of similar generalizations; and thus, it is self-generative" (EP 1: 245, 1887).

A crucial problem facing readers of this passage, both at the end of the nineteenth century and now, might be how to understand what Peirce had in mind when he wrote about matter, even at the smallest levels, "acting". Matter is acted upon, it does not act in and of itself. But if it is accepted that matter can act, then we can also accept that it can acquire habits. As Thorndike's work above shows, habits are acquired when patterns of action are preserved because they yield good outcomes. But to believe that matter can act in and of itself is very difficult, given the metaphysics of our time which, broadly speaking, are still those of the late nineteenth century.

How then can we approach this aspect of Peirce's work at the present time? Although complete reduction has been shown to be impossible, confidence in mechanism remains high to this day. Many popular books present contemporary scientific discoveries, especially in physics and biology, as showing how the human phenomenon fits into the wider order of the cosmos. A reviewer of one such book says: "The laws of physics have not changed in 13.8 billion years. In some unimaginable cosmic future, the speed of light in a vacuum will be the same, and the mechanics of waves–water, seismic and light–will be as they were in the beginning" (Radford 2014).

The echo of biblical language in the phrase, "as they were in the beginning", serves as a reminder that the cultural dynamics of the last few centuries have resulted in science having thrust upon it the role once played by religion. This probably would not have been a problem for Peirce. His early encounter with Swedenborg appears to have remained with him and informed much of his thought, especially the blending of tychism and agapism in his later writings. For Peirce the source of form and permanence in the cosmos was not the fiat of a benign, transcendent creator. Rather, it is the immanent creativity of the cosmos itself which, agapism suggests, is also benign.

Why cosmic creativity might be benign will be considered again at the end of this chapter. First we need to consider more fully what we are to make of "cosmic creativity", if we allow ourselves to call Peirce's ideas that, in the context of contemporary metaphysics. Such an idea clearly doesn't fit within the conceptual framework around science and philosophy that has emerged over the last few centuries. Within that framework, physical laws are necessary features of the cosmos that will always be what they are now. Moreover, given those laws it is possible to explain how, under the right conditions, living systems can arise and evolve. Broadly put, the assumption is that physical laws produce evolution.

Peirce's view appears to be the opposite: evolution produces physical laws. This is a radical challenge to what we might call the Materialist Neo-Darwinian Conception of Nature, to borrow part of the sub-title of Thomas Nagel's book *Mind and Cosmos* (Nagel 2012). The full subtitle is actually: "Why the Materialist Neo-Darwinian Conception of Nature is almost certainly false." But this conception of nature has been so productive that to question it is often taken as a relapse into pre-scientific supernaturalism. Indeed, Nagel's book was criticized for giving comfort to nonsense such as Intelligent Design. In fact, the book is not anti-scientific but merely points to some shortcomings in scientific accounts of how living things, especially human beings, come to have intentions and experiences.

In doing so, the book can stand as one of a number of signs that there may be something distinctive about the way science is developing at the present time. What seems to be happening, in different disciplines and apparently independently, is that technology has so amplified our powers to observe, investigate and experiment that we now know a great deal more than we can explain. Consequently there is a kind of metaphysical groping towards a new worldview. Science proceeds something like this all the time, but there seems to be something more radical going on at present. The new metaphysics takes experience, intentionality, and all other aspects of mental life to be fundamental features of the cosmos (Chalmers 2013). This is strongly reminiscent of Alfred North Whitehead's surmise that at its most fundamental level, the cosmos is an organic process; the ultimate and irreducible parts of nature are subjects, not objects. This is panpsychism, and although not deriving from Whitehead, a number of philosophers have begun to rehabilitate panpsychism in various forms and for various reasons (Strawson 2006; Skrbina 2009). This holds out the prospect of replacing mind in the cosmos as part of a more inclusive scientific world view in which sentience, intentionality, and qualia are seen as natural kinds rather than as anomalies that require special explanations or over-stretched conceptual tools, like emergence.

Although this is a radical break with the past, examples of changes in science that reflect this tectonic shift in metaphysics are not difficult to find. In biology, the idea of the organism is returning after having been rendered almost invisible by reduction to genes in one direction and by being lost in populations in the other (Nicholson 2014). Advances in genetics have had the unintended consequence of forcing biologists to abandon entrenched ideas about genes, which are now seen as necessary but not sufficient contributors to the creation of phenotypes. They are just one component in a systems approach where epigenetic factors, especially development, learning, and niche-creation must all be taken into account (Oyama et al. 2003; Odling-Smee et al. 2013).

Elsewhere in biology there are signs of a renaissance of the rational biology of Goethe and D'Arcy Thompson. An early example was the work of Brian Goodwin (2001), who studied with Conrad Waddington, who in turn was influenced by Alfred North Whitehead. Goodwin's work, which helped with the return of rational biology, was marked by a consistent and reasoned opposition to strict, that is, reductive, Neo-Darwinism. Under that view, the structure of

organisms arose from little more than genetic roulette. Instead, he developed a radical systems view in which evolutionary forces act on phenotypes, not genotypes. Active organisms, as they develop and learn and through meaningful actions, seek to harmonize themselves with their living environment and hence help generate their own selective pressures. This is effectively Lamarckism by other means.

Although rational biology is certainly more Lamarckian than conventional Neo-Darwinism, it does not reject the biochemical understandings of genetic activity on which neo-Darwinism rests. It does, however, take organisms to be active intentional centers of agency who investigate their surroundings for opportunities to carry out those intentions. Instead of the reductive views of neo-Darwinists, and, for that matter, behaviorists and computational cognitivists, this approach has at its core the notion of meaning. As the usage of "meaning" shows, it is a concept with a Janus-like quality. It points both to and from the organism. An intentional organism *means* to act; the environment of that organism provides objects and situations that *mean* to it that particular actions can be carried out. For biology to deal in meaning requires combining two important approaches which, taken together, promote a shift towards a panpsychist metaphysics.

One is James Gibson's radical approach to perceiving and acting. Gibson was a consistent critic of the computational metaphor for cognition. He also rejected the idea that what the senses provided was impoverished and ambiguous and thus some form of inference was needed in order to perceive accurately. It was assumed that this inference took the form of internal computation, that worked out what objects and situations were available as the basis for action. Gibson's approach, known both as ecological psychology and as the theory of direct perception, offers a different view. It is based on the idea that animals had evolved sensory systems that matched their capacities to act. The central concept is that of "affordance". An affordance is a directly-perceivable opportunity for actions of which the perceiver is capable. Thus chairs afford sitting for people and cats but not for bats or horses; flowers afford feeding to bees and humming birds, but not to snakes or sloths, and so on. The idea here is that meaningful action drives the mutual evolution of active perceivers and the environments, including other organisms, towards which they act, which is very much in the spirit of rational biology.

The second important approach is biosemiotics, which combines Pierce's semiotics with Jacob von Uexküll's meaning-based biology. Peirce's triadic notion of the sign as "something that stands for something to someone in some capacity" goes beyond Saussure's dyadic notion, which is synchronic and hence static. Peirce allows the "standing for", which he calls the interpretant, to be itself a sign that can lead to further interpretants, thus making possible a diachronic chain of meaning and signification more applicable to living processes.

Uexküll's approach to living processes was likewise meaning-based. He was dissatisfied with Darwinism since, having been strongly influenced by the *Naturphilosophie* of Hegel and Schelling, he preferred to see progressive change as the unfolding of a plan rather than the accumulation of useful accidents. He saw environments as integrated systems of living things

harmoniously interacting with one another on the basis of meaning. For Uexküll life itself was based on meaning: "… life can only be understood when one has acknowledged the importance of meaning" (Uexküll [1940] 1982: 26). Biosemioticians bring these two approaches together to offer a picture of the organic world as perfused, and hence structured, by the exchange of signs (Hoffmeyer 2009; Romanini and Fernandez 2014). The resemblances here to rational biology are clear. Moreover, we can view the patterns of meaningful signs that harmonize the animals, plants and possibly the material components of ecosystem, as habits in the Peircean sense that have developed through mutual co-evolution.

Bringing together biosemiotics and Gibson's theory of direct perception, we can view affordances as signs that pass between mutually evolved organisms in the course of interacting with each other. Affordances also have an affective dimension. For example, the bared fangs and deep growls of dogs, both look and sound dangerous, while the smell of ripe peaches is delicious in itself. This recalls Spencer's view that such affective charges of perceptual experiences are psychological adaptations evolved to keep organisms away from danger and attract them to things which are beneficial.

Affordances are the behavioral and perceptual currency exchanged within ecological systems. They are meaning-based and integrate the three fundamental areas of psychology: cognition, conation, and affect. Moreover, they are not confined to any particular level of the living world. The affordances involved in the lives of long-lived social animals such as chimpanzees will be complex and liable to change when compared with those that matter to an organism like a parasitic tick, which will be simple and more stable. In particular, when organisms are able to learn, the repertoire of affordances will be open to progressive change. But complex or simple, conceptually, all affordances are the same. They are mutually evolved signs that guide the interaction between organisms and their surroundings. Affordances in Peirce's terms are habitual patterns of exchange of meaningful action. Seen in this light, the evolution of the living world is not so much the preservation of accidents as the perseveration and elaboration of habits that have proved beneficial (or at least not terminally deleterious) to active forms of life as they seek new ways to engage with their surroundings on the basis of meaning.

Conceptually tracing this process back in time raises the metaphysical issue of how life began, or, recasting this question in terms of the rational biology above, when did meaning-based interactions appear? Karl Popper commended the work of Wächtershäuser on the origins of life (Popper 1987; Wächtershäuser 1987). Wächtershäuser suggested that early self-sustaining chemical systems, so early that they predated the appearance of true organisms that replicated via genes, might have been capable of simple forms of trophic behavior based on sensitivity to light.

While Popper dismisses panpsychism, if it could be shown that there could have been light-driven action in early forms of organized matter, this would seem to be what is required for something like what Chalmers (2013) calls panprotopsychism to be true. It can stand as another example of the shift towards a less mechanistic and more life-friendly metaphysics noted above.

A further example of a move away from mechanism can be seen in cognitive science where the computer metaphor for the mind, a lingering echo of nineteenth-century reductive mechanism, has been discarded. It was productive in the 1950s, but its limits are now clear and it has been replaced by an approach that recognizes that cognition is not detachable from the bodies of active organisms nor the situations in which they act (Rowlands 2010).

These changes, and others like them, not only hint at a new metaphysical picture but also reflect the postmodern shift in scientific epistemology (Griffin 1988). The shift challenges boundaries, methodologies become less conservative, single-factor explanations are weakened, and over-arching meta-theories, such as the computer metaphor or reductive neo-Darwinism, are replaced by a pluralistic synthesis of views and approaches, some of which may come from outside what is conventionally regarded as science.

Among the sciences though, physics is in some sense bedrock. When reductionism is discussed —either as something to be aimed at or as something to be avoided—the reductive chain and hence the explanatory buck generally stops at physics. So, while a postmodern reappraisal of methods and theories may influence sciences like psychology and biology, perhaps we would expect physics to be immune.

But in physics too there are signs that limits may have been reached and that radical challenges are being proposed. Despite the success of theories of matter at very small dimensions, it remains impossible to bring quantum theory together with relativity, and a grand unified theory appears no closer than ever it was. One notable response to this has been the work of Lee Smolin and colleagues (Unger and Smolin 2015). Although their work does not have Peirce's metaphysical breadth, there are some striking resemblances. Smolin takes as his central hypothesis that: "… the laws of nature evolve …" (2015: 355); and that how we think about time determines what we think a physical law actually is: "The notion of a law of nature is much changed if one thinks that the present moment and its passage are real or are illusions hiding a timeless reality. If one holds the latter view, then laws are part of the timeless substance of nature; whereas on the former view this is impossible, as nothing can exist outside of time" (2015: 361). As time is the essence of experience, such a view is much more mind-compatible than the timelessness of both classical and modern physics.

It was Peirce's deeper conviction that the cosmos was indeed mind-like in a fundamental and creative sense that prompted his proposal that the laws of nature are contingent and have evolved. Although creativity implies the appearance of something new and habit implies the re-enacting of something old, paradoxically, in Peirce's view the core of creativity is habit. More precisely, it is the capacity to acquire and to elaborate habits, as illustrated by these excerpts from the quotation above: "… all things have a tendency to take habits … every conceivable real object … actions in the future to follow some generalization of past actions; and this tendency is itself something capable of similar generalizations; and thus, it is self-generative" (EP 1: 245, 1887).

Peirce's view of the origins of the creativity of the cosmos appears to lie in the crucial last section of this quote. Habit in and of itself in not creative. But habits in and of themselves will be subject to variation along with the physical and mental events that are their vehicles, this being an important aspect of Peirce's tychism. If the tendency to take habits both varies and generalizes, it opens the way for habitual patterns of activity to evolve and spread from one ontological level to another.

When active organisms explore the world and find affordances of value, in a sense they play with the world. Thus a pattern that was pre-figured in playful abductive variation at the mental level could be enacted at the physical level. If it proves useful (or at least not selected out), it may then be re-enacted and eventually preserved in habitual patterns of action and the objects that afford that action. Thus, to put this idea in the form of another "just-so" story, protohumans may have discovered that flint-like stones offering certain affordances could be useful in breaking or striking. When the properties of the stones to flake in a certain way provided further affordances such as scraping or cutting, protohumans may have noticed and assimilated them into their habitual patterns of action, thus changing them. Here, habitual patterns can arise at any level and generalize up or down the ontological continuum stretching from the predominantly mental to the predominantly physical at the other. The use of "predominantly" here is meant to indicate that no purely mental or physical levels of nature actually exists. The continuum is just that: the single dimension of the plenum of nature. What is being suggested here is akin to what David Bohm may have had in mind when he suggested that events and objects at all level of reality had both a mental pole, that in a sense that seems close to Peirce, that he identified with signification, and a somatic or physical pole (Bohm 1985).
But it still sounds odd to say that all things, from human beings to atoms can acquire habits. To make it sound less so, the next section will approach the notion of habit from more familiar ground. Animals, and especially human animals, clearly do acquire habits and develop them in unique ways. Perhaps reflecting on how this has come about may help to understand what habits are and how they exist at different levels of nature.

The Odd Habits of Human Beings

Peirce's sense of habit appears to be that of a tendency for events of any sort and at any level to repeat themselves or to persist in some way that carries the history of previous events with them. The repetition is not perfect, else we would be trapped in what Whitehead called the "repetitious mechanism of the universe". This opens up a path into the future where variation and selection occurs at all levels, from the physical building blocks of the cosmos to the supposed higher reaches of human consciousness, thus eliminating the boundary between biological and pre-biological evolution.

But in the human case, habit can become paradoxically detached from its physical and biological vehicles. Reflexive consciousness, of which human beings appear to have a monopoly, means that habits of any kind, mental or physical, can be noticed and modulated. We are able to

recognize habitual patterns of thought and action, evaluate and manage them. Stopping smoking, trying to use gender neutral language or not to think about something that worries us are all familiar examples. The basis of change in habits here is some sense of their worth. Other animals acquire habits and change them too, but the process is not reflexive. It has more to do with the pragmatics of survival, which in the case of social animals might involve imitating those habits observed in conspecifics that lead to good outcomes and eliminating those that don't.

Both humans and other animals develop habitual ways of interacting with the affordances of the objects and events in their surroundings. In many cases, these are relatively fixed and we talk of animals depending on instincts to survive. In other cases animals develop relative novel ways of interacting with their surroundings, usually through social learning and development. This is part of the distinction made originally by Ernst Mayr between, respectively, "closed" and "open" evolutionary strategies Mayr 1974).

The human case is special by virtue of being uniquely open. The affordances of the human environment are mostly human made. Many species alter the affordances of their niche but the human species has taken this to such a degree as to make a qualitative break with the rest of the living world. Activity theorists such as Leontiev saw that what made the human mind unique was guided development within an environment "… transformed by the activity of generations" (Leontiev 1981). This transformation and the process of guided re-invention of habits originating from previous generations, is a human monopoly. It produces a culture of material affordances and the social practices that go with them. This idea was taken up by psychologists seeking to extend Gibson's ecological approach to the social domain by socializing affordance (Costal 1995, Heft 2001). The social practices developed by humans and presumably proto-humans, allow habitual ways of acting, and by implication, of perceiving, to become objects of attention and hence improved, perhaps initially by the preservation of useful accidents.

It is this that has allowed the human mind to become the unique creative force that it is. Michael Tomasello, in exploring this process, points to the enormous differences between the cognitive resources of humans and apes despite their remarkable genetic similarity (Tomasello 2008). As there has not been enough time for these differences to evolve genetically, the explanation must be epigenetic. Here he singles out the ability to co-operate and the cultural accumulation of human-made artefacts and the practices that go with them, which are then subject to progressive change through the efforts of successive generations. This is something that is observed in other animals, but it is vestigial when compared with the technologized environment created by human beings over the last few thousand years.

How artefacts and practices are accumulated and improved is clearly important, but perhaps just as important is how they appeared in the first place. Many animals, especially social apes like chimpanzees, are tool-makers, but they are not tool-improvers to anything like the extent that human beings are. Here the notion of affordance might be useful in proposing how human beings may have come to be so adept at the making and progressive re-making of tools and other

artefacts. Affordances, in Gibson's original formulation, concern what is perceived to be doable in the world as it presents itself to the senses. They are about perceiving the world "as is", so to speak. They are evolutionary habits of perception and action. But, as Peirce proposes, habits can vary and develop. What may have occurred in human evolution is the appearance of a new and distinctive habit, that of seeing things "as if". That is, when dealing with the affordances of an object or situation, humans may have developed the ability for metaphorical or counterfactual perception and, presumably, counterfactual thought as well.

To illustrate: when picking up a rock, a chimpanzee might notice, seeing it "as is", that it afforded the opening of hard-shelled nuts through pounding. A human or protohuman might also notice that if parts of the rock were to be removed to create a sharp edge, it would afford cutting and scraping. This requires the ability to perceive the rock counterfactually, that is, "as if" it were other than it actually is. Perception though is not enough, and to produce the edge would require removing bits of the rock. This could happen accidentally in the course of using the rock as a pounder. To an animal only able to see things "as is", the accident might pass unremarked. But an animal, or protohuman, able to see or imagine things as other than they are might also be able to notice the new affordances of this accidental outcome and perhaps intentionally reproduce it. Once intentional reproduction is possible, social learning (either by imitation or guided participation) will preserve this habit and most likely modify it so as to make it more effective. This process of externalization and improvement, something that Tomasello calls the "Ratchet Effect", when allied with reflexive consciousness and the ability to perceive counterfactually may well be something like the evolutionary process that led to human beings being able to acquire and improve habits in a manner not found anywhere else in the living world.

Such "just-so" stories about human evolution are easy to invent and virtually impossible to test, but the scenario above doesn't seem too improbable. More specifically, it points to the significance of being able to break habits or to explore, perhaps metaphorically or playfully, variations on habitual patterns of action. Children are very much inclined to exploratory play in order to find out what objects can be made to afford. Imaginary or mimetic play is a particularly rich case. Mimesis is rare in the animal world and when it is observed it seems to be a relatively fixed pattern of behavior, such as when birds mimic frequent sounds in their surroundings of no significance for their own survival, like the ringing of telephones. True mimesis, that is, the conscious reproduction of sounds or actions intended to communicate to a conspecific that something is being referred to, is only observed in humans. Indeed, Merlin Donald proposes that the capacity for true mimesis in this sense was a crucial developmental stage in the evolution of the human mind (Donald 1991). Prior to that stage, perhaps the noticing of new affordances sketched above could be seen as pre-figuring the capacity for mimesis. If, for example, the sharp edges produced by flaking a flints are seen to have the same affordances as human fingernails or teeth, then something akin mimesis has occurred. It is an early form of imaginary play expressed in perception and action but depending on mental processes somewhat like abduction. In this case, to make it more concrete, scraping needs to be done. Teeth and nails will do to some extent, but more effective means are sought. Now, the affordances of stone flakes become salient and,

after an imaginary leap, are explored. Having been found to be effective, they are more likely to be remembered, used, reproduced, and improved. Thus new habitual patterns of perception and action appear and, in social species, will be imitated and as they spread will be developed by further exploration, again driven by more imaginative play.

While we can't know about the imaginary lives of animals, if there is any, we do know that they are able to find the affordances of things by exploratory and playful-seeming actions. In captivity chimpanzees can learn to operate quite complex devices and to pass the skills on socially. In the wild, orangutans are known to use a variety of tools but, since they are mostly solitary, will be less likely to develop tool using skills by imitation.

To devise or discover how to use tools is to learn or create affordances. Species with stable patterns of ecological habitation, might not appear to be discovering anything about the environment to which they are adapted, but in fact they are adapted because of affordances discovered by previous generations. These discoveries will have been preserved and passed down either by virtue of natural selection or, in more complex cases, by genetic assimilation. Organisms sharing the environment in question will also be adapted, not only to the fundamental physical features of it, such as climate, but also to each other. Animals that habitually graze will co-exist with grass species whose habits of growth are adapted to being grazed. Thus the interacting habits of species create a system of mutual affordances which, if useful, will over time become integrated, or to use a term much favored by Uexküll, harmonized.

This recalls some of Peirce's discussions of habit, especially mental habits, and the pragmatist approaches to value and truth. Habits of thought either survive and develop or disappear by virtue of how well or ill they fit, or harmonize, with other habits and with experience. Habits of action will *a fortiori* be the same. The habits of species and systems of species must likewise be compatible and over evolutionary timescales will have become so. However, as conditions are never static there must also be the possibility of generating or discovering new habits and new affordances. When conditions change so as to make old habits ineffective or harmful, new ones must be found. Here, Peirce's view is that this constitutes a variety of contradiction or problem that stimulates an abductive effort after a resolution. Again, this could be said both of patterns of thought and, perhaps in a more concrete sense, of patterns of action. For example, if we are trying to thread a needle and the thread is not rigid enough to get it through the eye, we will most likely cast around for some means to make it more rigid and so change what we can do with it, that is, to alter its affordances in the service of a particular end. Even though there is a single target affordance, rigidity, the various means could be quite different, such as doubling it, twirling it, moistening it, and so on.

There are echoes of Heidegger here. When a tool is being used it is, in Heideggerian terms, ready-to-hand. Its affordances are expressed in carrying out actions for which it's designed, and neither the tool nor its affordances are actually present in consciousness. What will be conscious is the task itself or perhaps the object of the task. If, however the tool is being examined, perhaps

with a view to repairing it, improving it, or using it in a novel way, then it becomes present-to-hand. Now it is an object of conscious scrutiny and new affordances may be discovered or created by modification.

Apart from the human case, conscious and purposeful modification of affordances is likely to be rare. Playful modification with the preservation of affordance discovered incidentally might be more common though. On a much broader scale, the co-evolution of species and their environments can be seen as a kind of reciprocal exploration of a mutual affordance space. While it might sound fanciful to call it playful, the actions of animals who employ, in Mayr's terms, an open evolutionary strategy, are often exploratory and investigate their surroundings in ways that are focused on specific outcomes such as becoming familiar with new locations or discovering whether something can be eaten or not. Simpler species with closed strategies will presumably be less capable of exploratory behavior. However, here we might note that Popper's enthusiasm for Wächteshäuser's theory of the origins of life was principally because it attributed something like exploratory behavior even to very early, simple one-celled organisms.

The testing and breaking of habitual ways of perceiving and acting is the means by which forms of life can extend their ecological niche. How quickly this happens will depend where the form of life lies on Mayr's open-to-closed continuum. In closed forms it will be slow. A stable pattern of interaction with stable surroundings is not going to be improved by experimenting with new habits. An example here might be sharks, some species of which the fossil record shows to have been anatomically, and hence behaviorally, stable over very long periods. In open forms, which will typically have extended social interactions and relatively long developmental periods in the life span, exploratory behavior and the testing of new habits is likely to pay off. The classic work on the spread of food-washing in groups of monkeys can stand as an example here (Itani 1958).

Harmonious Habits and Benign Panpsychism

The examples above are a very small and highly speculative survey of how habitual patterns seen in the living world might develop and change. But, as suggested at the start of this chapter, the point in making it is to help to understand Peirce's vastly more ambitious surmise that "… all things have a tendency to take habits. For atoms and their parts, molecules and groups of molecules, and in short every conceivable real object, there is a greater probability of acting as on a former like occasion than otherwise." There is a large gap in both scale and credibility between treating habits at the scale of animals and plants and the idea that every constituent of the cosmos has a tendency to "take habits". The scare quotes here seem justified since the proposal presents such a challenge to the implicit metaphysics of the present time. The challenge becomes more radical still if, reflecting Peirce's agapism, we add the idea that habits may have value.

But rather than abandon or dilute the challenge, we might instead strengthen it by bringing it together with another radical challenge, that made by Alfred North Whitehead. Whitehead's organic metaphysics also sought to bring together matters of fact and matters of value in a fundamental way. How familiar Whitehead was with Peirce's work isn't clear. He played some

role in editing Peirce's papers at Harvard, but he makes little or no reference to Peirce in his writings. However, both Whitehead and Peirce rejected a mechanistic worldview, which Whitehead refers to as the materialistic worldview in some places. Both offer a variety of panpsychism and both take the structure of the cosmos to be the product of evolution. They see little value in making a distinction between areas of science that deal with what is conventionally seen as the physical, or non-living, world and those that deal with living processes.

Whitehead expresses this clearly in a number of places. In his *Science and the Modern World*, he says "Science is taking on a new aspect which is neither purely physical nor purely biological. It is becoming the study of organisms. Biology is the study of the larger organisms; whereas physics is the study of the smaller organisms" (Whitehead 1926: 125). Like Peirce, Whitehead rejected a purely mechanistic, or materialistic, view of nature as patently inadequate to account for living processes including subjective mental life. True novelty and the progressive change seen in the evolutionary emergence of the living orders could not, in his view, be properly accounted for by a mechanistic metaphysics based upon insensate matter and timeless, unchanging laws. Aim, purpose, and intentionality, all qualitative aspects of mental life, cannot be understood if the only way they could have come to exist, according to the mechanistic view, is to somehow appear, *ex nihilo,* from a cosmos that is in reality totally dead.

Instead what Whitehead proposes is a living cosmos. There are no dead parts or inactive levels of nature. No part of nature lacks an organic connection to every other part: "… we should reject the notion of idle wheels in the process of nature" (Whitehead 1938: 214). Organic connection, both within an organism and between the organism and what it encounters in its surroundings, is of the essence of all organisms, which, as the quote above shows, are the ultimately real constituents of the cosmos in Whitehead's view. The structure of the cosmos, what enduring objects we take to be there, is in this view a matter of evolution. Moreover, even what we commonly assume to be the very nature of objects, is also in need of radical revision. In place of the massy indestructible but dead particles of Newton's universe, or the more lively particles in the standard model of contemporary physics, Whitehead offers processes and structured activity that has aim. Whitehead is quite explicit in his radical application of this organic view: "… the emergence of organisms depends on a selective activity which is akin to purpose. … the enduring organisms are the outcome of evolution; … beyond these organisms there is nothing else that endures. On the materialistic theory, there is material—such as matter or electricity—which endures. On the organic theory, the only endurances are structures of activity, and the structures are evolved" (Whitehead 1926: 130). Here, enduring evolved structures of activity seems to be very like Peirce's extended notion of habit.

Now the patterns of complementary affordances that underlie the harmony of an ecosystem are exactly that: structures of activity. They endure, but are not constant. In a continual process of historically constrained change, patterns of mutually evolved affordance will arise and persist so long as they have a sufficient degree of compatibility with other patterns around them to do so. When they do not, they will fade and be replaced by others that do. Here there is more than just

resemblance between this view of the evolution of biological order and Peirce's view of how thought develops. In fact, if we are to take Peirce's surmise that "… all things have a tendency to take habits" as universally as he seems to have intended, it is identity. But if, to follow both Peirce and Whitehead, no distinction is to be made between living and, supposedly, non-living processes, then what mental things can do and what physical things can do is identical in some very deep sense. Because "things" can be both physical and mental, or any mixture of both in any proportion, the enduring patterns in which they participate and by which they endure are the same. Within such a panpsychist framework, it is possible to see how nature could form habits at any level. To accept this is this is to cross the credibility gap referred to above.

But to accept a panpsychist worldview like this requires crossing wider credibility gap since it runs so strongly counter to ideas about the physical world that have been regnant for the past four centuries or so. Even for the open-minded, the proposition that all levels of nature have something mind-like about them is virtually impossible to take seriously at first encounter. In discussions with skeptics, who are the norm, anyone defending panpsychism is likely to be told that "giving atoms minds" or something like that is absurd and un-parsimonious. This is understandable. The only minds human being know are their own (albeit partially) and so the idea that every part of nature is mind-like in some way, panpsychism is easily taken to mean just that—that things as simple as atoms are able to make decisions, have thoughts, feelings and so on.

This difficulty is not only encountered when trying to get on terms with Peirce but also with Whitehead. Both use common terms in radically broadened ways, "habit" in Peirce's case and "experience" in Whitehead's. The everyday meanings of words are hard to leave behind, so on hearing "habit" we tend to think of the human habits we know by direct acquaintance. But Peirce applies the term habit to any and all levels of reality. Likewise when hearing "experience" we think first of the percepts and thoughts of which we're conscious. But, again, Whitehead's radical proposal is that not all experience is conscious and that in this wider sense it is to be found at all levels of reality. Objections to panpsychism derive, at least in part, to the difficulty of relinquishing habitual meanings of terms.

But when more fully thought through and rigorously presented, panpsychism, in its contemporary manifestations avoids these problems. The re-appearance of more informed versions of panpsychism is another manifestation of the contemporary shift in metaphysics. That panpsychism fell from fashion reflected the constriction on the scientific imagination that followed the swing towards positivism in the early twentieth century. But that is not typical of Western thought considered in the longer term (see Skrbina 2005, Sprigge 1984), nor is it typical of worldviews found outside the Western cultures, Daoism and Hinduism being clear examples. Contemporary panpsychists are not attributing minds like those of animals or human beings to elementary particles and the like. What they are doing is proposing that every level of nature, has both physical and mental characteristics. This idea was developed in some detail by Bohm, who, like Peirce, sees signification as a crucial aspect of how activity at different levels of nature is

actually the same activity mediated by the flow of meaning (Bohm 1985: chapter 3). Whitehead does not discuss signification per se so much as symbolism, which is an elaborated type of signification found only in human beings. Even so, as a preparation to discussing symbolism proper he notes that its origins lie in primitive elements of experience that are probably shared with what he calls "low-grade organisms" (1927: section 3). This recalls Poppers enthusiasm for Wächtershäuser's suggestion that proto-organisms may have had some form of perceptual system.

Panpsychism is not a scientific proposition, but a metaphysical one. Presently, metaphysics is rarely found in mainstream philosophy but it is all too easy to find appeals to panpsychism in quasi-mystical efforts to repair modernism's disenchantment of the cosmos. But these, by simply attributing too higher a grade of mental life to the material world, are little more than the description of a problem masquerading as a solution and actually explain nothing.

The grounds for taking some form of panpsychism seriously are in fact quite simple. Rather than being unparsimonious, it is in fact the reverse, since it is a solution to an enduring and important problem—the mind-body problem. The material world clearly exists, albeit that we may have to accept some form of Kantian limit to what we can know about it. Experience, in the form of qualia, also exists, even more clearly since the fact of conscious experience is what human beings are most certain about. As Nagel points out, qualia are what make the mind-body problem intractable. If our worldview, what Nagel terms the Materialist Neo-Darwinian Conception of Nature, offers only insensate ultimate elements, then metal experiences become inexplicable. Without adopting a panpsychist position of some sort, the emergence of mental life is rendered mysterious. It requires the assumption that things which are essentially dead, and which can only be known quantitatively, can give rise to living qualitative experience. If anything is unparsimonious, it is this.

Moreover, a panpsychist worldview is fundamentally relational. That is, the interactions between different levels and parts of the cosmos are based on meaning and on the inner natures of the interacting parts. This idea is clearly expressed by Peirce, Whitehead, Bohm, Uexküll, and other advocates of panpsychism old and new. Whitehead, like William James, criticizes the destructive analysis advanced by Hume and his followers that would deny the relations between things any ontological significance. To Whitehead, and to rational biologists like von Uexküll, the interrelatedness of the organic world, was patent. It could not be properly understood as the mere accumulation of accidents or the chance encounters of atoms in the void. Rather it was the result of mutually evolved patterns of actions which survived, that is, became habits, because they were beneficial. Here beneficial could be defined as promoting Uexküll's harmonized patterns of reciprocal signification. This perhaps helps to fit Peirce's notion of habit more fully into the move towards panpsychism which, it is being suggested here, seems to be in progress at the present time.

If there is such a move, why is it happening now? The character sketch of science offered at the start of the chapter is one of rapidly developing techniques for investigating the world allied with a sense of having reached various conceptual limits. Knowledge of the physical world has reached a methodological peak, perhaps symbolized by the large hadron collider and its massive instruments buried in underground chambers the size of cathedrals, again reflecting the religious status that science has had thrust upon it. This status often leads to popular treatments giving scientific findings far more significance than the scientists who make them would. Issues in quantum physics, especially those concerning observation and non-locality are too quickly taken to have demonstrated that consciousness directly influences physical events or to support paranormal phenomena. In fact, it doesn't appear that scientific findings, for all that they are penetrating ever more deeply into the nature of the physical world, are bringing us any nearer to an understanding of the mental world.

A panpsychist view of the cosmos, which takes it to be creative, benign, and in some sense sacred, appears so commonly in all the worlds cultures that it may be considered a human universal (McLuhan 1994, Gottlieb 2003). Something like this view is now to be found, not only in popular accounts (e.g., de Quincey 2002), but also in the work of scientists themselves who are exploring science's ethical and even spiritual dimensions in order, as Stuart Kauffman puts it, to "re-invent the sacred" (Thompson 2010, Kauffman 2010).

Within the panpsychist worldview that seems to be re-appearing, Peirce's surmise that nature forms habits becomes more acceptable or at least sounds less odd. Naturally enough, since Peirce advanced the notion of habit in the way he did as part of his particular version of panpsychism. Also part, and possibly a fundamental part, of that version was that evolution was not shaped by physical and biological forces alone, but was also an expression of selfless love (Peirce 1893). This proposal sounds as odd, or perhaps more odd, to contemporary ears as does his radical extension of the notion of habit. The idea that he called agapism, he is happy to acknowledge, derives from his appreciation of Swedenborg for which he thanks William James.

Agapism is a more developed expression of the pragmatist notion of truth. Truth is what works, what survives through being compatible with what surrounds it. This, allowing there is continuity between all levels of being, which is Peirce's notion of synechism, there is causal continuity between the real of mental life, that is between ideas and logical interactions and the more embodied realms of organic and physical being. His view is that "… matter is not completely dead, but is merely mind hidebound with habits. It still retains the element of diversification; and in that diversification there is life" (EP 1: 312, 1892). Diversification and intrinsic variation, tychism, brings the opportunity to develop new habits. Thus an idea, an organism, or a particular configuration of matter will persist so long as it fits with what surrounds it. With agapism, Peirce adds a spiritual dimension to the notion of "fit". Habits of mind or matter will survive if they mesh with what is around them, but survive here is not a Darwinian competition for existence, but more like the search for harmony found in Uexküll and in Goodwin. Harmony in and of itself is positive. It opens up the way to novel and more

developed patterns of harmonious existence. Here we find a view of evolution, perhaps akin to that of Teilhard de Chardin's or to Bergson's, which takes evolution to be purposive and to progressively increase what is of value. This re-insertion of value into nature is not so much to "re-invent" the sacred as to place it at the heart of the cosmos.

This blending of scientific and religious or spiritual matters cannot, of course, fit with Hume's division of the factual from the normative. Yet it may not seem as inappropriate as it might have done in the past. Given the dark geopolitics of our time, a metaphysical shift of the sort that has been sketched here, along with its ethical implications, is sorely needed. It is vital that we move on from the mechanistic metaphysics of the nineteenth century that has helped human beings to damage the biosphere. Some form of panpsychism that combines Peirce and Whitehead would be intrinsically evolutionary and would be the basis of a reasoned environmental ethic. While it would be scientific, it would also permit what we might call the re-sacralizing of the cosmos. To do so would be to recover the intuitive surmise that the cosmos is perfused with value and that value has to do with inter-relatedness, what Uexküll called harmony.

Environmentalists such as Arne Naess and Aldo Leopold likewise recognized what is needed to avoid damaging the living systems on which human life depends. It is to have a value ethic of harmony at the heart of our implicit metaphysics. Leopold was particularly clear on this: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise" (Leopold 1949: 262). This is no new insight, it can be found in the religions of the world. For example, the Sanskrit phrase *Vasudhaiva kutumbakam* is found in the earliest Vedic hymns. It is translated as, "The earth is one family", with the implications of co-operation, cherishing, and harmlessness. In contemporary Judaism too, we find Abraham Joshua Heschel saying something very like this: "The good does not begin in the consciousness of man. It is being realized in the natural cooperation of all beings, in what they are for each other. Neither stars nor stones, neither atoms nor waves, but their belonging together, their interaction, the relation of all things to one another, this constitutes the universe. No cell could exist alone, all bodies are interdependent, affect, and serve one another" (Heschel and Rothschild 1997: 106).

Panpsychism is a stimulus to thought rather than a completed testable system. It leaves a lot to do. For example, critics often note what is called the "combination problem". This problem is that while it is all very well to propose that every element of the cosmos is mind-like in some way, as both Peirce and Whitehead do, how are these myriad minds to get together to form the larger minds, like that of human beings? The insights of the likes of Heschel and Leopold suggest that there is an evolved harmony of all levels of existence. Accepting this hints at a solution to the combination problem.

But a metaphysics of evolved harmony is not merely the means to solve philosophical problems. It offers a chance of relinquishing an engrained habitual way of conceiving, and perceiving, the cosmos in order to develop a new one. Strongly engrained habits are hard to break and new ones

feel odd at first, especially if you are able to consciously reflect on them, as human beings are. If you are not able, as Thorndike's cats were not, then new habits may just have felt slightly ineffective until practiced. If there is no capacity to reflect at all, as will have been the case with Wächtershäuser's proto-organisms, if they existed at all, any feeling involved in acquiring new habits would have been vestigial. But not absent, given Whitehead's maxim that not all feeling is conscious or following Bohm's view that all events have both a mental and a physical pole. Taking Peirce's metaphysics in something like this spirit makes habit talk when applied outside its usual realm sound less odd.

What has been proposed here, and elsewhere (Pickering 2016) is that such a metaphysics will help renew our experience of the world as coherent and that that coherence is in some sense benign. Such a change will help repair the ecological damage presently being done to the living systems of the world. Choosing to see the cosmos under this aspect will require practicing a new habit of mind. Although it would feel odd at first, with time it could become natural. And if it were done, it could just be a difference that will make a difference.

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