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RESEARCH

Umwelt Theory, Biosemiotics and Damage Limitation

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Abstract
Phenomenology, particularly as developed by Merleau-Ponty, primarily concerns how human beings perceive and act towards the world they encounter, their life-world. Umwelt theory, by contrast, primarily concerns the animal lifeworld, which is also the concern of Biosemiotics. Exploring the overlap between the two disciplines requires a fuller understanding of how human perception has evolved to become so very different from that of animals. This article will try to provide that and show how that may help to address the ecological crisis surrounding us. Human beings now develop and live in in a world where most of what they encounter are cultural artefacts. In fact, as Simondon suggests, human beings and technological objects are co-evolving. This has brought about radical changes in the way we relate to the natural world. But these are not necessarily changes for the better. Indeed, McGilchrist claims that the last thousand years or so of cultural evolution has profoundly impaired how human beings attend to the world. This paper will suggest that this impairment has contributed to the ecological crisis we now face, and that to help meet it both Biosemiotics and Umwelt theory should take more account of the revival of interest in panpsychism as seen in the work of Goff and others.

Introduction: the Oddity of Us

Animals experienced the natural world before there were people. Non-human consciousness predates ours by billions of years, yet academic phenomenology concerns the human Lebenswelt almost exclusively. For example, the Stanford encyclopaedia of philosophy identifies phenomenology almost exclusively with the human form of conscious experience and merely notes in passing the existence of other forms. It is as if the insights of von Uexküll and other naturalists, not to mention the organic

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metaphysics of Whitehead and Peirce, are little more than footnotes to the principal body of work on human experience. But, as Whitehead and many others have noted, not all experience is conscious. Moreover, non-human experience is primary, both phylogenetically and, in some sense, ontogenetically, since time is needed for infants to become fully human.

Being fully human is odd. Our place in the natural order is a puzzle. Do we belong or don't we? There certainly seems to be a natural order out there, ranging from the imponderably vast cosmos, through the familiar dimensions of our homely planet, down to the sub-atomic level, where, once again, things get imponderably small. We know a great deal about how all that seems when regarded objectively. But we also know, in a very convincing way, how a particular part of it, the mind, seems subjectively. The problem is putting the two sorts of knowing together.

That being so, it would be wise to understand how that happens as best we can. What makes us so special and separates us from a world that would function perfectly well without us, and on present evidence, would actually function a whole lot better? Most answers usually appeal to evolution and to what has allowed human cultures to become so remarkably more complex and productive than those in the animal world (e.g. Donald, 2005; Tomasello, 2000; Heyes, 2019a, b). Among the principal evolutionary developments are the ability to use symbols and an enhanced capacity for understanding the actions of others. Below we will suggest a further development occurred when human beings acquired the capacity for metaphorical thinking and perception.

The phenomenology of the natural world will have changed over time, and our present encounter with it is likely to be very different from that of early hominids. Hoffmeyer suggested that evolution would produce "… more sophisticated forms of semiotic freedom in the sense of an increased capacity of organisms to interpret complex signs" (Hoffmeyer, 2010, p. 378). Gibson too, based his theory of affordance "… the reciprocity that has evolved between living systems and their environments… related to perceiving and the execution of purposes." (Gibson, 1979, p. 170). Hence the phenomenology of the encounter between perceivers and their Umwelts includes seeking or noticing opportunities for action, meaning that affordances should be treated as signs, thus bringing together, Merleau-Ponty, Biosemiotics and Umwelt theory and opening the way to a deeper ontological understanding of semiosis (Pickering, 2007, 2017). As Foti notes, Merleau-Ponty's later work was moving in this direction (Fóti, 2013, chs. 4, 5 and 8).

However, what opportunities are noticed depends on what is perceived and on who perceives them. For the vast majority of non-human perceivers the objects and situations they encounter are perceived literally, that is, 'as is'. Crucially however, since human consciousness is uniquely reflexive, they have evolved the capacity to perceive metaphorically or counter-factually, that is, they can perceive objects and situations 'as if' they were other than they are. This has profoundly altered the phenomenology of the natural world. Heidegger and White in particular note how it has been 'disenchanted', in Weber's sense, and made to appear as a mere standing resource for human purposes (Heidegger, 1977; White, 1967).

The exceptional semiotic capacities of human beings means that they are able to co-operate to a far greater degree than other animals. The sorts of co-operation seen

in termite mounds or in the murmurations of starlings, while remarkably effective, is nonetheless tied very closely to particular behaviours. Human beings, by virtue of their vastly greater semiotic resources can co-operate through cultural systems like laws, can innovate and can externalise and so preserve innovations. This has produced a huge and continually expanding web of interdependent technological resources. Technologies like stone tools and fire lie some millions of years back in human history, but in very recent times the web of technological products has grown at a prodigious and accelerating rate. Although these products, and the practices that go with them are extremely recent when considered on evolutionary timescale, they now dominate the cultural web surrounding the human phenomenon. It is within this web we now emerge, individuate and exercise an entirely new form of phenomenology. To understand how this new form emerges the following three sections treat human evolution, development and the capacity for metaphorical cognition. The final sections of the paper will consider why this new form has obscured the natural world and how that relates to the ecological crisis we now face.

Being Cultural Shapes Human Being

Human beings are exceptional because of the fundamental role that cultural epigenetic influences have played in the last few thousand years of their evolutionary history. Culture is not a human monopoly by any means, but in the human case it is uniquely influential. Its cumulative effects have allowed human beings to modify their surroundings and externalise technological systems to such an extent that they create the niche in which they evolve to a far greater extent than any other species. While many organisms modify their environments and hence shape their own evolutionary path to some degree, in the human case this modification has become so radical as to create a new phase of human evolution. As a response the conceptual toolkit of evolutionary theory has expanded so much that Laland and colleagues suggest "An alternative vision of evolution is beginning to crystallize, in which the processes by which organisms grow and develop are recognized as causes of evolution.", that is genes are not the only vehicle by which information is passed between generations (Laland et al., 2014).

Particularly relevant here are concepts like niche-construction, cognitive gadgets and what has become known as 'Evo-Devo'. Evo-devo is a systems approach to the necessary inter-relation of evolution and development; it is central to what Müller and others call the Extended Evolutionary Synthesis (Müller. 2007; Oyama et al., 2001). This is especially relevant to human beings since, far more than any other species, they are born ready to be shaped by what the environment offers (e.g. Wheeler, 2016). We are, as the social philosopher John MacMurray put it "… adapted to being unadapted." (MacMurray, 1961). It has long been recognised that the information passing between generations is not only genetic but epigenetic and cultural, and that cultural information may, productively, be itself changed in the process of transmission. However, what is happening now is that the developments in evolutionary theory are showing just how radical a role technologised culture plays in creating the human condition and that that role begins in infancy and perhaps even before.

Cognitive gadgets were proposed by Celia Heyes as the basis for what she calls cultural evolutionary psychology (Heyes, 2019, a). Of that she says: "In common with evolutionary developmental biology (evo-devo) and the extended evolutionary synthesis, cultural evolutionary psychology underlines the importance of developmental processes and environmental factors in the emergence of human cognition." (op cit. p1). Cognitive gadgets are the most distinctive feature of cultural evolutionary psychology, and these according to Heyes "… are what make human minds and lives so very odd." (Heyes, 2019,b, p. 1). Cognitive gadgets are skills like language, imitation and the ability to recognise the intentions of others. This latter as Tomasello has shown, is far more highly developed in human beings even though apes are capable of it to some degree (Tomasello, 2019). These cognitive skills have hitherto been regarded as largely innate, but Heyes proposes that they are learned and passed down between the generations by way of culture. The notion of cognitive gadgetry has attracted constructive critical responses. For example Baggs et al. feel that Heyes tends "… to overlook the ways that we reshape the world itself in ways that facilitate, constrain, and structure the cognitive work that we do. This idea is key to modern biological thinking. At the root of the extended evolutionary synthesis (Laland et al., 2014) is the notion of organism-environment mutuality and, in particular, the concept of niche construction: the idea that animals reshape their environments through their actions, and this in turn structures the selection pressures exerted on current and future generations…" (Baggs et al., 2019, p. 16–17).

Niche-construction is somewhat like the Baldwin effect, namely, that the behaviour of organisms, and in particular any behaviour that alters the environment around them, modulates the processes of natural selection. This in turn means that in some sense organisms are active in their own evolution. As researchers in the field have put it, since niche-creation modifies selection pressures we should "… regard the dynamic complementary match between organisms and environments as a product of reciprocal interacting processes of natural selection and niche construction." (Day et al., 2003, p. 93). Niche-construction is widespread in the natural order, but is so highly developed in the human case that it constitutes a qualitative jump (e.g. Laland, 2017). More specifically, the niche that human beings have constructed is rich with objects and practices that extend human intentionality into the material world, as Gilbert Simondon recognised (2012; 2016). In *Understanding Media*, which is subtitled The Extensions of Man, McLuhan writes: "During the mechanical ages we had extended our bodies in space. Today… we have extended our central nervous system itself…" (McLuhan, 1964, p. 19). Like McLuhan, Simondon considers a crucial aspect of what he calls 'Technicity' to be the translation of human agency into technological objects. But going further than McLuhan, he also claims that thereby technological objects have acquired a degree of autonomy, meaning that their agency is partly their own. Here, Simondon is not dealing with the sort of quasi-agency exhibited by artificial intelligence, but with the physically embodied agency of the objects themselves.

Niche-construction and the "… dynamic complementary match between organisms and environments…" noted by Day et al., which here will be termed mutuality, provide some of what Heyes appears to have overlooked. Cognitive gadgets have evolved within the niche which human beings have constructed. That niche is funda-

mentally cultural and central to culture is technology, or more significantly technicity, in Simondon's sense. Human beings have intentionality, but, as Simondon points out, technological objects are 'materialised human intentionality'. These are gadgets in the more conventional sense; they are physical devices made by human beings to afford particular sorts of human action. But learning and internalising those affordances, especially in early life, is a major part of what makes us the human beings that we are. The technological objects around us shape us, but we in turn shape them. That is a new and very recent form of mutuality; human beings individuate reciprocally with technological objects, but so do technological objects, with the help of human beings; we co-evolve with them. All evolution will have been co-evolution, but now we are in a new of reciprocity.

Beyond Affordance

Gibson's theory of affordance is based on "… the reciprocity that has evolved between living systems and their environments… related to perceiving and the execution of purposes." (Gibson, 1979). This is an earlier recognition of the "… dynamic complementary match between organisms and environments…" noted by Day et al. Hence for the vast majority of evolutionary history, the encounter between perceivers and their surroundings will have, crucially, included seeking or noticing opportunities for action; this means that affordances need to be treated as signs (Pickering, 2007). Indeed, treating evolution within a biosemiotic framework led Hoffmeyer to suggest a direction for evolution, namely that it would be towards "… the evolution of more sophisticated forms of semiotic freedom in the sense of an increased capacity for responding to a variety of signs" (Hoffmeyer, 2010, p. 9). That increase in capacity has accelerated enormously in the human case due to the technologised culture surrounding them, especially in infancy.

When considering how humans use technological objects, Heidegger points out that they fade from notice so long as they function adequately, as his distinction between the *zuhanden* and *vorhanden* experience of objects makes clear (Heidegger, 1977). Experiencing an object as *zuhanden* experience, means that the object is, literally, 'to hand' that is, it is in the process of being used for some task. It is, hence, not an object of attention. That is mostly assigned to the task, as when, to use an example of Heidegger's, a hammer is used to drive in a nail. There, attention is mainly on the nail and whether it is being driven into the work piece as intended. By contrast, experiencing an object as *vorhanden* means that it is literally, 'present to' or 'before' the hand. This means that the object itself is the focus of attention, as a hammer might be when, the head having come loose, the user was trying to find out what was wrong.

Now infants will experience objects as *vorhanden* without reading Heidegger. Most things they find to play with will be new and they will seek to discover what they afford by way of exploratory action. Starting with primary circular reactions and playful investigation, infants will gradually accumulate a repertoire of schemas relating to familiar objects. These will progressively be experienced as *zuhanden* once assimilated into more developed action schemas and so fade from focused awareness. But the objects encountered by infants can bring with them cultural meaning in the

shape of the acquired intentionality to which Simondon has drawn attention. The prodigious plasticity of the infant nervous system means that as objects are encountered, patterns of neural connectivity will form that reflect the functional properties of those objects. Many of these will have been strongly shaped by culture, that is, by previous generations of human beings.

To return to Heidegger's example, compare an infant who has learned to play with, say, a rattle with one who has learned to play with toy hammer. Both rattles and hammers can be used to strike things, and indeed, the infant may well enjoy discovering that using the rattle to hit things rather than just waving it about produces a distinctive sort of noise. However, once the grasping and hefting of both objects have been acquired, the distribution of weight in the hammer invites its use in a particular way that the rattle does not. A hammer is made with that use in mind as it were, it is a tool, a technological object with human purpose translated into it. Here, a culturally shaped object has, through its very design, acted as a guide through what, in Vygotskyan terms, is a zone of proximal development, that is, a place "… of potential development as determined through problem-solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Here, the hammer, in effect, provides the guidance courtesy of those who made it for a purpose.

The process by which infants acquire skills is now, more than ever, bound up with technological objects whose affordances are a qualitative advance on what was available before the advent of modern technology. Technological objects have become, in a sense, more social than they were by virtue of the way in which human purposes have been translated into them. They also appear earlier in infancy, when cultural transmission is at a fundamental sensorimotor level, this is an example of the acceleration of semiotic freedom referred to above.

As their motor development proceeds infants and encounter toys with more developed affordances. At later stages, some of these, like those of balancing beams, puzzles with pieces that fit together or Russian-doll nested figures, for example, still reflect fairly directly the way they have been made. Others though, aimed at older children, will have affordances that depend on some sort of mechanism, such as the toy nut and bolts with which infants play and so discover helical movement. Wheeled toys are an obvious example, along with toys that have some way of storing energy. Wheeled toys that are either push-and-go or pull-back-and-release are particularly rich in affordances. They would probably have to be first demonstrated by an adult, who as it were, ushers the child into the zone of proximal development, but after that the toy itself would take over the teaching role. Playing with such toys is not only interesting and pleasurable in itself but is also a form of cultural transmission by stealth. The child learns about inertia, momentum and energy storage at a preconceptual level, and actually feels these things as they play. Of course, these things can be felt anyway, when interacting with more everyday objects that can be pushed, pulled and lifted. The point here is that toys into which human intentionality has been translated further enrich the physical experience and present it far earlier than in eras prior to modern technologies.

Objects like those described above are ideal teachers. They are patient, consistent and always there. Moreover, they appear very early in human development, when human minds are most apt to learn. One major factor in the way infants now develop

is that technology has made cultural learning possible far closer to start of life. Infants clearly enjoy playing and discovering what toys and objects will do. Early learning through play in this way will leave sensorimotor memories bringing together visual, spatial and motor experiences. These pre-verbal sensorimotor traces of discovery play will also have the positive affective tone that comes with encountering things with interesting novel affordances and perhaps the sense of achievement that comes with learning how to employ them. Such early affective experiences with technological objects may well influence creative thought and action later in life.

All technological objects are social, but some are more social than others and the point advanced here is that, Simondon's work helps us to understand how the materialised intentionality of technological objects encountered in infancy mediates a form of cultural transmission that leaves a uniquely deep trace.

Accepting Simondon's claim that technological objects have autonomous agency means that human beings don't just employ them, but co-evolve with them; a Lamarkian form of co-evolution that Simondon refers to as 'Technicity'. He refers to this as 'individuation' in very much the same sense as it is used by Jung, by whom he was deeply influenced. But instead of Jung's psychic unfolding, Simondon claims the acquired intentionality makes it possible for objects to develop, in reciprocal interaction with human users, into new forms that in turn lead to their further development.

To illustrate, consider the wheel. By affording biologically impossible continuous rotary motion, it became a technological object of immense power. It may have originated through noticing that heavy loads could be more easily moved by placing them on rollable objects like logs. But as the affordance of rollability in logs was inserted into wheel-like objects, human intentionality became materialised, externalised and extended. The materialised intentionality in the wheel, now mobile itself, will have moved and been translated through a series of technologies, which at one stage will have produced wheeled vehicles requiring axles and bearings. These, when functioning well, would have been *zuhanden*, as it were, and given given little attention. When problems arose or when improvements were attempted, attention would become *vorhanden* and means to improve them would have appeared such as lubrication and special bearing materials. But this opened the way for a circulation of the materialised intentionality of the wheel itself as it was recursively inserted into its own individuation as a subsidiary technological object in the form of, for example, ball bearings, of whom pebbles and logs are distant ancestors.

Here we encounter a parallel, recursive translation in the conceptual and material domains. When adults engage in creative problem solving they may, consciously or not, use, things that were learned at very young ages, possibly in the form of affect-laden sensorimotor images. These, being in some sense abstract and fluid, may be more available to be used in imaginative ways. When infants play with technologically shaped objects and other gadgets, they acquire a repertoire of such images rich in the sedimented intentionality of previous generations. This repertoire is a form of cognitive gadget itself, a cultural invention that wasn't available to infants until very recently, evolutionarily speaking. This is the point; technological objects are a medium for cultural transmission which, when considered on an evolutionary timescale, were non-existent until very recently. Such encounters are now ubiquitous and happen early in human development when our nervous systems are most open

to being shaped by them. They will have added a distinctive cultural strand to the epigenetic web that now surrounds human individuation.

The rotary motion examples above illustrates Simondon's view that technological objects have a superabundance of affordances over and above those translated into them by their human makers. The affordance of continuous rotary motion, originally utilised for moving heavy objects on other rollable objects, were the materialised intentions to carry and to be mobile. These intentions then escaped their original forms and became free to be translated in turn into roller bearings, waterwheels, turbines, roller skates, cradle toys with helical screws, frisbees, trackerballs and so on. Moreover, the concept of continuous rotary motion can also escape its material manifestations completely and appear in the purely conceptual domain as, for example, the carbon and nitrogen cycles, economic cycles, the latter having the added dimensions of inertia and momentum.

Individuating alongside technological objects, human beings are shaped by technicity especially in early life. This is a significant component of the epigenetic systems that make modern human beings what they are. Technological objects for Simondon are autonomous agents of cultural change and transmission. Like Heidegger, he draws attention to the fundamental changes in human consciousness that technology has brought about. However, unlike Heidegger, who seems at times to hanker back to an ideal pre-technological state of human development, Simondon's programme takes us onwards to a fuller understanding of the co-evolution of biological and technical systems, though it needs to be carefully distinguished from the fantasies of too many futurologists.

The developmental significance of technological objects is but one part of the fundamental change in human phenomenology that has occurred over the recent period of human evolution. Another, equally important, part is the uniquely human capacity for metaphor. When cultural products evolve, a type of creative translation is occurring, as their meanings are not only preserved but are also elaborated and refined. Some of this is mediated by the material object itself in Simondon's view, but mostly it is due to the efforts of ordinary adults and creative technologists. It is here that the uniquely human capacity for metaphor plays a central role (Pickering, 2018, p. 124–125).

Metaphor Matters

Gibson's theory of affordance is fundamentally about the direct perception of opportunities to do what an organism is adapted to do. This will have been the phenomenological character of the vast majority of non-human and pre-human encounters with the natural world, both now and over the course of evolution. It needs to be remembered that what opportunities are perceived depends on the organism that perceives them. A squirrel can scramble to safety up a tree while a pursuing dog cannot. Affordances signify what actions are possible for a particular organism in a given situation. More specifically, they also suggest what can be done with or to objects. A stone, may be perceived directly as graspable, heftable, throwable and so on by human, and pre-human, beings. But these actions aren't possible for other organisms,

even though they can deal with stones in some ways. A burrowing animal like a badger, for instance, will move stones out of its way when creating its sett.

Here, both in Gibsonian and Heideggerian terms, objects are experienced directly as *vorhanden*. They are perceived literally, 'as is', although it must be born in mind that perceiving 'as is' also depends on the perceiving organism, e.g. what is climbable for a squirrel is not for a dog. Crucially however, humans have evolved the capacity to perceive 'as if'. That is, they can perceive objects and situations metaphorically or counter-factually, as if they were other than they actually are. It is here that a capacity for metaphor becomes relevant. Human reflexive consciousness not only makes it possible for objects also to be experienced as *zuhanden*, but also, and crucially, it makes it possible to see an object as it might be like if changed in order perform some function (Pickering, 2018). Both a child's imaginative play and the modification of a stone to make a blade share in this capacity for metaphorical perception. It is not unique to humans but in other species it is far less developed and tightly restricted to particular objects and situations.

The evolution of metaphorical perception has had a crucial role in bringing the world of human technological culture into existence, within which its powers have become prodigiously enhanced and diversified. The affordances that will have been created in the process, although dependent on human cultural apprenticeship, are mediated by the same psychological processes with which human beings, and all organisms, deal with the signs found in nature. It is in that sense that biosemiotics, the study of natural signs covers both nature and culture. As Hoffmeyer puts it: "… the interpretation of signs and meaning cannot, as it is often assumed, become criteria for distinguishing between the domains of nature and culture. Rather, cultural sign processes must be regarded as special instances of a more general biosemiosis that continuously unfolds and acts in the biosphere." (Hoffmeyer, 2015, p. 610). Indeed, and what makes cultural sign process special at the level of technologised objects is the uniquely human capacity for assimilating them, especially in early life. A young child and a kitten might both enjoy playing with a set of keys, but only the child will get to understand how keys and locks function.

Human beings aren't natural because they have evolved the capacity for reflexive consciousness and metaphorical perception (Pickering, 1999, 2018; Deely, 2010). This has made it possible to create technological objects into which human intentionality has been translated. Early experiences with them equip us with a repertoire of skills and, perhaps just as importantly, a repertoire of perceptual metaphors deriving from having learned to use their affordances. These are peculiarly mobile, given the unique human capacity for adopting a reflexive, *vorhanden* stance to what they encounter. This allows the affordances of technological objects to become detached free-floating signs. Jean Baudrillard points this out in what he terms the "Emancipation of the Sign", a uniquely human capacity that detaches signifiers from the signified so allowing them to become autonomous: "The emancipation of the sign: remove this 'archaic' obligation to designate something, and it finally becomes free…" (Baudrillard, 1993, p. 7). Signs have become free to mediate the co-evolution of human beings and technological objects in a process of circular translation. Objects are created, refined and human beings accommodate to what they afford earlier and earlier in human development. As these affordances are assimilated they become available

for translation, which is the preservation of meaning across transformations, and hence metaphorical re-insertion, allowing the co-creation of new objects and concepts, much as Simondon suggests.

To broaden the meaning of translation like this is to follow Petrilli's observation that "… translation does not only concern the human world, anthroposemiosis, but rather is a constitutive modality of semiosis, or, more exactly, of biosemiosis." (Petrilli, 2003, p. 17). Hoffmeyer likewise observes that "Natural translation is not a macro-level process but a process which is played out by individual entities at many levels from single cells to organisms or even populations and perhaps ecosystems." (Hoffmeyer, 2003). What has been proposed here is that this playing out should be broadened beyond the natural world to include the role of the material vehicles for cultural meanings. In short, to include Simondon's notion of Technicity.

This helps to understand what makes human beings so odd. Our place in the natural order may remain puzzling, but perhaps we now have a fuller understanding of how we individuate within the uniquely technologised niche that has appeared in the last ten thousand years or so. This niche is part of the semiosphere, an ecology maintained by the circular translation of signs through material and mental forms. It is this that has profoundly altered human consciousness and with it the phenomenology of the natural world. So much so that the majority of the present population of the planet, namely, those living in urbanised surroundings, are alienated from it compared with the human beings of quite recent times, say, the Magdalenian peoples who created the cave paintings of Lascaux. The consequences are all too clear in the shape of the environmental crisis which has appeared in the last few centuries. The final section of the paper will examine something of how this has happened.

Consciousness and Crisis

As early modern human beings evolved, the phenomenology of the natural world will have been a mixture of the practical and the magical. The hunter-gatherers of those times will have had extensive perceptual and constructive skills that allowed them to make use of the resources around them. What they will have encountered in their everyday lives will almost exclusively been what the natural world provided. Additionally, there will have been animistic myths about the origins of the cosmos and ritual practices to propitiate the supra human powers believed to govern a world beyond their control. Although our knowledge of the cosmos is now vastly greater, their understanding of the plants and animals on which they depended would have been much deeper than ours. For example, realising that overuse of this or that resource had bad consequences would have been directly, almost emotionally, perceptible to them in ways that are no longer available to most of us.

Such perceptual skills have been lost as contemporary human beings now develop and live in urbanised environments where most of what they encounter are cultural artefacts. This has brought about radical changes to the way we relate to the natural world. Heidegger, White and many others note how it has been 'disenchanted', in Weber's sense, and made to appear as a mere standing resource for human purposes. This is a fundamental driver of our ecological crisis. The natural world is no longer seen as providing resources to be used, but as something to be used up. For example,

before the entry of European settlers, the First Nation peoples of the American plains regarded the buffalo as kin whose wellbeing was integral with their own. The settlers regarded them as expendable game, reducing their numbers from well over thirty million at the start of the nineteenth century to about three hundred at the finish.

This is a particularly sharp illustration of what White presciently suggested in his paper *The Historical Roots of Our Ecological Crisis*: "In Antiquity every tree, every spring, every stream, every hill had its own genius loci, its guardian spirit. These spirits were accessible to men, but were very unlike men; centaurs, fauns, and mermaids show their ambivalence. Before one cut a tree, mined a mountain, or dammed a brook, it was important to placate the spirit in charge of that particular situation, and to keep it placated. By destroying pagan animism, Christianity made it possible to exploit nature in a mood of indifference to the feelings of natural objects.… our present science and our present technology are so tinctured with orthodox Christian arrogance toward nature that no solution for our ecological crisis can be expected from them alone." (White, 1967). It would be hard to say whether biosemiotics, as a good example of the leading edge of science is so "tinctured", but it nonetheless inherits some fundamental values from orthodox science.

Biosemiotics, as Hoffmeyer pointed out, brings into question the distinction between the natural and cultural worlds. But that distinction has in any case been blurred to the point of invisibility by human activities over the past few centuries. For example, dogs have been bred over many centuries to be useful and companionable. Their cognitive capacities are now greater than those of the many species of feral dogs still extant. They are, to that extent, cultural products. The empathy and that grows up between dogs and people, especially when they work co-operatively, makes it obvious that dogs are conscious. But dogs don't know they're conscious and never will. People do, and it is due to this reflexivity that we understand what signs are. We not only use them to designate others and other things but also to designate ourselves (Pickering, 1999). Deely takes this reflexivity to define the human condition "What distinguishes the human being among the animals is quite simple… only human animals come to realise that there are signs distinct from and superordinate to every particular thing…." (Deely, 2010, p. 10). We are, as Deacon puts it 'The Symbolic Species' since culture turns signs into symbols (Deacon, 1997).

This is what has allowed humans to become the profoundly cultural species that we are. The capacity for reflexive symbol-use will have evolved gradually through the processes of mimesis, invention and externalisation that Merlin Donald proposes as the origin of the modern human mind (Donald, 2005). While reflexivity is not itself a cognitive gadget in Heyes' terms, it is one of the most crucial preconditions that made it possible for gadgets, especially language, to appear. It is also what makes it possible for human beings to examine the flow of their own experiences and actions in order to refine them, not only individually but also collectively, giving rise to what Tomasello terms the 'Ratchet Effect' (Tomasello, 2000). By this he means the Lamarkian process by which cultural products, both physical and conceptual, are critically improved over successive generations, a notion very similar to Technicity.

When cultural products evolve like this, a type of creative translation is occurring, as their meanings are not only preserved but are also mobilised, elaborated and refined. Some of this is mediated by the material object itself in Simondon's view,

but much of it is due to the creative use of the uniquely human capacity for metaphor (Pickering, 2018, p. 124–125). Now, when those technologists were infants some objects they will have encountered will have had human intentionality translated into them. As their affordances were discovered, something was learned. An infant who plays with a helical screw toy has learned about a mechanical innovation that has been preserved for thousands of years. What is then learned would be retained in the form of a sensorimotor image. Such images are pervasive in creative thinking, which being enjoyable in itself, may re-connect, consciously or not, with images of pleasurable play retained from early childhood.

Here we again encounter a recursive translation somewhat like the wheel and ball bearing example above, but in the conceptual domain. When adults engage in creative problem solving they may, consciously or not, use things that were learned at very young ages, possibly in the form of affect-laden sensorimotor images. These, being in some sense abstract and fluid, may be more available to be translated into new domains and forms in imaginative ways. Biosemiotics is an important conceptual tool for understanding translation in this wider sense. This is one aspect of what has been attempted here.

Another particularly powerful attempt is by anthropologist Tim Ingold in his article *Evolution without Inheritance: Steps to an Ecology of Learning* (Ingold, 2022). Ingold notes: "Attempts to integrate human culture, history, or symbolic imagination into a comprehensive theory of evolution have, up to now, foundered on a bifurcation between mind and nature deeply embedded in the project of modern science. This article attempts to overcome the bifurcation by foregrounding the process of learning,…" (op. cit., p. 32). Ingold's proposal is to recast evolutionary theory by giving cultural learning the role formerly played by biological inheritance. This is, again, something like what has been proposed here, namely, that learning from material cultural products is central to how human beings develop within the un-natural order of culture.

Ingold makes two indirect but important allusions to two long-standing challenges to the Cartesian schism between the mental and physical realms. The first is the use of 'bifurcation' to describe the schism, which Ingold uses in just the sense of A.N. Whitehead's philosophy of organism (e.g. Whitehead, 1920, p. 30). The second is Ingold's title, which is modelled on Gregory Bateson's influential *Steps to an Ecology of Mind* (Bateson, 1972). Bateson's concern was with what he called "The pattern which connects" (Bateson, 1980, p. 16), which, being the preservation of meaning over transformation, is translation in a nutshell. The deeper implications of Bateson's work are as relevant as ever as we move into a time of deepening geopolitical crises (e.g. Brier, 2008). To broaden the scope of biosemiotics as proposed here will help us to realise more fully how deeply interdependent the human condition is on both the biological and cultural orders of reality. This, in turn may help to address the ecological crisis we all face.

When infants play with technologically shaped objects and other gadgets, they acquire a repertoire of sensorimotor knowledge rich in the sedimented intentionality of previous generations. This repertoire is a form of cognitive gadget itself, a cultural invention that wasn't available to the infants of ten thousand years ago. This is the point. Early encounters with technological objects are a medium for powerful

forms of cultural transmission which, when considered on an evolutionary timescale, were non-existent until very recently. Such encounters are now ubiquitous and happen early in human development when our nervous systems are most open to being shaped by them. They will, very recently, have added a distinctive cultural strand to the epigenetic web that now surrounds human individuation.

Treatments of cultural transmission tend to concentrate on the adult symbolic domain, such as languages, worldviews and beliefs (e.g. Tarnas, 1991). Some deal with the material structures, tools and techniques but the emphasis is on how they enhance the ways in which adult human beings form societies and amplify how they can act on the world (e.g. Mumford, 1967). What is being proposed here develops these approaches, in line with recent treatments of the extended evolutionary synthesis, biosemiotics and the theory of affordances (e.g. Kull, 2022; Heras-Escribano & de Jesus, 2018).

Finally, briefly, but perhaps more radically, what has been put forward here should also be considered in the light of the work of Iain McGilchrist. McGilchrist proposes, albeit on a far larger scale and rather in the spirit of Heyes's cultural evolutionary psychology, how human phenomenology has evolved to become profoundly different from that of earlier modern humans. This can be considered in both in the long and short terms.

In the longer term, he believes that the evolution of language has led to a gradual shift towards left hemispheric dominance (McGilchrist, 2009). He is careful to avoid the too often over-stated claims of earlier decades that the right and left hemisphere work in such different ways that it means there are effectively two minds in each head. He emphasises that the brain still works as an integrated whole, but also offers evidence that the right and left hemispheres have different cognitive styles, as it were. Some examples, of many, are that the left hemisphere is more likely concerned with the constructive manipulation of parts while the right is more concerned with seeing things as a whole; the left understands language more literally while the right can better deal with ambiguity and irony (McGilchrist, 2019a).

In the shorter term, McGilchrist believes that Modernity, with its emphasis on quantitative, analytic reduction has enormously amplified the phenomenological consequences of the differences between the right and left hemispheres by favouring the left. These differences are more in how they interpret what the senses provide and less in what they store or represent. That difference shows itself how we encounter and perceive the world and crucially, how we attend to it. For McGilchrist, attention is "… not just another "cognitive function" – it is actually nothing less than the way in which we relate to the world." (McGilchrist, 2019b). How we relate to the world is not merely an instrumental matter, it is driven by purpose, affect and value. It is this that leads McGilcrhist to the view that: "Attention is a moral act: it creates, brings aspects of things into being, but in doing so makes others recede. What a thing is depends on who is attending to it, and in what way." (McGilchrist, 2009, ch. 4).

These themes in McGilchrist's work are expanded and deepened in his *The Matter with Things: Our Brains, Our Delusions, and the Unmaking of the World*, which he prefaces with these words: "At the core of the contemporary world is the reductionist view that we are – nature is – the earth is – "nothing but" a bundle of senseless particles, pointlessly, helplessly, mindlessly, colliding in a predictable fashion, whose

existence is purely material, and whose only value is utility… I cannot remember a time when I thought this sounded at all convincing; and a lifetime's thinking and learning has done nothing to allay my scepticism. Not only do I think it is mistaken, I believe, but actively damaging – physically to the natural world; and psychologically, morally and spiritually to ourselves as part of that world. It endangers everything that we should value." (McGilchrist, 2021, p 5). Following McGilchrist's lead, we have an opportunity to ally biosemiotics with the recent return of interest in panpsychism and the notion of a purposive cosmos (Goff, 2019, 2023; Goff & Moran, 2022; Pickering, 2023).

Biosemiotics in the shape of Umwelt theory can, and should help to limit and perhaps in time repair the damage to which McGilchrist and many others draw our attention. One of the more obvious evidence of damage is the ecological crisis which in biosemiotic terms can be seen as the diminution of meaning - the loss of relationship and hence integration. As Maran puts it: "Umwelt theory may help to notice this deprivation of meanings occurring on a global scale, as it focuses on animals' subjective worlds and meaning-connections with ecosystems, instead of seeing extinction as a result of external ecological forces". (Maran, 2023, p. 385). What has been proposed here is that Umwelt theory will be able to help more effectively if it is expanded to take more account of how the Human Umwelt has become technologised and how this has fundamentally altered human phenomenology.

Summary and Conclusion

Here we have examined some of what has, in very recent times, made the human condition so oddly disconnected from the natural world. We are the culturally shaped species *par excellence* and a crucial part of what has made that possible is the evolution of the capacity to perceive and cognise metaphorically. This has taken us far beyond the dependence on what the natural world affords. The world within which human beings now individuate is largely a technological creation. While this has made life a great deal better in many ways, the darker side of having so much power to manipulate the world is starkly obvious in the shape of the ecological crisis.

We can no longer see the natural world as it actually is, that is, how it was seen by human beings in the quite recent past. The senses of the Magdalenian artists of Lascaux will have been identical to ours, perhaps even sharper, yet the world they beheld was entirely different. Then, the natural world will have been virtually untouched by human activity and very little of what they saw in their everyday lives will have been created by people. Now, however, most of what most of us encounter most of the time are technological creations. Not just the buildings, roads, billboards and the incessant noise of great cities, but also the orderly agricultural landscapes, the selectively bred organisms and the vapour patterns in the skies. All these are human creations. Adult human experience is now so much a cultural product that a sensitive understanding of the natural world has been obscured. As a consequence the living systems of the world, on which we depend, are being fundamentally damaged. Biosemiotics and Umwelt Theory will both be more effective in helping to limit the damage if broadened to take proper account of how technology shapes human consciousness.

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Data Availability No datasets were generated or analysed during the current study.

Declarations

Competing Interests The authors declare no competing interests.

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