Lived Experience and Cognitive Science

Reappraising Enactivism's Jonasian Turn

Mario Villalobos • Universidad de Tarapacá, Chile; Instituto de Filosofía y Ciencias de la Complejidad, Chile • mario.kirmayr/at/gmail.com
Dave Ward • University of Edinburgh, UK • dave.ward/at/ed.ac.uk

> Context • The majority of contemporary enactivist work is influenced by the philosophical biology of Hans Jonas. Jonas credits all living organisms with experience that involves particular "existential" structures: nascent forms of concern for self-preservation and desire for objects and outcomes that promote well-being. We argue that Jonas's attitude towards living systems involves a problematic anthropomorphism that threatens to place enactivism at odds with cognitive science, and undermine its legitimate aims to become a new paradigm for scientific investigation and understanding of the mind. **> Problem** • Enactivism needs to address the tension between its Jonasian influences and its aspirations to become a new paradigm for cognitive science. By relying on Jonasian phenomenology, contemporary enactivism obscures alternative ways in which phenomenology can be more smoothly integrated with cognitive science. **> Method** • We outline the historical relationship between enactivism and phenomenology, and explain why anthropomorphism is problematic for a research program that aspires to become a new paradigm for cognitive science. We examine the roots of Jonas's existential interpretation of biological facts, and describe how and why Jonas himself understood his project as founded on an anthropomorphic assumption that is incompatible with a crucial methodological assumption of scientific enquiry: the prohibition of unexplained natural purposes. We describe the way in which phenomenology can be integrated into Maturana's autopoietic theory, and use this as an example of how an alternative, non-anthropomorphic science of the biological roots of cognition might proceed. **> Results** • Our analysis reveals a crucial tension between Jonas's influence on enactivism and enactivism's paradigmatic aspirations. This suggests the possibility of, and need to investigate, other ways of integrating phenomenology with cognitive science that do not succumb to this tension. **> Implications** • In light of this, enactivists should either eliminate the Jonasian inference from properties of our human experience to properties of the experience of all living organisms, or articulate an alternative conception of scientific enquiry that can tolerate the anthropomorphism this inference entails. The Maturanian view we present in the article's final section constitutes a possible framework within which enactivist tools and concepts can be used to understand cognition and phenomenology, and that does not involve a problematic anthropomorphism. **> Constructivist content** • Any constructivist approach that aims for integration with current scientific practice must either avoid the type of anthropomorphic inference on which Jonas bases his work, or specify a new conception of scientific enquiry that renders anthropomorphism unproblematic. **> Key words** • **Human experience, living beings, autopoietic theory, enactivism, Hans Jonas, phenomenology.**

Introduction

« 1 » What is the nature of human experience? Are there *nonhuman* forms of experience? And, if so, how are human and non-human forms related? Should we believe, for example, that dogs, mice and bacteria all enjoy a form of experience that shares fundamental properties and structures with our own? In this article, we will review, compare and evaluate the answers that two different but intimately related theories give to these questions: (a) a Varelian enactive approach, and (b) Maturana's autopoietic theory. It will be argued that current Varelian enactivism, enraptured by the songs of Jonasian phenomenology, involves an antiscientific anthropomorphism that jeopardises its legitimate aim of becoming the new paradigm of cognitive science. We will show that it is possible to make use of enactivist concepts and tools to study cognition without anthropomorphism, and that to do so need not alienate phenomenology from cognitive science. In doing so, we will see that Maturana's conceptual system, by eschewing the sort of anthropomorphism that characterises Jonasian philosophical biology, is worthy of consideration as an alternative theoretical framework for enactivism.

Enactive phenomenology and the problem of anthropomorphism

« 2 » Phenomenology, both as a method and as a philosophical system, plays an essential role in current enactive cognitive science, at least in what we shall call here *Varelian enactivism* (VE). VE, sometimes called "canonical enactivism," represents the classical version of enactivism launched by Francisco Varela, Evan Thompson & Eleanor Rosch in 1991, and later developed by Andreas Weber & Varela (2002), Ezequiel Di Paolo (2005, 2009a), Thompson (2007),

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Tom Froese (2011) and other authors. VE was incubated during the 1980s on the basis of what we think was an opportune, critical and insightful diagnosis of cognitive sciences. For more than three decades, cognitive science accumulated many important and productive theories and models of human minds and cognition, but said nothing, or almost nothing, about the experiential aspect of our mental life. The original motivation to bring phenomenology into cognitive science was, precisely, to complement and enrich the scientific theorization with a rigorous method of analysis and examination of human experience (Varela, Thompson & Rosch 1991). Cognitive science was silent about human subjectivity, and the noble mission of enactivism was to help it find its voice.

« 3 » The introduction of phenomenology into cognitive science was and remains, we think, a very important contribution, and enactivism should be credited for having taken the first steps in that direction. Phenomenology, however, is not a simple and uniform philosophical corpus. There are different sub-schools and circles of authors, with importantly different theoretical emphases, assumptions and metaphysical commitments. A preliminary, non-exhaustive and tendentious list might distinguish between the eidetic constitutive phenomenology of Edmund Husserl, the realist phenomenology of the Munich group, the existentialist phenomenology of Martin Heidegger, the bodily phenomenology of Maurice Merleau-Ponty, the social phenomenology of Alfred Schutz, the hermeneutical phenomenology of Paul Ricoeur and Hans-Georg Gadamer and the biological phenomenology of Hans Jonas (Spiegelberg 1994; Moran 2000; Smith 2013; Salice 2015). The heterogeneity of phenomenology as a philosophical research programme means that the project of integrating phenomenology and cognitive science will look different depending on the conception of phenomenology being employed.

« 4 » While the first generation of VE (1990–2000) was primarily influenced by and concerned with the bodily phenomenology of Merleau-Ponty, the second (current) generation has taken as a central axis the biological phenomenology of Hans Jonas. Throughout the rest of the article, when

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we refer to VE, we have the contemporary, Jonasian strand in mind. This move, as we shall see, has considerably expanded the scope and coverage of VE, extending the phenomenological analysis of human experience in particular to the analysis of living beings' experience in general. The turn from the specifically human to the universally biological, which we call the "Jonasian turn," has changed the course of VE as a research program, theoretically committing it to the existence of a "deep continuity" (Thompson 2007) between life and mind. However, as we will try to show, the Jonasian turn also commits VE to a problematic anthropomorphism in its theorising about cognition.

« 5 » What do we mean by anthropomorphism, and why should it be viewed as problematic? Roughly speaking, anthropomorphism is the practice of attributing human features to nonhuman entities. We might, for example, explain the way in which the Nile river flows toward the sea by saying it *wants* to reach the sea, or has the *purpose* of reaching it. Although widely used in certain discursive contexts (e.g., poetry) and systems of beliefs (e.g., myths), anthropomorphism is not welcome in scientific research and theorising. Hydrologists will not accept an explanation of the Nile's behaviour in terms of desires, purposes or similar teleological concepts – except perhaps as an explanatory heuristic or metaphor that functions as a temporary substitute for the genuine, *scientific* explanation. In general, any theory or research program that wants to be recognized as a respectable scientific project has to make sure its ontological assumptions and explanatory principles are free of anthropomorphic elements.

« 6 » Succinctly, then, the problem of anthropomorphism for VE, as we see it, is this:

a VE offers itself as a scientific research program that aims to become the new paradigm for cognitive science.
b VE endorses Jonas's philosophical biology.
c Jonas's philosophical biology is an anthropomorphic project.
d Anthropomorphic projects are not scientifically valid research programmes.

« 7 » Might the enactivist deny any of these four points? We take the first point to be relatively clear and uncontroversial.

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Whilst VE has from the outset been an interdisciplinary research program that draws on influences that are often seen – wrongly, in our view – as orthogonal or hostile to scientific investigation of the mind, such as Buddhism and phenomenology, it has always presented itself as a scientific research program. Moreover, from its inception (Varela, Thompson & Rosch 1991) until its more recent formulations (Thompson 2007; Stewart, Gapenne & Di Paolo 2010), VE has always manifested paradigmatic ambitions within cognitive sciences. VE does not see itself as complementing or enriching the work of the cognitivist (computational and representational) paradigm in cognitive science; it sees itself as displacing it.

« 8 » The second point is also uncontroversial. Since Weber & Varela's (2002), wherein Jonas is introduced as the new clue to understanding biological systems, VE has been cultivating and deepening its Jonasian affiliation through a series of important and influential works (Weber & Varela 2002; Di Paolo 2005, 2009a; Thompson 2007; Froese 2011; Froese & Di Paolo 2009, 2011; Froese & Ziemke 2009; Froese & Stewart 2010; Di Paolo, Rohde & DeJaegher 2010; Kyselo 2014).

« 9 » How about the remaining two points? Though the case for them takes a little longer to explain, we think it is just as clear – and we find it in the work of Jonas himself. Jonas recognizes the deep conflict that exists between science and anthropomorphism and, for reasons we will explore in the next section, deliberately chooses the latter over the former.

Jonas's philosophical biology: Science versus anthropomorphism

« 10 » Outside the circle of cognitive sciences, Jonas's philosophy of life has been recognized, by critics, sympathizers and by Jonas himself, as an anthropomorphic philosophy. When John Yolton reviewed Jonas (1966), he complained that in contrast to the contributions of Merleau-Ponty and other phenomenologists, in Jonas's phenomenological analyses of biological systems "nothing but behaviour and anthropomorphism are at work" (Yolton 1967: 256). In contrast,

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sympathizers such as Michel Weemans and Bertrand Prévost, inspired by Pierre Montebello's notion of "higher anthropomorphism" (Montebello 2003), see in Jonas's philosophy a virtuous, sophisticated and "assumed [form of] anthropomorphism [which is] beyond the criticism of modern rationality" (Weemans & Prévost 2014: 7).

« 11 » Whether criticized or applauded, Jonas's philosophical biology seems to leave few doubts about its anthropomorphic character (Lindberg 2005; De Jesus 2016; Trnka 2016).[1] The reason for this is simple – it is Jonas himself who presents and defends his philosophical project as a kind of anthropomorphism. The reasons that lead Jonas to embrace anthropomorphism are philosophically profound and complex, involving historical, ontological and epistemological arguments. Here, for our purposes, we will focus only on some key points of his argumentation and motivation.

« 12 » In *The Phenomenon of Life* (1966), Jonas opens with this rich and informative philosophical declaration (which we think is worth quoting at length):

> "Put at its briefest, this volume offers an 'existentialist' interpretation of biological facts. Contemporary existentialism, obsessed with man alone, is in the habit of claiming as his unique privilege and predicament much of what is rooted in organic existence as such: in so doing, it withholds from the organic world the insights to be learned from awareness of self. On its part, scientific biology, by its rules confined to the physical, outward facts, must ignore the dimension of inwardness that belongs to life: in so doing, it submerges the distinction of 'animate' and 'inanimate.' A new reading of the biological record may recover the inner dimension – that which we know best – for the understanding of things organic and so reclaim for the psychophysical unity of life that place in the theoretical scheme which it had lost through the divorce of the material and mental since Descartes. Accordingly, the following investigations seek to break through the anthropocentric confines of idealist and existentialist philosophy as

1| See also the presentation "Thinking of the living body in Hans Jonas and Merleau-Ponty" by Carl Sachs & Shane Epting at the conference "Continental Philosophy in the Desert" at the University of New Mexico, 2010.

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well as through the materialist confines of natural science." (Jonas 1966: ix)

« 13 » Jonas's philosophy aims to overcome the dualism inherited from Descartes ("the divorce of the material and mental"), which he thinks still plagues contemporary science and philosophy. Scientific biology, confined to the physical facts, acknowledges no experiential inner dimension of living beings. Likewise, the existentialist philosophy in which Jonas (as a student of Heidegger working in the mid-20th century) was steeped is anthropocentric – the structures of subjectivity explicated by Heidegger (1962), Sartre and others apply only to us humans. Human subjectivity and existence, in this picture, appear cut off from the rest of the natural world, and Jonas believed that this rupture had profound consequences for our self-understanding. Comparing the modern existentialist and scientific view of the world to a Gnostic conception of a hostile nature against which we are pitted in constant struggle, he writes:

> "Not even this antagonistic quality is granted to the indifferent nature of modern science, and from that nature no direction at all can be elicited. This makes modern nihilism infinitely more radical and more desperate than gnostic nihilism ever could be for all its panic terror of the world and its defiant contempt of its laws. That nature does not care, one way or the other, is the true abyss. That only man cares, in his finitude facing nothing but death, alone with his contingency and the objective meaninglessness of his projecting meanings, is a truly unprecedented situation." (Jonas 1966: 233)

« 14 » This is one important reason why Jonas felt that a key task for philosophy was to offer a "new integral […] philosophical monism" (Jonas 1966: 17) that recognizes the unification of the physical and the psychological in life. What is needed is to recognise that particular structures of human experience and existence extend, in different degrees, to every form of life. We must come to see that:

> "The great contradictions which man discovers in himself – freedom and necessity, autonomy and dependence, self and world, relation and isolation, creativity and mortality – have their rudimentary traces in even the most primitive forms of life, each precariously balanced between being and not-being, and each endowed with an internal horizon of 'transcendence'." (ibid: ix)

« 15 » The expression "rudimentary traces" is important in this quote. Jonas is not saying that we must recognize a one-to-one projection or mapping between human existential features and those possibly present in animals. The idea is, rather, that we may find in basic organisms minimal forms or rudimentary versions of the human existential condition. However, even with this important nuance, the "existential interpretation of biological facts" offered by Jonas has a price. The application of existentialist categories to nonhuman creatures is not only problematic within the phenomenological-existentialist tradition (Hösle 2008; Vogel 1996), but, in a broader context, insofar as the attribution that it entails of human features (i.e., *Dasein's* experiential features) to nonhuman forms of life constitutes a form of anthropomorphism. Jonas is aware of this, and also that anthropomorphism is in conflict with science.

« 16 » The issue is especially visible in the case of teleology. We saw above that Jonas is concerned with the way science banishes meaning from nature. Jonas holds that, when drawing up a list of what scientific modes of description preclude us from attributing to natural systems, "foremost among the exclusions will stand that of teleology" (Jonas 1966: 33). Moreover, "[t]he struggle against teleology is a stage in the struggle against anthropomorphism" (ibid: 36). Teleology, along with "other "anthropomorphic" features" (ibid: 37), is unacceptable for science because it presupposes the projection of human experiential features into the natural world, while:

> "[Modern science assumes] that final causes have relation to the nature of man rather than to the nature of universe – implying that no inference must be drawn from the former to the latter […]; putting a severe ban on any transference of features of internal experience into the interpretation of the external world." (ibid: 35)

« 17 » Anthropomorphism is considered "scientific high treason" (ibid: 34), and teleology, being a form of anthropomorphism,

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cannot be accepted as a part of the scientific theorizing.

« 18 » Jonas thus recognizes the deep incompatibility that exists between science and anthropomorphism, and sees a need to choose between them. He sees the choice as follows:

> "*Either* to take the presence of purposive inwardness in one part of the physical order, viz., in man, as a valid testimony to the nature of that wider reality that lets it emerge, and to accept what it reveals in itself as part of the general evidence; *or* to extend the prerogatives of mechanical matter to the very heart of the seemingly heterogeneous class of phenomena and oust teleology even from the 'nature of man' […], that is, to alienate man from himself and deny genuineness to the self-experience of life." (ibid: 37, emphasis added)

« 19 » Partly for the historical and ethical reasons at which we gestured briefly above, Jonas perceives a significant danger in such alienation from ourselves. Thus, he recommends the first option: to take the teleological experience of human beings as evidence of the presence of teleology in every form of life. And he invites us to assume this view, bravely, "without fear of the blame of anthropomorphism" (ibid: 33). The sense of this claim is interesting and revealing. Jonas has acknowledged that in modern science, anthropomorphism is a banned practice. However, he thinks that his philosophical project must nonetheless be carried out without fear of condemnation. Why is this so? It might be thought that Jonas is confident he can prove that his philosophical project, understood properly, is not genuinely anthropomorphic, and so demonstrate its innocence before the court of modern science. But that is not Jonas's stance. For he thinks that in the conflict between anthropomorphism and modern science, what is wrong is modern science, not anthropomorphism. He argues that modern science has no sound justification for its anti-teleological and anti-anthropomorphic attitudes. According to him, properly viewed, "the exclusion of teleology is not an inductive result but an a priori prohibition of modern science" (ibid: 34). The rejection of teleology and natural purpose is not an empirical result that has been secured by modern science but rather, in Jonas's view, a

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presupposition whose acceptance as a guiding methodological principle is a necessary condition for modern science's existence and practice. For the same reason, he finds that "the anathema on any kind of anthropomorphism" proves to be, on closer examination, more "a prejudice" than an empirically demonstrated principle (ibid: 23). When Jonas says that his philosophical project must be carried out "without fear of the blame of anthropomorphism," he does not mean that before the court of modern science the project can be proved innocent, but rather that he does not recognize the authority of the court, and so does not fear its condemnation.

« 20 » As we noted above, it is not our aim here to criticize Jonas's choice of an immanently teleological conception of the living world over a mechanistic one. Rather, our aim is to point out the incompatibility of this choice with the methodology of natural science. We have just seen how Jonas makes the case for this incompatibility. Might Jonas be mistaken in thinking that an appeal to unexplained natural purposes is at odds with scientific method? We find it hard to see how this could be the case. Above, we claimed that an explanation of the movements of a river in terms of its goals or desires would be rightly unacceptable to hydrologists. Similarly unacceptable by modern standards is an Aristotelian explanation of why rocks fall through the air while fire rises up. According to Aristotelian physics, all matter has a natural order towards which it tends – thus a rock falls through the air because it *strives* towards the earth, whilst fire strives to be above the earth and the air. From the perspective of modern science, the problem with this Aristotelian view is not that it specified the wrong elements, or was mistaken about the particular *telos* that characterised each element; rather, it was the fact that its explanations appealed to a teleological view of nature. Science now demands that teleological characterisations of phenomena be *earned* in a particular way – they must follow from some non-teleological characterisation in a theoretically motivated way. Spelling out just how this might work is, as the recent history of philosophy of mind and biology suggests, a tricky task. But, as we have just seen, it is not a task that Jonas takes up. Instead he chooses, for rea-

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sons we briefly explored above, to "take the presence of purposive inwardness in one part of the physical order, viz., in man, as a valid testimony to the nature of that wider reality that lets it emerge […]" (ibid: 37), inferring the presence of teleology in the non-human world on the basis of our own experience.

« 21 » Coming from philosophy, and specifically from Heideggerian circles, Jonas feels free to challenge the modern scientific establishment, calling for a pre-modern view of living beings. His project, after all, consists of building a new *philosophical* biology, not a new biological *science*. That is Jonas; but what about VE? VE, as we said, not only forms a part of the community of cognitive sciences, but aspires to become its new paradigm. Yet they share the anthropomorphic inference from our lived experience of teleology to its existence in all organic life that Jonas acknowledges puts his views irremediably at odds with modern science. As Weber and Varela put it in their agenda-setting paper:

> "[B]efore being scientists we are first living beings, and as such we have evidence of our intrinsic teleology in us. And, in observing other creatures struggling to continue their existence – starting from simple bacteria that actively swim away from a chemical repellent – we can, by our own evidence, understand teleology as the governing force of the realm of the living." (Weber & Varela 2002: 110)

« 22 » This passage is representative of the way in which current proponents of VE deploy the Jonasian inference (see also Di Paolo 2003: 25; Di Paolo 2005: 431; Thompson 2007: 163; Froese & Di Paolo 2009: 440f). Our grounds for crediting non-human organisms with teleological properties are to be found in our own experience, and our knowledge that we too are biological organisms, *not* in an independently motivated theory of how teleology can emerge from the purposeless materials of the non-living world. In embracing and following Jonas's existential biology, VE subscribes, willingly or not, to a visible and substantive anthropomorphism. Unlike Jonas, however, VE does not seem to be in the position of freely acknowledging its anthropomorphic commitment – nor does it provide the kind of

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ideological or ethical defence of this commitment we have alluded to above, or address its incompatibility with the modern scientific enterprise. Indeed, as far as we know, VE has not publically recognized the anthropomorphic component of its Jonasian affiliation. Is this mere forgetfulness, or fear of public punishment for "high treason"? We think VE needs to review, sooner or later, and for the sake of its own research program, the anthropomorphic elements inherited in the Jonasian turn. To ignore the issue and go on as if it did not exist is not only a bad strategy but also a dangerous one. It is a bad strategy because the biological scientific community knows perfectly well how to detect anthropomorphic biases, and maintains a permanent vigilance with respect to them (Wynne 2007, 2004; Tyler 2003; Mitchell & Hamm 1996; Kennedy 1992). It is a dangerous strategy too, because it may motivate philosophical reactions such as those recently expressed by Paulo De Jesus (2016), to whom the questioning of anthropomorphic elements in the enactive theory becomes a reason to replace phenomenology with a different theoretical paradigm (namely biosemiotics), as if anthropomorphism was an inescapable result of extending conclusions informed by phenomenological arguments to the level of nonhuman animals.[2] Placing

2| One of the authors (DW) would like to clarify the following points: De Jesus's (2016) paper is a careful and important treatment of the theoretical relationships between autopoietic enactivism, radical enactivism (Hutto & Myin 2012), and Jonasian phenomenology. I am in complete agreement with almost all of its exegesis and conclusions, but want to use this opportunity to clarify several important differences between this article's treatment and De Jesus's. First, De Jesus is concerned with criticizing Jonas's extension of phenomenological categories to nonhuman animals (and the adoption of this extension by enactivists) on two scores – its anthropomorphism, and its analogical reasoning. I agree with both of these criticisms. But this article's concern is exclusively with the way in which the anthropomorphic inference at the heart of Jonas's phenomenology places it, and any paradigm that follows it in this respect, at odds with modern scientific practice. Second, De Jesus (2016) often writes as if it is not merely Jonasian phenomenology, but phenomenology *tout court* that should be eschewed by a viable enactivism. An important point that follows from the argument of the present article is that other phenomenological schools might be happily integrated with an enactive cognitive science, as long as they do not endorse Jonas's anthropomorphic inference. Lastly, and relatedly, in the next section it is argued that eschewing what is problematic about Jonas's enactivism need not entail denying the existence of phenomenological continuity between human and non-human animals – Maturana's autopoietic theory, in my view, is a form of enactivism that allows for experiential continuity without anthropomorphism.

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Jonas in the context of the Husserlian and existential phenomenologists to whom he was reacting makes clear that this is not the case.

« 23 » The introduction of phenomenology, as we said before, is perhaps the most valuable contribution of VE to cognitive science. Why put it at risk by loading it with anthropomorphic elements? Why not recover a more standard version of phenomenology, focused on and restricted to the examination of *human* experience, in keeping with the original spirit of VE? Before the Jonasian turn, Varela, Thompson and Rosch described *The Embodied Mind* as "a modern continuation of a program of research founded over a generation ago by the French philosopher, Maurice Merleau-Ponty." (Varela, Thompson & Rosch 1991: xv), and subtitled their book "Cognitive Science and *Human* Experience" (our emphasis). The prospect of combining bodily phenomenology with contemporary cognitive science was and remains, we think, an insightful, promising and important agenda. What is gained by, under the banner of a questionable anthropomorphism, trying in addition to teach us lessons about *bacterial* experience?

« 24 » If Jonas's philosophy of life is not the best option for the development of VE as a scientific research program, what kind of theoretical framework might fit the bill? What kind of biological theory might allow us to preserve phenomenological interests of VE without risking its scientific validity? In the next and final section of the article, we argue that Maturana's autopoietic theory, contrary to what VE seems to assume (Froese & Stewart 2010; Di Paolo 2009a; Thompson 2007), is in a position to do this.

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Another Way With Life and Mind: Maturana's autopoietic theory

« 25 » As is known, Humberto Maturana's autopoietic theory (MAT) is one of the main theoretical antecedents of VE. VE sees MAT as an important intellectual ancestor of its research program, but also as a theoretical construction that needs to be overcome in several respects (Froese & Stewart 2010; Thompson 2007; Di Paolo 2005, 2009a). One of the main aspects to be overcome, according to the representatives of VE, has to do with the subjective dimension of organic life; what they call, following Husserl, the "lived experience" of living beings. As we saw above, VE claims that living beings are not only complex physicochemical systems that produce themselves (i.e., molecular autopoietic systems), but also entities that enjoy an *experiential dimension*. According to VE, MAT, with its systemic, mechanistic and cybernetic approach, "is insufficient to account for this lived dimension of living being" (Froese & Stewart 2010: 10).

« 26 » In this section, we will argue that there is no necessary tension between a commitment to MAT and endorsing the claim that there is an experiential dimension to all living systems. What MAT cannot accommodate, as VE sees, is this experiential dimension *when it is understood in the existentialist and anthropomorphic terms of Jonasian biology*. But Jonasian biology is only *one* way of thinking about the experiential dimension of living beings and is not, absent further arguments from VE, one we are compelled to accept. One may accept, for example, that every living being endowed with a certain sensory system is capable of some kind of sensory experience or qualia, thus making room for a minimal and yet genuine form of lived experience in living beings. And one can do this without necessarily accepting the idea that every living being, just because it is a living being, is capable of existentialist experiences such as concern, freedom, and purposiveness. As we will show, MAT has its own way of thinking about the lived dimension of living beings, and of understanding the relationship between human and nonhuman forms of experience. We want to show this about MAT not with the purpose of demon-

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strating that it has the "correct" view about living beings, but rather to offer to VE an example of a theoretical framework that we think suits its phenomenological interests without dragging it into the problem of anthropomorphism. MAT, as VE points out, takes a mechanistic and cybernetic approach to living beings. But this need not make it, as we will see, incompatible with or insufficient for granting an experiential dimension to the existence of living beings. MAT conceives of living beings as mechanistic and deterministic systems, hence as entities without purpose, freedom of action or intentional properties, but is not committed to seeing them as zombies devoid of any form of experience. We think VE's belief to the contrary stems from its endorsement of the Jonasian anthropomorphism described in the last section; in fact, we shall see that what MAT precludes is not phenomenology but anthropomorphism.

« 27 » Maturana has said many things about human experience, but very few about nonhuman forms of experience (there are, as we shall see, important reasons for this). And he has addressed human experience mainly in the context of epistemological and metaphysical discussions about realism and anti-realism (Maturana 1978, 1988, 1990, 2003), not in the context of discussions about the phenomenological aspects of experience. However, we think he has said, here and there, enough to extract from his writings a coherent and systematic view about the phenomenological aspects of living beings' experience. The exegesis we provide in this section, though, should be viewed as a brief elaboration of what we think MAT can say about the experiential dimension of living beings, rather than as a rendition of an alleged explicit and mature Maturanian theory about living beings' experience.

« 28 » Maturana (1995a, 1996) speaks of living beings' experience in relation to two basic dimensions or domains of existence:

- the physiological domain of the organism's sensory dynamics, and
- the relational domain of the behavioural interactions of the organism as a totality.

The first experiential domain is constituted by the structural dynamics of all the sensory systems of the organism, in all their

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modalities (visual, auditory, tactile, etc.) and divisions (exteroceptive, proprioceptive, interoceptive). This is the domain wherein the organism exists and has its identity *as a physiological entity*, unlike the second domain, wherein the organism, according to MAT, exists and has its identity *as a relational entity* (more about this distinction later on). Every organism endowed with some form of sensory system, with or without a nervous system, is assumed by MAT to have some form of sensory experience (Maturana 1996), i.e., what we call in standard philosophical parlance "qualia." For example, unicellular organisms (e.g., bacteria, paramecia), which lack a nervous system, are endowed with sensoeffector systems composed of macromolecular structures such as membrane receptors, microtubules, cilia and flagella, capable of exteroceptive phenomena such as chemotaxis and magnetotaxis. These sensory phenomena, even in the absence of a nervous system, are assumed by MAT to be sufficient to bring about some form of sensory experience or qualia at a microorganic level. Similar sensory structures are assumed to generate similar sensory experiences, and different sensory structures are assumed to generate different sensory experiences. Thus, for example, all visual systems, in mammals, birds, reptiles, fish, insects, etc., are assumed to generate, in spite of their architectonic differences, some kind of *visual,* rather than auditory, olfactory or tactile experience. The visual experiences associated with the different visual apparatuses may differ in certain aspects (e.g., monochromatic versus polychromatic vision), but always remain within the domain of the visual phenomenology. In this sense, the different experiential phenomena brought about by the different sensory modalities are thought to be incommensurable among them. A congenitally blind person, for example, cannot (MAT assumes) generate or evoke visual experiences in virtue of the functioning of her auditory or olfactory systems. In the same way, we humans, lacking the biological structures required for electroreception, cannot generate or evoke the kinds of sensory experience that MAT assumes are associated with electroception in sharks, duck-billed platypuses, bees and other animals.

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« 29 » The second experiential domain, on the other hand, is constituted by the behavioural interactions and space of coexistence that the organism establishes with its environment, or, in a broader sense, by its characteristic mode of life. Maturana calls this experiential domain, neutrally and without major metaphysical pretensions, the "psychic space" of the organism (Maturana 1995a, 1996). Because of the anti-naturalistic connotations of the English word "psychic" (which Maturana does not intend), where Maturana talks of "psychic space" we will instead talk of an organism's *psychological* space. This relational domain, as we said before, corresponds to the space wherein the organism exists and has identity *as a relational entity*. As with the physiological domain, every organism, insofar as it establishes a certain relationship with its environment, is assumed to have a corresponding form of relational experience (Maturana 1996). For example, non-social (solitary) organisms exist in a psychological space mainly based on dynamics of structural coupling with non-living entities. Social organisms, instead, exist in a psychological space mainly based on dynamics of structural coupling with other organisms (usually conspecifics), establishing different kinds of communicative dynamics or patterns of behavioural coordination. As with the physiological domain, MAT assumes that similarities and differences between the psychological spaces occupied by organisms correlate with similarities and differences in their experiential lives.

« 30 » For our purposes here, there is one distinction between modes of psychological space that is of particular importance, marked by the presence or absence of language in an organism's relationship with its environment. Organisms that relate to their environment and each other using language occupy a *linguistic psychological space*, while organisms without language do not. According to MAT, human psychological space is distinctive in being essentially linguistic in this way; to be a human being is to exist and operate in language (Maturana 1978, 1988, 2003; Maturana, Mpodozis & Letelier 1995). Language, in MAT, is a special form of communicative behaviour, namely *recursive* communicative behaviour (Maturana & Varela 1987). Whereas many

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non-human social animals are able to generate effective systems of communication or behavioural coordination, only humans, according to MAT, operate in a domain of communicative behaviours that is characterised by *recursion* (Maturana 2003). Maturana's *cybernetic* conception of recursion is importantly different from the more familiar linguistic property of recursion as it figures in (e.g.) Marc Hauser, Noah Chomsky and Tecumseh Fitch (2002). Maturana's recursion is not a compositional property of language itself, but a characteristic of the *process* by which he argues language emerges – human language is recursive in his sense because it emerged from a process that proceeded via repeated operations on its own result (Maturana 1995a). But this is not the place to analyse the technicalities of Maturana's theory of language (though see Villalobos 2015 for a relevant summary). What interests us here is to review the kinds of experiential phenomena that language, according to MAT, makes possible.

« 31 » MAT claims, for example, that time and temporality, as organizing structures of experience, arise with language (Maturana 1995b). Past, present, future and correlative categories such as beginning and end, origin and finality, according to MAT, have experiential presence only for linguistic organisms. Since a certain sense of future, of result or final state is necessary for purposes and goals to figure in experience, MAT holds that only linguistic creatures enjoy a teleological experiential dimension. MAT also claims that language gives rise to the semantic and intentional dimension of experience (Maturana & Varela 1987). Only linguistic organisms can operate in representational domains and have a sense of "aboutness." Language, finally, makes possible the sense of self and the phenomenon of self-consciousness (Maturana 2002, 1995a; Maturana & Varela 1987), and through these, experiential dimensions such as freedom, responsibility and normativity, among others (Maturana 1988).

« 32 » Let us be clear – all of these are bold philosophical claims with respect to the role of language as an organizing principle of experience, which stand in need of much further elaboration and defence if their acceptance is to be motivated. Our aim here is not to defend or justify any particular one

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of these claims. Recall that we are not trying to convince the reader that MAT has the correct view on these topics, but only to present the kind of experiential view that follows from MAT, and thereby to illustrate an alternative way enactivists might view the relationship between life, phenomenology and cognitive science. The crucial point in MAT's view for our purposes is this: just as there is incommensurability between experiences associated with distinct sensory modalities, MAT claims that the two basic modalities of psychological space – linguistic and non-linguistic – are also associated with incommensurable experiences. Inhabitants of non-linguistic psychological space cannot generate the kind of experiential phenomena characteristically correlated with linguistic psychological space, nor can inhabitants of linguistic psychological space evoke the kind of experiential phenomena enjoyed by their non-linguistic neighbours (Maturana 1996). Thus, to the extent that only humans are assumed to operate in a recursive linguistic domain, MAT holds that only humans can enjoy the particular experiential dimensions associated with linguistic psychological space. That is, it is only *human* experience that is appropriately characterised in terms of purposes, a sense of self, meaning, intentionality, freedom and normativity.

« 33 » Clearly, there is much more to be discussed with respect to MAT and its view of living beings. But for present purposes, it is important we focus on two main points. The first is that MAT, contrary to the assumptions of contemporary defenders of VE, recognizes the existence of an experiential dimension in living beings. It holds that every living being, insofar as it exhibits some form of sensory and relational dynamics, instantiates some form of experience. The second point concerns the key question of just how much we humans are entitled to conclude about other living beings' experience. MAT holds that we can say many things about *human* experience, and in that sense it is entirely compatible with the use of phenomenology *in its traditional application*. But things are different with respect to nonhuman living beings. According to MAT, we humans can recognize the existence of an experiential dimension in nonhuman living beings, but

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cannot say much about its specific features. The particular experiential domain we are talking about matters. If we are considering the *sensory* experiential domain, then we can assume some hypotheses with respect to the sensory experience of some living beings, provided we can demonstrate the existence of similar sensory structures and dynamics. But if we are considering the experiential domain associated with the psychological space inhabited by nonhuman living systems, then we do not have room for such an exercise. Let us recap how these points follow from the features of MAT we have sketched above.

« 34 » Can we humans legitimately assume that nonhuman living beings enjoy some kind of visual experience? "Of course we can," says MAT. We can see that this is one of the basic assumptions throughout Maturana's career as a neurophysiologist of visual perception. In his extensive studies with frogs and pigeons, Maturana always assumes that these animals, having retinal structures endowed with photosensitive cells, optic nerves and specific cortical zones, enjoy some kind of visual experience (Maturana 1959; Maturana et al. 1959, 1960; Lettvin et al. 1959; Lettvin et al. 1961; Maturana & Frenk 1963, 1965; Maturana, Uribe & Frenk 1968; Maturana & Varela 1982; Varela et al. 1983; Maldonado, Maturana & Varela 1988). Certainly, as is well known, Maturana rejects the idea that the phenomenal states generated by these visual systems are representations of a pre-given and external reality, but he never questions the existence of such states per se. For example, Maturana never questions that pigeons have chromatic experiences, but he denies that such experiences are specified by external factors such as the spectral composition of the light wave (Maturana, Uribe & Frenk 1968).

« 35 » This is, of course, a simple version of what is known as the *Argument from Analogy*. Since our visual experience is based on the functioning of biological structures such as photosensitive cells and certain specific nervous nuclei, nonhuman organisms exhibiting similar biological structures are expected to have *some kind* of visual experience too. The analogy is grounded on the assumption that the sensory experience generated by the visual apparatus of humans is commensurable with,

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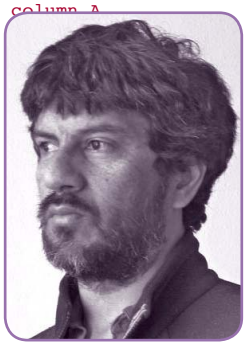

MARIO VILLALOBOS
obtained a Masters in philosophy at the University of Chile, and received his PhD in Philosophy of Mind and Cognitive Science from the University of Edinburgh. He is Associate Professor of Philosophy at the School of Psychology and Philosophy, University of Tarapacá, Chile, and Associate Researcher at the Institute of Philosophy and Complexity Sciences (IFICC), Chile. His main areas of research are the autopoietic theory of living beings, the enactive approach, and cybernetics. In particular, Mario develops and defends a Strict Naturalistic approach to cognitive science, which he takes to be a philosophical reconstruction and deepening of Ashby's cybernetics and Maturana's biology of cognition.

DAVE WARD
is a lecturer in philosophy at the University of Edinburgh. His research focuses on the relationships between perception, agency and understanding, arguing that these three capacities are constitutively and reciprocally interdependent. He is interested in the historical antecedents of such a view of these relationships (in the German Idealist and Phenomenological traditions, for example), the consequences of such a view for contemporary debates in the philosophy of mind, perception and moral psychology, and the relationship between this view and cognitive science past and present.

though not necessarily identical to, the sensory experience generated by the visual apparatuses of nonhuman living beings. But hold on – have we not been criticising VE for inferring conclusions about the experiential lives of nonhuman organisms from our first-person acquaintance with our own? In attributing properties of our sensory experience to other animals is MAT not likewise guilty of anthropomorphism? We can choose to define anthropomorphism this way if we wish. But the important point is that the anthropomorphic inference that VE inherits from Jonas is problematic in a way that MAT's inference is not. MAT's inference from properties of human sensory experience to properties of its nonhuman relatives is grounded by the conviction that our empirically determined grasp of the structural dynamics of the physiology of our sensory systems is our best guide to the properties of our sensory phenomenology. If this is right, then we may conclude that similarity in biological structure goes with similarity in sensory experience. Once again – our aim here is not to defend conclusively or to motivate this inference or the conviction that underlies it, but to show that MAT is importantly different from VE in this regard. This is because, as we saw in the previous section, VE infers the presence of *teleology* and *purpose* in nature on the basis of their presence as dimensions of our experience and in doing so places itself at odds with the rejection of natural purposes that is – as Jonas himself argues – a prerequisite for the pursuit of the modern scientific enterprise.

« 36 » No doubt the narrower range of experiential properties we may legitimately take ourselves to share with nonhuman animals will appear insufficient to the eye of VE. For what VE wants is the recognition of the living being as a rudimentary existential subject, endowed with minimal and yet genuine forms of teleology and freedom, concern and selfhood. MAT, according to VE, fails to become aware that when pigeons see a strawberry, they not only distinguish a particular colour and shape, but perceive a fruit that they value as a desirable goal, and that this is so because pigeons, like all living creatures, are intentional and teleological agents that are autonomous – they strive to stay alive. MAT "fails" to see the existentialist features that Jonas and VE see in living beings because, as we saw above, it holds that the experiential domain of an organism is given by the structural dynamics of its sensory systems *and* the dynamics of its relational domain or psychological space, and that just as different sensory modalities are assumed to be incommensurable, different modalities of psychological space – notably, the distinct regions of linguistic and non-linguistic psychological space – are assumed to be incommensurable too. Since MAT holds that features such as purposiveness, intentionality, freedom, agency and normativity depend not upon biological structures but upon the essentially linguistic character of

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human psychological space, we cannot assume these existential features of our experience are ones we share with nonhuman animals. We have here what we might call an *Argument from Disanalogy*: the incommensurability of the psychological space occupied by humans and nonhumans entails that we humans cannot evoke the psychic space of non-linguistic living beings, let alone characterize it with the features of our own linguistic psychological modality. It is important to note that this does not commit MAT to denying that many nonhuman animals *appear* to act intentionally and purposively – indeed, MAT's account of the teleological character of our experience might furnish us with materials we could use to explain why so many events in our world appear to us this way. Nonetheless, MAT argues that the distinctive characters of linguistic and non-linguistic psychological space provide us with a principled reason to refrain from taking this appearance of teleology at face value.

« 37 » In this way, MAT is, as we can see, compatible with the assumption that every living being instantiates some kind of experience, but incompatible with the assumption that said experience must have human-like features. That is, MAT is compatible with the enactive demand to acknowledge the experiential dimension of living beings, but in a way that prevents the problem of anthropomorphism.

Conclusion

« 38 » Contemporary VE must address the anthropomorphic credentials of the Jonasian phenomenology it has taken to its heart. If the diagnosis we have presented here is correct then we can see three options for VE. It might abandon its aspirations to become a new paradigm for an integrated cognitive science of life and mind. It might defend a new conception of scientific inquiry, according to which the positing of natural purposes that receive no further explanation in terms of structure or dynamics is no barrier to scientific legitimacy. Or it might abandon the anthropomorphic inference it inherits from Jonas and look for a new way to integrate phenomenology and cognitive science. We have suggested that Maturana's autopoietic view provides an example of how this last option might be carried out. Whether or not the future of enactivism lies with Maturana, the last of the three options just presented is, in our view, the most appealing by a large margin. The original Merleau-Pontian roots of enactivism should be recovered, and our focus should be a naturalistically acceptable explanation of how our subjective lives emerge from the dynamics of our bodily engagement with the world. In fact, we think that most enactivists believe that they are engaged in just such a project. However, we have argued above that insofar as they rely on the Jonasian inference

from the teleological character of our own experience to the existence of analogous structures in the experience of all living organisms, they preclude the possibility of a full integration of their views with cognitive science. The Jonasian inference is tempting because it relieves enactivists of the obligation to provide a demonstration of how teleology and subjectivity are unavoidably entailed by the biological and interactive structures to which enactivists appeal. But this is the temptation of theft over honest toil. A genuine scientific revolution deserves better.

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Open Peer Commentaries

on Mario Villalobos and Dave Ward's "Lived Experience and Cognitive Science"

Confusion of Reflective Domains?

Humberto R. Maturana
Escuela Matriztica de Santiago, Chile
hmr/at/matriztica.org

> Upshot • I shall not address directly the article on which I am supposed to comment, and that I find very interesting, but I shall make four commentaries on the general subject of the confusion of domains in our reflection on biological and cultural phenomena.

First

« 1 » Science is a conceptual and operational instrument that we use for explaining any experience that we may live through proposing some process or mechanism such that if it were to operate, it would give rise in us to the experience that we are explaining in the domain of our living in which we live it. As we do science, we explain the coherences of our living with the coherences of our living. The fundamental care in doing science is not to confuse domains, that is, not to try to explain the coherences of what occurs in one domain with the coherences of what occur in a different, not intersecting domain.

« 2 » When we speak of biological phenomena, we refer to all that occurs in the operation of living systems in the continuous realization of their existing as molecular autopoietic systems. When we speak of cultural phenomena, we refer to all that happens in the domain of the realization of human beings as a person as they participate in reflective conversations with others or with themselves. The biological and the cultural phenomenal domains do not intersect and what occurs in one cannot be deduced from what happens in the other. No doubt the biological processes and the interpersonal relations operate through molecules as they occur in their realization of the molecular autopoiesis of the living beings, and they affect each other in their realization, but the biological processes and the interpersonal relations are different kinds of phenomena and to confuse them is a conceptual mistake. Accordingly, notions of purpose, finality, intentionality, etc. do not apply to the happening of the molecular biological processes; they apply and make sense only in the domain of human relations as distinction of particular aspects of human behavior in the domain of the co-ordinations of living in reflective conversations.

Second

« 3 » When living systems arose on the earth some 3.8 billion years ago as discrete molecular autopoietic entities, they arose together with the molecular ecological niche that made them possible as organism-niche ecological unities. Living systems, as molecular entities, are structure determined systems; and in their interactions with other molecular entities, all that takes place is a reciprocal triggering of structural changes that results in the arising in them of dynamic configurations of molecular architectures that constitute the ecological organisms unities in which they exist, are conserved and transformed or disintegrated. So, when living systems arose as organism-niche unities integrating the ecological domain that made them possible, they arose as dynamic components of a dynamic molecular architecture that became the biosphere in which, and in coherence with which, they have been continuously conserved and transformed since their origin millions of years ago. The fundamental result of this historical process is that every living system exists only in operational coherences with the molecular architecture that constitutes the dynamic biosphere that makes possible the realization of its molecular autopoiesis in its individual ontogeny as a manner of living that can be conserved as the same or with transformations from one generation to the next. In other words, the biosphere occurs as an extended molecular architecture that exists in continuous change and transformation around the conservation of a network of intercrossing ecological organism-niche unities in which each organism realizes its molecular autopoiesis following a path of change and transformation defined at every instant in its locality by the coherences of its inner sensations in the processes of its actual realization. When this process stops happening, the organism-niche ecological unity disintegrates as the organism dies. The extended molecular architecture that is the biosphere in which we now live is the present of the conservation and transformation of the one that arose with the origin of the network of ecological organism-niche unities that began with the origin of living beings near 4 billion years ago.

« 4 » In this manner, the evolution of living systems has occurred in the changing dynamic molecular architecture of the biosphere in the never-interrupted conservation of molecular autopoieisis through a process of reproduction of manners of living that, at the same time as they have conserved it, have give rise to variations in the form of their realization in the constitution of branching lineages of intercrossing ecological systems of organism-niche unities of which every living system now living is a present case. When this process of repro-

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http://constructivist.info/11/2/802.villalobos

duction stops happening in any given lineage, the lineage becomes extinct.

« 5 » In other words, the result of all this is that all living systems living now occur in sensory, operational and relational ecological coherence in the locality of the dynamic molecular architecture of a biosphere that is continuously arising with realization of the network of interrelated ecological organism-niche unities that they spontaneously integrate while they realize their living. That is, we human beings, as living systems, exist today as a spontaneous result of the history of transformation of a biosphere that begun as a molecular architecture integrated and conserved in the uninterrupted realization of living system that arose spontaneously as discrete molecular autopoietic systems with the ecological medium that made them possible millions of years ago.

Third

« 6 » Living in reflective conversations is our human cultural manner of living together; and living in language in reflective conversation is our particular ecological niche. Language is a manner of living in recursive co-ordinations of inner feelings, of doings and of emotions, in reflexive conversation. And living in recursive co-ordinations of inner feelings, doings and emotions is our manner of making distinctions in our living that constitute the entities, processes and relations of the cosmos that arises as we explain the coherences of what we do and of what happens to us in our living with the coherences of the realization of our living. Notions such as purpose, aim, intentions, adaptation, adequacy, progress, thoughts, reflections, etc. belong to what we do as we recursively co-ordinate our inner feelings and emotions as we operate in the recursive co-ordinations of our feelings, doings and relations as they arise in the course of our reflexive conversations as we coordinate our doings – thoughts, desires, fears, concerns, explanations as well as the doings that we do as we live them.

« 7 » None of the notions that we use as we reflect about the happening of what we do in our conversations as we describe the orientation of our reflections or our doings apply to what occurs in the spontaneous realization of the dynamic molecular architecture of the biosphere. As we use our reflective notions as if they applied to the processes of the molecu-

lar architecture of the realization of living systems in the biosphere, particularly if we use them metaphorically, we confuse operational and conceptual domains in a manner that interferes with our understanding of the worlds (cosmos) that we generate as we explain the coherences of our living with the coherences of our living, obscuring our understanding of our own living in reflective conversations. And when that happens, we lose sight of how we are responsible as conscious human beings for the worlds that we generate in the dynamic architecture of the biosphere that we integrate with all the sensory, operational and relational dimensions that arise with our living as we are in reflective conversations.

Fourth

« 8 » I appreciate the references and use that the authors make of my work, which I consider they do in a very adequate, and I agree with them in their fundamental conclusions. Now I would like to add the following reflection. Perhaps the expression "experience" is too anthropomorphic in itself because it entails an implicit act of abstracting a configuration of feelings as some kind of psychological entity about which we can talk as something that occurs independently of our distinguishing it. In our conversations, my colleague Ximena Dávila Yáñez (see Maturana & Dávila 2015) and I have come to the conclusion that in our human case, when we speak of an experience, we always refer to something that we distinguish that happened or is happening to us in our living. For example, walking is not lived as an experience unless we refer to it in our reflections: an experience in our human living is something that we are aware is happening or did happen to us. In the present development of robotics, with the design of many automatic systems that have inner sensors to accommodate to the changing circumstances in which they are made to operate, imitating what happens with living systems, would we say that they have experiences like we do? Would we compare what we think is happening in them with their inner sensors guiding their movements with what is happening in an animal searching for its food?

« 9 » A living being exists as an organism in dynamic sensory coherence with the circumstances in which it lives as a result of the never-interrupted evolutionary his-

tory of transformation of the biosphere that arose as the ecological niche of the first organisms in the origin of living systems near four thousand million years ago. As a result of the continued operational, relational and sensory coherence of the living systems with the molecular architecture of the biosphere since its origin, every organism appears as if it operated with a purpose in the ecological medium in which it happens to live in sensory, operational and relational coherence as a result of such evolutionary history. Similarly, a robotic system appears to act with a purpose in the medium in which it operates as the result of a human design, but there is no purpose in its operation.

« 10 » I think that this article is very valuable because it opens a reflective space in relation to how to understand the increasing evolutionary complexity of the inner sensors and operational abilities of the organisms that has resulted in the social living that constituted the space in which our living in language arose with the arising of our humanness and of our awareness that we are responsible of the worlds that we generate together. With my colleague Ximena Dávila, I think that we human beings are a spontaneous result of an evolutionary history guided by the conservation of the well-being of living together in the intimacy of the coordinating the doings of the daily chores that created the loving relational space in which arose our manner of living in conversations in which we reflect about their origin, … have ethical concerns …are aware that we are not the product of some mysterious design, and in which we feel responsible for what we do and not do, and we think, that this is very wonderful.

Humberto Maturana Romesín showed that living beings are molecular autopoietic systems, and that language as a biological phenomenon occurs as a flow of living together in co-ordinations of co-ordinations of consensual behaviors; and cognition as a biological phenomenon occurs when an organism operates adequately to the circumstances of its living, conserving its autopoiesis as a consequence of the operational-relational coherences with its niche that are proper to it in the present of its living as a feature of the history of the evolutionary structural drift to which it belongs.

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column A

Can the Lived Experience of Living Beings Be Approached through Inference?

Shigeru Taguchi
Hokkaido University, Japan
tag/at/let.hokudai.ac.jp

> Upshot • Villalobos and Ward seem to disclose a fundamental problem without solving it – a problem to which neither the Jonasian nor the Maturanian inference can offer a solution. It should be addressed by a phenomenological analysis of our basic experience of aliveness.

« 1 » Basically, I agree with Mario Villalobos and Dave Ward's view that it is not profitable for enactivism to adopt the overly existentialist and anthropomorphic language of Hans Jonas (1966). Speaking of "freedom" and "concern" in primitive living beings seems too metaphorical. If these expressions are to be understood as more than just metaphors, they have to be translated into a more precise language.

« 2 » I also agree with the authors' claim that non-human living beings also have phenomenological "lived experience," although the latter is not necessarily comparable with *human* experience. However, the Maturanian *inference* that the authors present (§35) seems insufficient to endorse the view that all living beings have lived experience. I will return to this point later in this commentary.

« 3 » In general, the target article does not seem to solve, but (seemingly unintentionally) discloses, fundamental problems: Why and how can we acknowledge that living beings have (subjective) experience? What does this acknowledgement mean in the ultimate sense?

« 4 » The authors might also think that it is necessary to address these fundamental questions in order to prepare for a "genuine scientific revolution" (§38). However, the authors apparently fail to see that the discussions in this article leave the above-mentioned fundamental problems unresolved.

« 5 » It is possible that Jonas also suggests that we should address these essential questions. However, Jonas's metaphorical allusions must be insufficient to answer them. In my view, those questions should be addressed by concrete phenomenological analyses of our rudimentary experience of "life" or "aliveness." Still, phenomenologists have not properly engaged in this task so far. This is an unsolved problem for phenomenologists as well. It might be said that enactivists disclosed this problem, but have not yet deepened it.

« 6 » To address properly the question: "How can we acknowledge living beings' experience?", enactivism should not uncritically opt for the "Jonasian inference" that cannot dispel the suspicion of anthropomorphism. But, on the other hand, it also does not seem to be a fundamental solution to adopt the Maturanian idea that human experience is incommensurable with non-human experience (§32). This does not solve, but merely sharpens the fundamental question, which now reads: How can we acknowledge "experience" of non-human living beings if it is essentially different from ours? Why can we call it "experience" if it is not similar to our human experience?

« 7 » Villalobos and Ward acknowledge the fact that "many non-human animals appear to act intentionally and purposively" (§36). This problem of "appearance" cannot be rendered harmless by saying that non-human animals *appear* to us to have intentions and purposes whereas *in fact* they do not. The appearance and the factual being of experiential life cannot be separated without creating fundamental problems. As Francisco Varela pointed out, our tacit recognition of "living" or "being alive" constitutes the basis for all considerations and investigations of living beings, but is not explored by biologists and researchers of life (Varela 1979: 3–6). If we thoroughly ignore the fundamental "appearance" of life, we will find nothing other than physical and chemical mechanisms in this universe. If we find life in this universe, our extremely primitive acknowledgement (or perception) of "aliveness" is already at work (see also Barbaras 2008).

« 8 » This fact is too primitive and rudimentary to be noticed in our natural attitude. That is why we need a phenomenological investigation of it on the basis of a phenomenological epoché. In particular, we should suspend simply presupposing our fundamental experience of "aliveness" because we always see life through the medium of this experience, and cannot attentively observe it as such as long as we take its function for granted. Therefore, it is necessary to activate reflectively our awareness of this experience itself. This means deeply sinking into our most basic experience of aliveness in which "seeing life" and "being life" cannot be separated. Edmund Husserl tentatively developed considerations on empathy into non-human living beings, including animals that are considerably remote from humans such as jellyfish (Husserl 1973: Text No. 6). However, he did not deepen his analysis in this direction. Phenomenologists after Husserl have also rarely faced this task. (A rare exception is Renaud Barbaras, e.g., 2008).

« 9 » Interestingly, enactivism opened our eyes to this fundamental problem. In the first chapter of *The Embodied Mind*, Varela, Evan Thompson and Eleanor Rosch call our attention to a "fundamental circularity":

> "Thus in reflection we find ourselves in a circle: we are in a world that seems to be there before reflection begins, but that world is not separate from us." (Varela, Thompson & Rosch 1991: 3)

« 10 » What is said here about the world also applies to life. A living being appears to exist as such before we reflect, but in fact, the aliveness that makes it appear as a living being cannot be separated from our reflection and seeing. Our seeing makes it possible for living beings to appear as such, and this appearance makes it possible for our seeing to find living beings as such. What we should do is straightforwardly step into this circularity: "we should go back where we started, to the concreteness and particularity of our own experience – even in the endeavour of reflection" (ibid: 12).

« 11 » In the concrete fact of such a circular phenomenon, our own experience and the aliveness of living beings inseparably belong to each other. It is through the medium of this fact that we see living beings as living. The fact that we intuitively acknowledge that living beings have a certain kind of experience is arguably rooted in this circular phenomenon. Experience can not only be experienced internally, but also experienced by other experiences. A phenomenological investigation into this basic fact can possibly make more explicit how "experience" of living beings is experienced in our basic and factual perception of aliveness. Such an investiga-

tion is worth trying because the fundamental fact of perceiving aliveness has been scarcely investigated. As I already suggested, this fact can hardly be observed in reflection because it is in a sense too close to our own act of seeing the world. Phenomenological epoché is an effective way to break our blindness of this kind to what is at work in the middle of our own experience of living beings.

« 12 » Let us return to the question: How and why can we see living beings as experiencing beings (not as zombies)? We cannot answer this question by any kind of *inference*. If we, like Jonas, infer from human experience what experience of non-human living beings is like, we already presuppose our own fundamental experience that makes it possible for us to see living beings as living. The same applies to the Maturanian inference from similarity in biological structure to similarity in sensory experience (§35). Before the inference, we already find non-human animals to be living. This means that the inference is already based on the fundamental experience or perception of aliveness that is previously in operation. This experience makes it possible for us to acknowledge (or even directly feel) that living beings have their own experience. The ability that we use when we see animals as living is not of an inferential nature. To grasp the aliveness of living beings, we employ an ability that is much more basic and primitive than inference. What is needed here is not to infer, but to go back to that original ability and experience. By this move, we can face the above-mentioned circularity. Neither the Jonasian nor the Maturanian inference is capable of this task.

« 13 » This idea of circularity between knowing and the known can be traced further back to the intuition shown at a common origin of the Varelian and the Maturanian theories. In *The Tree of Knowledge,* Humberto Maturana and Varela explained, "what this book aims to show […] is that all cognitive experience involves the knower in a personal way, rooted in his biological structure" (Maturana & Varela 1987: 18). This is also called the "cognitive circle" or "ongoing recursiveness" (ibid: 241f).

"This circularity, this connection between action and experience, this inseparability between a particular way of being and how the world appears to us, tells us that *every act of knowing brings forth a world.*" (ibid: 26)

« 14 » Maturana and Varela also comment that this circularity "is so obvious and close that it is very hard to see" (ibid: 23). This is an essentially phenomenological way of thinking. The task of phenomenology is to bring carefully into awareness the fundamental fact of knowing experience that is difficult to observe because it is too obvious and close to our own experience (Taguchi 2006: 3–22). At this point, enactivism touches on the most authentic problem that Husserlian phenomenology addresses. Both enactivists and phenomenologists should go back to the original intuition of Maturana and Varela that is still showing us the way.

« 15 » In sum, what is at stake here is the fundamental phenomenon in which "seeing life" and "being life" are not two separate events, but constitute one and the same original fact. A life comes into "being" in the midst of my seeing it as life, and I see a life just because there exists a life. The phenomenon of life necessarily emerges "between" being and seeing, or rather, it consists in an inevitable circularity. Jonas does not enter this one and the same phenomenon of circularity. For him, knowing and the known fact of life seem to be separate facts. That is the reason why Jonas' philosophy cannot shake off the suspicion of anthropomorphism. The important thing is not to make an *inference* from one to the other, but to straightforwardly face the phenomenological *fact* of seeing life that takes place in the midst of our experience. This fact gives no room for inference. Instead, it should be phenomenologically described and analyzed. In such a way, we can keep enactivism away from anthropomorphism and, at the same time, we may possibly find a way to rehabilitate (a certain kind of) teleology in thinking of life, as the new stream of Varelian enactivism seeks.

Shigeru Taguchi is an associate professor at Hokkaido University, Japan. He has been working on phenomenology and recently also engaged in consciousness studies and Japanese philosophy. He is the author of *Das Problem des Ur-Ich bei Edmund Husserl* (2006) and two Japanese books on phenomenology.

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Sweeping Anthropomorphism Under the MAT

Paulo De Jesus
Goldsmiths, Univ. of London, UK
paulo242/at/hotmail.com

> Upshot • Villalobos and Ward reappraise enactivism's "Jonasian turn" and discover an untenable anthropomorphism at its core. As a corrective to this, the authors propose a Maturanian-inspired account of experience (MAT) that could accommodate central enactive insights while avoiding anthropomorphism. In this commentary, I will delve a bit deeper into Villalobos and Ward's treatment of anthropomorphism. In so doing, I will show that the notion of anthropomorphism (a) trades on an ambiguity that leaves the authors' own position open to accusations of anthropomorphism and that (b) it needs further justification for why it is at odds with science. I conclude with a few words on why the authors' assessment of a similar proposal by myself is unfounded.

« 1 » This important target article takes up an issue first raised in De Jesus (2016) against Varelian enactivism (VE) and attempts to rectify it with insights drawn from the work of Humberto Maturana. I am in total agreement with what I understand to be the two core theses of this article: (a) that Jonasian phenomenology is anthropomorphic and that VE falls into the same difficulties by following Hans Jonas, which as a consequence (b) requires VE to forego Jonasian phenomenology and adopt an alternative framework to accommodate its theoretical ambitions. I do, however, want to raise some concerns regarding the term anthropomorphism and how it is used by the authors. My reading of the target article suggests at least two possible ways in which the accusation of anthropomorphism could be understood, one compatible with the authors' overall arguments, the other not. Thus, because the authors are not entirely clear on which meaning of anthropomorphism they have in mind, they leave themselves open to accusations of anthropomorphism. It is further noted that the authors provide *no justifica-*

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tion for the claim that anthropomorphism is at odds with science.

« 2 » Let us begin by identifying the two distinct meanings of the term anthropomorphism at play in the article. The term anthropomorphism is variously used throughout the target article to mean either (a) the attribution of *human mentality/experience* to *nonhuman organisms* or (b) the view that nonhuman organisms are in possession of *any kind/type* of mentality/experience. That is to say, while (a) maintains that it is anthropomorphic to attribute human type mentality to nonhuman organisms, (b) considers it anthropomorphic simply to conceive of nonhuman organisms as possessing any type of mentality. For the sake of our discussion let us call (a) standard anthropomorphism (SA) and (b) benign anthropomorphism (BA). Generally speaking, anthropomorphism, particularly with regards to biological sciences, encompasses both meanings (Kennedy 1992). However, in the context of the article and enactivism more generally, these two meanings of the term need to be kept in mind in order to avoid unnecessary confusion.

« 3 » When Mario Villalobos and Dave Ward argue that anthropomorphism is at odds with modern scientific practice, it is far from clear which of the above two meanings they have in mind. They offer (§5) the standard definition of anthropomorphism as the practice of attributing human features to nonhuman organisms. At the same time, they also note that hydrologists would not explain the Nile's behaviour in terms of "desires, purposes and similar teleological concepts." This suggests that, in the context of biological science, for Villalobos and Ward, nonhuman organisms such as the Nile should not be understood in terms of desires, purposes and similar teleological concepts since these are strictly human properties. The authors thus appear to understand anthropomorphism in terms of BA, that is, it is anthropomorphic to regard nonhuman organism as possessing *any* type of mental properties *whatsoever* because only humans possess such properties.

« 4 » This understanding is especially prominent in Villalobos and Ward's discussion of Jonas's views on anthropomorphism. The authors begin their discussion by noting that Jonas's project centred around rejecting the view that "scientific biology, confined to the physical facts, acknowledges no experiential inner dimension of living beings" (§13). Here, anthropomorphism, for Jonas as for Villalobos and Ward, is a consequence of attributing an experiential inner dimension to nonhuman organisms. It is thus anthropomorphic to regard nonhuman organisms as possessing any type of mentality/experience (BA). It is this view that Jonas considers to be anthropomorphic and that he goes on to embrace in contradistinction to scientific biology. Villalobos and Ward follow suit and agree with Jonas that any research project that embraces *this type of anthropomorphism* is at odds with scientific practice. Villalobos and Ward can thus be read to be using the term anthropomorphism for anyone committed to BA.

« 5 » However, at the same time, anthropomorphism as SA also begins to emerge. As Villalobos and Ward (§14) point out, after taking issue with the fact that biological science does not account for the phenomenological dimensions of nonhuman organisms, Jonas takes the further step of arguing that it is through *our own* undeniable phenomenological experience that we are justified in attributing similar experiences to nonhuman organisms. Here, the SA meaning of anthropomorphism comes into play and is attributed to Jonas by Villalobos and Ward, who argue (§15) that this too is at odds with scientific methodology and practice. The overall discussion on anthropomorphism thus does not explicitly distinguish between these two meanings and proceeds as if anthropomorphism should be understood to encompass both meanings. But why, if at all, is this important?

« 6 » This ambiguity becomes important when we begin to question and probe why anthropomorphism – *which* anthropomorphism – is "at odds with science." Villalobos and Ward (§20) take the lead from Jonas on this question and simply reiterate, as Jonas did, that there is a deep incompatibility between science and anthropomorphism and that therefore we need to choose one over the other. Jonas chose anthropomorphism and Villalobos and Ward choose science. But here, we need to be careful in identifying what exactly is it, in the first instance, that Jonas is rejecting and embracing? To understand why Jonas considers his philosophical project to be one worth pursuing without condemnation and moreover preferred to science, we need to recognise that he is rejecting the view that (biological) *science denies any form of phenomenology to nonhuman organisms.*

« 7 » Jonas is thus first and foremost arguing that one cannot, without further argument, simply discredit the possibility that other organisms possess some sort of mentality or phenomenological experience. In other words, Jonas begins his argument against modern biological science by embracing BA, and therefore insisting that all organisms do have a phenomenological dimension. Thus, the core motivation for Jonas's embracement of anthropomorphism is the conviction that all organisms, not only humans, have an inner phenomenological dimension that in his view modern biological science was unable to account for or even recognise.

« 8 » The problem for Jonas, however, is that he then attempts to justify this conviction by drawing on his own embodied experiences. It is in so doing that Jonas inevitably commits himself to untenable SA. Nonetheless, when Jonas recognises and then argues that anthropomorphism is incompatible with science, it is not SA that he has in mind but rather BA. When Jonas argues that the "struggle against teleology is a stage in the struggle against anthropomorphism," Jonas means a struggle against BA and not SA. This is an important point because it bears directly on the authors' own broader aims of replacing Jonasian phenomenology with MAT.

« 9 » It is perhaps telling to note that at this stage, other than following Jonas on this point, Villalobos and Ward provide us with no further justification for why anthropomorphism is "at odds with science." But, as we have just seen, what Jonas is arguing against and then aligning himself with is far from being obviously "at odd with science." Surely, as the authors' MAT proposal attests, there could be no scientifically valid objection to wanting to explore whether nonhuman organisms possess phenomenological experiences. If there is, the authors need to provide us with some argument to defend this point and explain how it does not effect MAT. The authors do suggest (§22) that

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anthropomorphism is "bad" because the scientific community is very good at recognising anthropomorphic bias. But this is no argument whatsoever but merely a simple restatement of the same point by fiat. They also suggest that ignoring anthropomorphism is also "dangerous" because it could encourage positions such as my own (De Jesus 2016) – of which more shortly.

« 10 » Villalobos and Ward thus need to

- clarify what exactly they mean by anthropomorphism and
- provide us with an argument for why anthropomorphism is actually at odds with science.

A failure to do either of these leaves the charge of anthropomorphism not only unsatisfactory but more importantly leads to contradictions within the authors' own position. The problem for Villalobos and Ward is that their use of the term anthropomorphism clearly encompasses both meanings and as a consequence automatically rules out the possibility for any scientific exploration of the phenomenological experiences of other nonhuman organisms, including their own MAT proposal.

« 11 » While I would agree that it is scientifically problematic to adopt SA, it is far from obvious that defending BA should be understood in the same terms. Or, indeed, that it should be labelled anthropomorphic at all. MAT is, after all, a proposal that aims to accommodate the view that there is a phenomenological continuity between human and nonhuman organisms; are we to understand it as anthropomorphic and so at odds with scientific research? The dialectical logic followed by the authors in the target article, which fails to disambiguate the notion of anthropomorphism, seems inadvertently to commit them to precisely such a conclusion. While it might be correct that there is no necessary tension between advocating MAT and also holding the view that all living organisms have an experiential dimension, endorsing MAT must be considered anthropomorphic. MAT thus fares no better than Jonasian phenomenology.

« 12 » Note that the point raised here is not the same as the one anticipated by the authors (§35) regarding possible accusations of anthropomorphism. It is not because MAT recognises that analogous physiological sensory dynamics potentially give

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rise to analogous sensory experiences, but rather because Villalobos and Ward's own definition of anthropomorphism entails that only human organism have experience and nonhuman organisms do not; inferring otherwise is anthropomorphic. Clearly the authors should want to avoid this conclusion and to do this they need to be clear on the exact meaning of anthropomorphism. Furthermore, to bolster this, they will have to provide further arguments as to why their understanding of anthropomorphism is at odds with science.

« 13 » Le me conclude this commentary by saying a few brief words on the authors' reading of one of my papers addressing a similar issue. This analysis should I think go some way in showing that the authors' labelling of my position (De Jesus 2016) as "dangerous" is completely unfounded. First of all, in my paper I recognise that at the core of the life-mind continuity thesis proposed by VE is the intuition that other organisms have some sort of phenomenological experiences. In so doing, I allow not only for a phenomenological continuity between human and nonhuman organisms but also for a valid role for phenomenology within enactivism. Like the authors, I explicitly only reject *Jonasian phenomenology and not phenomenology as a whole.*

« 14 » Despite the issues raised here, this is undoubtedly an important article that should stir up much needed debate within the enactive community. If it does its job properly, it should get enactivists rethinking one of the key components – life-mind continuity – of its paradigm. While the finer details of the target article might still need further fine-tuning, the take-away message is undoubtedly clear and important.

Paulo De Jesus is a PhD student in the Computing Department at Goldsmiths, University of London. He has an MPhil in philosophy of cognitive science from King's College London and a BA in philosophy from Birkbeck, University of London. His main research interests are in the areas of enactive cognitive science and biosemiotics.

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Is Intentionality Banned from Sciences of the Living Being?

Jean-Luc Petit
Université de Strasbourg, Faculté de Philosophie, France
jeanluc.petit/at/unistra.fr

> Upshot • This commentary questions an assumption in the target article to the effect that science prohibits projecting any intentional properties or entities outside of human experience.

« 1 » By anthropomorphism, the authors of the target article mean "the practice of attributing human features (i.e., behavior in terms of desires, purposes or similar teleological concepts) to nonhuman entities" (§5). Such anthropomorphism, they claim, is prohibited in any respectable science. However, leaving aside the trivial case of innocent poetic metaphors humanizing elements of Nature (rivers *wanting* to reach the sea, etc.), it appears that such uncontroversial sciences as psycho- or even neurophysiology keep providing flagrant counterexamples to that claim.

« 2 » Specifically, an important literature on the cartography of the motor and premotor cortex in monkeys and other nonhuman animals has developed in the wake of Werner Penfield's pioneering work in man (Penfield & Boldrey 1937), revealing the presence of complex, integrated and intentionally-oriented neural representations of ethologically relevant behaviors, such as limb and mouth movements motivated by self-feeding or self-defense (Graziano 2015: 1–12; Kaas, Gharbawie & Stepniewska 2013: 407–414; Graziano 2009; Rizzolatti et al. 1987). This already shows that any search for brain correlates of intentional behavior involves rooting intentional properties in nature, specifically in sub-personal systems of the organism. And there is no question that sub-systems in the (human or nonhuman) organism (apart from the dimensions of behavior they encode) are more like automatic mechanisms than resembling whole human agents, the usual bearers of intentional properties. Without an unobjectionable 'anthropomorphism'of this type, cognitive neurosciences simply could not carry

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out their program. But the same sciences do not hesitate to take a more compromising commitment in favor of the existence of intentional properties in nature. If there is no surprise in finding neural correlates for goal-oriented behaviors, surely nobody would expect neural correlates for what amounts to telepathy! However, the studied animals not only possessed brain cognitive maps of the repertoire of innate or learned actions they use for attaining their own aims, but possessing the same maps enabled them to perceive and recognize directly, not inferentially, the intentions for alien actions by merely observing the postures and limb movements of other animals, and not necessarily conspecifics (Di Pellegrino et al. 1992: 176–180; Rizzolatti & Sinigaglia 2006).

« 3 » Notoriously, the researchers insist on acknowledging the existence of those high level neural motor representations or high level sensorimotor stimuli as irreducible to any linear, summative hierarchic recruiting of individual muscles or muscular synergies or low-level reflexes through corticospinal or thalamocortical pathways. In so doing, are not they typically "attributing desires, purposes and similar human features to nonhuman entities"? But how can we reproach them for doing so, unless we return to the ante-cognitive behaviorism of Watson or Skinner, which deprived the scientist community of the benefit of Theodor Lipps's (1903) profound intuition about the function of *Einfühlung*: the capability of putting oneself into the body of another observed agent that one is trying to understand, until its brain correlates – the so-called "mirror neurons" – were discovered in the monkey brain by Giacomo Rizzolatti and his team a century later?

> "It is as if these neurons (in F5 and AIP) reacted not to the stimulus as such, that is, to its form or its sensorial appearance, but to its *meaning* for the animal. But reacting to a meaning is precisely what one means by 'understanding' (Petit 1999: 239)." (Rizzolatti & Sinigaglia 2006: 49)

« 4 » In the world of day-to-day life, we might occasionally bump into pieces of furniture or be injured in a car crash, but far more constantly we deal with the intentions, wills, desires, ambitions, pretentions, etc. of other people. If ignoring obstacles in one's

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way would surely be unwise, pretending – as is usual in science – that the world can be reduced to its physical components without any intentional properties whatsoever would prove to be no less dangerous. "Nothing other than elementary particles dancing in a vacuum": whatever intellectual satisfaction a philosopher might draw from abiding by that dogma of the conventional scientific view of nature, it cannot be upheld seriously unless one concedes that the rich ontology of intentional entities of lived experience boils down to a mere illusion of consciousness. The current way out is to refer, as the ultimate aim of science, to the endorsement of a purely physicalist ontology and make do in the meantime with emergent properties at each level of organization of the living being considered as a complex system. But it is hardly satisfactory to assume level after level of emergent properties miraculously levitating in thin air above an indifferent material substrate. If intentional entities of our experience are not illusions of consciousness, the question is what support might they find at the subpersonal levels of organization of the living organism that we, the agents of intentional actions, are made of.

« 5 » Inert matter is characterized by a state of thermodynamic equilibrium that allows chance fluctuations that remain generally short-lived, not to say instantaneous. From a strictly physicalist point of view, the very possibility of existence for a living being consists in keeping itself, for a while, at a distance from thermodynamic equilibrium (Bailly & Longo 2006: 229–250; Longo & Montévil 2012). But how is such a durability of existence possible, considering the far higher probability of dysfunctioning than normal functioning of mechanisms responsible for the vital functions of living? In so complex a system, which involves a multiplicity of interleaved closed loop feedback influences, the least occurrence of a localized abnormal micro-event threatens to trigger a cascade of rapidly catastrophic consequences, putting its very survival in jeopardy. Answering that challenge, it was recently advanced that our aptitude for making sense of the circumstances of experience might be rooted in some "fundamental properties of the living being," such as an ability to invent original solutions to its problems of survival, appealing to resources

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of plasticity, vicariance, or even – however paradoxical it might seem for a complex organism – of "simplexity," not to say simplicity proper (Berthoz 2009, 2013; Berthoz & Petit 2014). But, surely, assuming up to now unrecognized, or simply neglected "fundamental properties" will have a price in terms of fundamental ontology? And it is uncertain that alluding to a yet unknown law of natural evolution might dispense us from enlarging the basic physicalist ontology with some measure of vitalist, or even intentionalist teleology. What measure? That is the question, if we are concerned that such a departure from the rule of Occam's razor in ontology remains tolerable for any scientific community. One is tempted to conclude that despite their allegiance to an officially physicalist ideology that does not match their actual needs, life sciences keep surreptitiously borrowing from the repertoire of intentional entities of a phenomenological description of human behavior. Except that the evidence of this state of affairs in natural science might remain imperceptible to anyone but the phenomenologist, who differs from all other theoreticians by his choice of taking a position not on the ultimate rock-bottom of things in themselves, as naive scientists do, but rather upon the phenomenal field of human conscious experience with a view to assessing the ontological assumptions of natural sciences in their investigation of the causal underpinnings of this same phenomenal field.

A professor of philosophy at Université de Strasbourg, **Jean-Luc Petit** has organized a series of workshops and conferences intended to promote dialogue between phenomenology and cognitive (neuro)science. In collaboration with Alain Berthoz at Collège de France (Paris), he co-authored and edited several collective volumes at the interface between these same topics.

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Modern Anthropomorphism and Phenomenological Method

Peter Gaitsch
University of Graz, Austria
peter.gaitsch/at/uni-graz.at

> Upshot • As a reply to the criticism that anthropomorphism and modern science are incompatible, targeting Jonasian phenomenology and Varelian enactivism, I suggest considering the concept of modern anthropomorphism, which seems prima facie compatible with the pluralistic situation of today's life sciences. My further claim is that the phenomenological method is intrinsically linked with this sort of anthropomorphism.

« 1 » In their stimulating target article, Mario Villalobos and Dave Ward reveal a major tension or ambivalence at play in Varelian enactivism (VE). To my mind, this ambivalence concerns, in the final analysis, the methodological function and the ontological status of the "experiential dimension" (§25) regarding VE. Namely, VE seems undecided whether it intends definitely to capture first-personal experiential facts by third-personal structures, or whether it intends to hold first-person experience as a realm on its own. In the former case, the methodological function of human lived experience would ultimately only consist of offering an *explanandum* for scientific practice, and in its ontological status, it would count as an epiphenomenon. In the latter case, human lived experience would serve methodologically by identifying a certain kind of experience, which is possibly attributable to another nonhuman living system or ultimately even to all biological systems, and ontologically, it would count as a "psychic reality" in its own right, possibly spread across all kingdoms of biological life. Although Villalobos and Ward deal with this question only with regard to the influence of Jonasian "anthropomorphism" on VE without directly examining VE's findings, their general claim about VE's ambivalence on this point appears rather convincing to me. But still the question remains whether this ambivalence is scientifically fatal or, on the contrary, might reveal itself to be scientifically prolific. Put differently, do we necessarily have to choose one of the two mentioned options in order to gain scientific reputation? It seems, on the contrary, that the ongoing research in cognitive science is not profoundly troubled by such philosophical foundational ambivalences. We can compare this situation with the interpretation of quantum mechanics, since in order to work successfully with the equations of quantum mechanics, we are not required to decide the still controversial question of its ontological interpretation in either a realist or a nonrealist sense. The persistent ambivalence does not corrupt its scientific reputation. Concerning the philosophical assessment of the experiential dimension, we might be in a similar state.

« 2 » Let me now turn to "problematic anthropomorphism." In discussions on science, the term "anthropomorphism" is commonly used as a polemical concept. Villalobos and Ward make no exemption when they define anthropomorphism as "the practice of attributing human features to nonhuman entities" (§5). This is *self-evidently* problematic; no further argumentation is needed. To avoid a discussion with a straw man, it seems therefore indispensible to think of a more substantial concept of anthropomorphism. This is also required by the option – only mentioned, but never explained in the article – that there might exist the possibility of "a new conception of scientific inquiry" (§38), which would include an *unproblematic* anthropomorphism. Usually, the authors place too much reliance on Hans Jonas's claim that "modern science" *as such* excludes any legitimate reference to anthropomorphism (§19). Although Jonas was, of course, not familiar with recent "pluralistic" developments in life sciences, especially in cognitive sciences, which led to a crumbling of the anti-anthropomorphist front (Köchy 2008: 21), he combines his bold claim with the important observation that the exclusion of anthropomorphism from "modern science" is not a matter of empirical results, but a thoroughly methodological issue (§19). It is unfortunate that Villalobos and Ward, in turn, seem to take this mutual exclusion as a matter *of principle* without considering the manifold methodological transformations that are conceivable and, what is more, are already making their way within the very framework of "modern science." In this way, they unintentionally commit themselves to the Heideggerian world view that anthropomorphism is tied to a "*pre-modern* view of living beings" (§21; my emphasis).

« 3 » Now let us conceive a substantial concept of *modern anthropomorphism* (MA). It has two facets, which already transcend Villalobos and Ward's framing of the discussion. First, MA legitimates itself as a methodological procedure by the insight that the "experiential dimension" is accessible only from a first-person (and, furthermore, second-person) perspective. This inextricability already tells us something about its ontology. But the point here is that MA is not a reckless practice of attribution (§5) but a rigorous matter of access. Second, unlike Villalobos and Ward, MA does not take it for granted that the features accessed by first-person experience are strictly speaking "human," as lived experiences do not come along with any name badge. MA takes the risk of specifying *features of life* by reflecting on his own experience *as a living and lived body* in order to "attribute" them to other living bodies. Indeed, in terms of the phylogenetic scale, this leads to a "top-down" approach to the phenomenon of life (Welton 2011; Vörös & Gaitsch 2016: 155), which takes what comes "last" in evolution, not what comes "first," as the exemplary case. Thus conceived, MA appears to be a perfectly legitimate, maybe complementary, stance in the pluralistic situation of modern life sciences, and VE's appeal to anthropomorphism seems *prima facie* justified. Furthermore, it is noteworthy that MA does not rely upon "ideological or ethical" reasons (§22), but is simply one more required epistemic strategy for getting to grips with the phenomenon of life.

« 4 » It is revealing that, although Villalobos and Ward intend to follow an entirely different road, they themselves make use of a basic kind of anthropomorphism, as they themselves concede (§35), in their presentation of Humberto Maturana's "phenomenology," which they introduce as an alternative to anthropomorphist VE. Indeed, in order to speak seriously of "visual experiences" of nonhuman organisms, we must ultimately refer to our own qualia, that is, to our experience of the quality of seeing, which we *then* can put into an empirical correlation

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with certain biological structures of our organisms, especially of our brains. Based on shared similar biological structures, we are *then* justified in attributing an (analogical) counterpart of our own qualia (the phenomenality of vision) to the nonhuman being. But Villalobos and Ward's presentation gives rise to another ambivalence with regard to the meaning of "experience": either, by allowing a "narrower range of experiential [i.e., epiphenomenal; P. G.] properties" (§36), it differs only gradually from anthropomorphist VE; or it implicitly assigns to the vague term "experience" an entirely third-person "structural" meaning, devoid of any experiential or phenomenal dimension – this, of course, despite assertions to the contrary (§37). What is worse, Villalobos and Ward's reading of Maturana provides us with a rather mutilated or poor phenomenology of the living being. Because they focus narrowly on similarities with respect to sensory systems and moreover *postulate* the "incommensurability" (§32) between human ("linguistic") and nonhuman ("non-linguistic") experiences, they do not consider the high phenomenological relevance of factual "behavioural interactions" (§28) *between human and nonhuman beings*. They end up by describing nonhuman organisms as epiphenomenal living systems, insofar as all causally relevant dimensions of experience, in particular all volitional aspects with their "intrinsic teleology" (Weber & Varela 2002: 110), are ruled out (§36). Probably, it is their intent to save the causal closure of the physical that leads them to the biased phenomenology of pigeons, since taking into account certain behavioural interactions, between the pigeon hunter and the pigeon, in the course of poisoning pigeons in the park, may have easily led to the conviction that these creatures indeed *strive* to stay alive.

« 5 » Since Villalobos and Ward still defend the idea of incorporating phenomenology into cognitive science, they opt for a phenomenology without anthropomorphism (§23), which should provide "naturalistically acceptable explanations of how our subjective lives emerge from the dynamics of our bodily engagement with the world" (§38; my emphasis). At this point, I have the impression that they overstate the "heterogeneity of phenomenology" (§3). For it seems well-established that all the authors mentioned, from Edmund Husserl to Maurice Merleau-Ponty and to Jonas, despite their differences, share a basic set of methodological concerns: the inseparability of being and appearing; the transcendental function of the human first-person perspective; the critical rejection of the "natural attitude" and of reductionism as an explanatory strategy; the reference to the prescientific lifeworld as the grounding source of sense and knowledge (Zahavi 2007: 13–35). According to this, any phenomenological analysis, in its default setting or starting position, strictly implies a – not necessarily idealistic (Gaitsch 2014) – kind of *correlationism* of human subjectivity and world. Concerning the phenomenological inter-subjective analysis of nonhuman life, it may well be the case that the phenomenological default setting could be methodologically transformed in order to correspond to nonhuman forms of life – this is precisely the important role of Husserl's genetic method of *Abbau* ("unbuilding" or "dismantling" the full-blown human subjectivity) with regard to biological life (Husserl 1973: 112–117). However, due to this methodological structure, phenomenology cannot do without attributing at least a basic kind of *minimal subjectivity*, characterized as a site for the appearing of the world, to the nonhuman "minimal organism" (Varela 1997: 81). Note that these conditions also apply to the work of Merleau-Ponty – to whom the authors refer to as being a more promising alternative to Jonas (§23, §38) – since Merleau-Ponty's general focus on the living and lived body – on "the dynamics of our bodily engagement with the world" (§38) – is not meant to lead to an objectivistic or utterly third-personal grounding of subjectivity, but precisely to a primordial kind of subjectivity. Therefore, providing a reductive explanation "of how our subjective lives emerge" (§38) is not a job that can ever be assumed by phenomenology, because phenomenology is methodologically intrinsically linked with top-down anthropomorphism in the style of MA. Given this, it is highly questionable how a "bottom-up phenomenology of biological systems" (Welton 2011: 102) could operate at all.

« 6 » From a phenomenological perspective, I finally want to suggest a philosophical answer to the initial question (which we may still leave open with regard to scientific practices). If VE is committed to phenomenology, then it has to admit the methodologically and ontologically irreducible status of the experiential dimension. The alternative is a (mis)use of some phenomenological insights for other purposes. However, it should be noted that this description of the situation is not tantamount to denying every possibility of naturalizing phenomenology by rethinking the modern concept of nature according to a "redefined non-reductionist naturalism" (Gallagher 2012: 89); but what it rejects is to construe the relation between naturalization and anthropomorphism as an unresolvable conflict.

Peter Gaitsch gained his PhD from the University of Vienna in 2013 with a thesis in metaphilosophy. He is a faculty member at the Department of Theology, University of Graz. His current research interests are in the fields of phenomenology, philosophy of biology and philosophy of religion.

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Varela's Sixth Step: Teleology and the Re-Visioning of Science

Steve Torrance
University of Sussex, UK
stevet@sussex.ac.uk

> Upshot • Jonas was not defending an unrestrained anthropomorphism but, rather, a "zoomorphism," which offered a rigorous, considered view of the deep phylogenetic origins of purpose and mind. Jonas did not reject science *per se*, but an alienated, rigid conception of the latter. His work helped pave the way to a richer science of mind.

The five steps – and a sixth

« 1 » There is no doubt that Andeas Weber and Francisco Varela's (2002) celebrated paeon to Hans Jonas was considered a landmark within the enactivist community. But was it a "wrong turn"? And how distinctive a contribution anyway did Jonas's thought make to enactivism?

« 2 » In order to answer that question, we must first consider the key elements of "canonical enactivism." One source for this (among many that could be selected) is to be found in Evan Thompson's tribute to Varela presented at a commemorative meeting in Paris (Thompson 2004; see also Thompson 2007: Part II). Thompson's lecture explicitly considers Jonas's contribution to Varela's thought, among many other currents in Varela's work.

« 3 » Thompson elaborates five key steps, which offers one way of summing up the core of mature Varelian enactivism. I here reduce Thompson's already concise outline (2004: 386f)[1] to a set of paraphrases. (I) *Life = Autopoiesis:* the conditions of autopoiesis are necessary and sufficient for the organization of minimal life. (II) *Autopoiesis entails minimal selfhood*: an organic identity. (III) *Selfhood entails the emergence of a world* – "a correlative domain of interactions proper to that self." (IV) *Self + world jointly entail sense-making:* the world of an organism is a source of appetitive significance. (V) *Sense-making = cognition,* in the minimal sense of sensorimotor activity to maintain autopoietic viability within the organism's world of significations.

« 4 » I suggest that Jonas's major contribution is that he enabled Varela to take a further step: (VI) *Sense-making/cognition entails immanent teleology.* Any autopoietic system defines itself as an intrinsically purposive identity. This was an important new step – a definite move away from the original conception of autopoiesis. As Mario Villalobos and Dave Ward (hereafter VW) point out (e.g., § 26), the classical theory of autopoiesis "conceives of living beings as mechanistic and deterministic systems, hence as entities without purpose, freedom of action or intentional properties." Or as Humberto Maturana and Varela put it themselves: "Living systems, as physical autopoietic machines, are purposeless systems" (Maturana & Varela 1980: 86)

« 5 » In a footnote to his Paris lecture, Thompson refers to email exchanges he had with Varela in 1999. Both had recently been reading Jonas's work. Thompson asked Varela how he saw Jonas's strongly teleological stance, given the anti-teleological slant that Varela had inherited from his original work with Maturana on autopoiesis. Varela was initially tentative: he preferred to see autopoiesis as a source of original intentionality (*aka* sense-making) rather than of original teleology. However, in a later exchange Varela indicated that he had come to have a "broader view" about what autopoietic theory implied: "in a funny way you do recover a full fledged teleology … [that is] intrinsic to life in action" (Thompson 2004: 395 fn 9; see also Thompson 2007: ch. 5 fn 7). This was the additional Jonasian step, which was defended with some vigour by Andreas Weber and Varela in their paper "Life after Kant" (Weber & Varela 2002; see also Weber 2002). Is it a mis-step?

« 6 » VW claim that Jonas's existential slant on biological facts assumes an egregious anthropomorphism, which is incompatible with enactivism's claims to provide an alternative *science* of mind. I challenge VW's case for convicting Jonas of an illegitimate anthropomorphism; and I also argue that their notion of what makes for a legitimate scientific enquiry is rigid and unexamined, and ignores or misunderstands a distinctive enactivist conception of science already well-elaborated by Varela and others prior to the "Jonasian turn." Jonas's work should continue to be taken seriously as a key source for elaborating the strong life–mind continuity – although his importance within enactivism can be overstressed.

Is the Jonasian turn a wrong turn?

« 7 » Anthropomorphism, as VW characterise it, is "the practice of attributing human features to nonhuman entities" (§5). An illustration they give of an illegitimate use of anthropomorphism is that of talking of a river as "wanting to reach" or "having the purpose of reaching" the sea. While fine as a figurative description, this cannot, they say, be part of serious scientific theorising.

« 8 » However, the way they present their illustrative example is puzzling. When purposes are attributed to rivers, etc. in this way, there is usually no *specific* mention of human purposes. The allusion is to purposive action in general – and that could just as easily cover a lion stalking its prey or a slug edging towards a lettuce-plant. Do lions or slugs have intrinsic purposes? Let us not judge that either way for now: but we certainly cannot assume at the outset that any attribution of purpose to non-human agents or processes must be inescapably anthropomorphic. To do so is to beg the question of how and where intrinsic purpose is found in the natural world.

« 9 » In order to establish Jonas's unacceptable anthropomorphism, the authors quote variously from *The Phenomenon of Life* (Jonas 1966; hereafter PL) They start by reproducing at some length (§12) the opening remarks of that book. However – again puzzlingly – the quotation from Jonas starts with a *critique* of anthropomorphism, or at least of anthropocentrism:

> "Contemporary existentialism, *obsessed with man alone*, is in the habit of claiming *as his unique privilege and predicament* much of what is rooted in organic existence as such …" (PL: ix; emphases added)

« 10 » Jonas wishes to distance himself from the stress on the human sphere that he found to dominate contemporary existential and phenomenological writing. Instead, his project was to apply a phenomenological perspective across the organic world. But in doing so, he was not trying to impose anthropic categories upon non-human living species in a simple-minded and anti-scientific way. His aim was not to eliminate science but to transform it. He saw the mechanistic scientific wisdom of his day as wedded to a conception of biology that problematized the subjective, experiential dimension of life, and foreclosed the question of teleology in organic existence.

« 11 » In the face of overly man-obsessed phenomenology, and of overly mechanism-obsessed science, Jonas proposed a unifying perspective that coalesced the human into the broadly organic sphere. This is surely a profoundly non-anthropomorphic stance. Admittedly, Jonas's outlook is human-centred in that it reverses a scientized "alienation of man from himself" (cf. PL: 37, cited by VW at §18) But it also reverses the alienation of humans from our fellow-creatures implied by anthropocentric viewpoints. For Jonas, the significant demarcation was between the living and the non-living – more specifically, between systems endowed with,

1| See Thompson (2007: ch. 6) for a revised version of these five steps and associated discussion.

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and systems lacking, a self-maintaining metabolism. In this respect, of course, he is on all fours with autopoiesis theorists, except, of course, he was not aware of the theoretical machinery of autopoiesis and how it might support his view.

« 12 » VW cite various passages from the early parts of PL to show Jonas's unacceptable anthropomorphism. In relation to one such passage, they observe that Jonas "finds that 'the anathema on any kind of anthropomorphism' proves to be, on closer examination, more 'a prejudice' than an empirically demonstrated principle" (§19; PL: 23). They see this and other of his remarks as evidence that Jonas is rejecting "science" and allowing himself simply to spread human-like purposes across organismic nature in a way that evades scientific rigour or justification. However, for some reason VW have chosen to suppress, from the latter citation, an important element in this passage. A fuller quotation from the original text reads:

> "The anathema on any kind of anthropomorphism, *even of zoomorphism,* in connection with nature… may turn out to be, in this extreme form, a prejudice." (PL: 23, emphasis added)

And compare this remark, not cited by VW:

> "Anthropomorphism at all events, *and even zoomorphism in general,* became scientific high treason." (PL: 37; emphasis added)

« 13 » Contrary to VW's claims, Jonas should surely be read, in these passages, as asserting, in the face of a scientific ontological correctness, the right to apply psychological attributions to organic nature, where necessary: this is hardly a chauvinist form of anthropomorphism. On the basis of the quotations given in the target article, when properly contextualized, Jonas can hardly be seen as a committing a deep methodological error. If it is one, then it is endemic throughout writings defending enactivist and autopoietic approaches.

Not rejecting but re-visioning science

« 14 » In fact, throughout this part of PL, Jonas is using his discussion of anthropocentrism to make a deep epistemological point, one that he develops over much of the

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book, and in many different ways – a point summed up in his often-quoted phrase that "life can only be known by life." A proper understanding of the "needful freedom" of the organism can be achieved only because the scientist is also herself a needful, organic centre of concern. Far from rejecting science, this is to re-vision science, to re-score the scientific enterprise in a new key. Such an approach is wholly of a piece with a key message of *The Embodied Mind* (Varela, Thompson & Rosch 1991) and later writings by Varela and other enactivists: a science of mind must be more than a merely third-person statement of the causal processes of an objectivised world. It must also embrace the first-person perspective of the scientist's lived experience – the embodied, concernful subjectivity that is inescapably part of owning a mind. (This is not to do with the specifically *human* nature of how we come to recognize subjectivity and purpose in creatures, but with our animate being.)

« 15 » In the Paris lecture referred to earlier, Thompson expands on how this essential message from *The Embodied Mind* has been taken less seriously than other messages from that work. He writes:

> "if I may be bold, I think that … the book's central theme has yet to be fully absorbed. That theme is the need for back-and-forth circulation between scientific research on the mind and disciplined phenomenologies of lived experience." (Thompson 2004: 382)

« 16 » Thompson traces the way in which the development of Varela's ideas on neurophenomenology in the mid-1990s provided a blueprint for an enhanced form of scientific understanding of mind, which engendered this circulation between science and lived experience. Varela's (1996) key paper on neurophenomenology targeted the "hard problem of consciousness," the explanatory gap between brain and lived experience. As Thompson puts it: "Francisco's insight was that no purely third-person, theoretical proposal or model would suffice to overcome this gap" (Thompson 2004: 383). And, quoting directly from Varela's paper: "the experiential pole enters directly into the formulation of the complete account" (Varela 1996: 345). To provide a full scientific account of consciousness, science had

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to be expanded to incorporate rigorous phenomenology. So, too, with the hard problem of teleology: Varela came finally to see, through the lens of Jonas's work, that this could be treated in a similar way.

Jonas situated

« 17 » So – at least on the basis of the selections of PL that they have quoted in their target article – VW's case against Jonas seems weak. Where Jonas appears to write in defence of "anthropomorphism" he is being rhetorical, and is in any case putting forward a "zoomorphism" rather than any specifically human-centred account of life. His rich attribution of psychological categories, including teleological notions, to primitive organisms is found in many other writers, both within and outside the enactivist tradition.

« 18 » A general doubt can be raised as to propriety of applying such terms as "sense-making," and other rich psychological terms, to a variety of primitive organisms, including bacteria moving up sugar-gradients. It could also be debated whether metabolic or autopoietic organization alone is sufficient to justify such attributions. But this is an issue that has to be discussed in relation to a whole variety of writers, not to Jonas alone. (See, for example, Ezequiel Di Paolo 2005; Thompson 2007, for discussion of one dimension of criticism; and Margaret Boden 2000 for a more robust skepticism; also Lynn Margulis and Dorion Sagan 1995; Maxine Sheets-Johnstone 1999 for a defence of such rich attributions)

« 19 » To sum up, Jonas does not seek to reject science but to deepen and enhance it in the light of his phenomenology of the organism. And his scientific critique is very much in harmony with that already embraced by Varela prior to the latter's endorsement of Jonas's work. The distinctive step that Jonas enabled Varela to take was to affirm that autopoietic or metabolic autonomy entailed an intrinsic teleology in living creatures. Varela was perhaps hampered by making such a move earlier because of his reluctance to cast himself loose from the mechanistic constraints of classical autopoietic theory. But such a move was in any case already encapsulated in the core enactivist doctrine that autopoiesis implied a "surplus of signification" (Varela 1991,

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1992) or "sense-making" (Varela 1984). If this richness of psychological attribution to primitive organisms is to be criticised, it is a general issue concerning enactivist and related approaches, rather than one specific to Jonas's work.

Steve Torrance is a visiting senior research fellow at the Centre for Research in Cognitive Science (COGS), University of Sussex, UK. He has written articles and edited collections on issues in enactivist philosophy, and on the relation between ethics and the sciences and technologies of mind.

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Phenomenological Teleology and Human Interactivity

Rasmus Gahrn-Andersen
Syddansk Universitet, Denmark
rga/at/sdu.dk

Matthew Isaac Harvey
Syddansk Universitet, Denmark
harvey/at/sdu.dk

> Upshot • We argue that Villalobos and Ward's criticism misses two crucial aspects of Varelian enactivism. These are, first, that enactivism attempts to offer a rigorous scientific justification for its teleological claims, and second, that enactivism in fact pays too *little* attention to the nature of human phenomenology and intentionality, rather than anthropomorphically over-valuing it.

« 1 » Mario Villalobos and Dave Ward (V&W) criticize Varelian-inspired enactivism (VE) for its apparent anthropomorphic inclinations. Allegedly, Varela and colleagues use human cognition as a model for cognition in general. V&W build their argument on several observations with which we agree, including (a) that Hans Jonas's biological phenomenology builds on human subjectivity in a way that, by his own admission, is incompatible with the ontology behind the modern scientific method, and (b) Francisco Varela and other enactivists fail to draw a terminological as well as phenomenal distinction between human agents' directedness and the directedness of other types of biological agents (e.g., Di Paolo 2005; Thompson 2007; Weber & Varela 2002).

« 2 » Despite this initial agreement, we think that V&W's overall criticism is misguided. The reason for this is twofold: first, V&W entirely leave aside VE's attempt to offer scientific justification for their use of teleological terms such as "intention" and "purpose," and second, while V&W are right to criticize VE for its problematic conception of intentionality, that conception is problematic primarily because it pays *insufficient* attention to human experience, rather than over-generalizing it. We will show that their criticism misses its mark for these reasons, although we agree that fundamental aspects of VE are a challenge to its paradigmatic aspirations.

Justifying enactive teleology

« 3 » Jonas's reasons for his anthropomorphic stance on teleology are endorsed by VE, in the passages indicated by V&W (§21), but in all cases the endorsement is either prefatory or ancillary to an argument that relates to Jonas in a different way. Rather than choosing one side of the distinction between ontologies that either explicitly relate to human experience (and so also to teleology) or those that utterly deny that phenomenology can play a role in science, VE builds on Jonas's recognition of a difference between living and non-living systems. For Evan Thompson (2007) and Ezequiel Di Paolo (2009b), the key point in Jonas is not a phenomenological one but rather an ontological one, namely that only living systems actively regulate their own interactions with the environment. VE, following Jonas, argues that for living systems it is sensible to talk of "purposes" and "intentions" as specifiable patterns in the dynamics of the system's operation. Non-living systems are taken to be non-teleological because they fail to display these same patterns. This means that speaking of "purposes" with respect to non-living systems is strictly metaphorical and so scientifically inadmissible.

« 4 » This means that V&W mischaracterize the relation between VE and Jonas's biological phenomenology. Especially with respect to teleology, it is a matter of inspiration more than endorsement. "The theory of autopoiesis can be called upon to complement this [Jonas's] account," writes Thompson (2007: 153), by specifying (ibid: 145f) the organizational characteristics of living systems (spelled out on ibid: 97–107) that justify speaking of them in intentional terms. Di Paolo (2005: 31) suggests that autopoiesis "provides a serious scientific account" of the "initial step" of the continual back-and-forth between science and experience that is essential to a successful investigation of cognitive phenomena. VE draws on Jonas for a perspective on the study of living systems, supported by certain useful concepts such as needful freedom. They also sometimes appear to have adopted the specific anthropomorphic aspect of Jonas's work picked out by V&W, but they do so first and foremost because it is a logical consequence of their interpretation of autopoietic theory, and subsequent development of it in terms of immanent purposiveness.

« 5 » It is in this specific sense that VE speaks of "purposes," "intentions," "norms," and other anthropomorphically-derived concepts (Barandiaran, Di Paolo & Rohde 2009; Barandiaran & Egbert 2014). For VE, the activity of an organism is intentional because – or rather, in that – it is organized into patterns that maintain its organization over time. This is, or at least can be read as, a perfectly legitimate piece of scientific theorizing, one that can be disputed by presenting evidence that some systems fail to display precarious operational closure.

« 6 » In light of this, V&W's failure to mention this seems very odd, given that they approve of Humberto Maturana's observer-dependent position (Maturana 2002), and take it to be unproblematic in its anthropomorphism, precisely because it is based in biological science:

> "[Maturana's autopoietic theory's] inference from properties of human sensory experience to properties of its nonhuman relatives is grounded by the conviction that our empirically determined grasp of the structural dynamics of the physiology of our sensory systems is our best guide to the properties of our sensory phenomenology. If this is right, then we may conclude that similarity in biological structure goes with similarity in sensory experience." (§35)

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« 7 » But this is exactly the type of argument most proponents of VE, *inspired* by Jonas, wish to make. And if this is so, then it is incorrect to say that VE is in the business of "positing […] natural purposes that receive no further explanation in terms of structure or dynamics" (§38). Because all living systems allegedly share a certain similarity in their organization, and because this specific organizational feature is definitionally linked to teleology, they are justified in speaking teleologically about non-human organisms on grounds independent of their acceptance, or not, of Jonas's theory.

Phenomenology and teleology

« 8 » We agree with V&W that VE usually promotes a simplistic view of intentionality. However, contrary to V&W's point, VE has not in fact paid special or undue attention to the phenomenological aspects of human cognition. This is evident from Hanne De Jaegher and Di Paolo's (2007) notion of "participatory sense-making," which neglects the constitutional role played by phenomenology in human social interactions (cf. the criticism by Stephen Cowley & Gahrn-Andersen 2015). In addition, similar neglect is also reflected in the fact that intentionality is generally conflated with the enactivist concept "sense-making," a concept that proponents of VE indiscriminately apply to everything from humans to animals and bacteria. Thompson offers the following definition of sense-making:

> "'Sense-making' is reminiscent of the phenomenological notion of intentionality, which signifies not a static representational 'aboutness,' but rather an act of intending, a purposive striving focused on finding satisfaction in further cognitive acquisitions and experience." (Thompson 2004: 389f)

« 9 » The phenomenological literature, however, reveals that there is more to human intentional directedness than what is implied by mere sense-making. For instance, Martin Heidegger argues that human cognition comprises a synthesis of two kinds of intentionality: (a) "primordial intentionality" and (b) "full intentionality" (cf. Dreyfus 1988). He thus suggests that cognitive agents first and foremost reflect an immediate, non-representational directionality towards the world. While this kind

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of directedness does not involve linguistic meaning, the same does not hold for full intentionality. Following Daniel Hutto and Erik Myin (2013), "full intentionality" may be seen as synonymous with fully-fledged human cognition since it involves linguistic meaning. This is in line with Maturana, who argues that humans differ from other species in that our cognition emerges as a "linguistic psychological space" (§30).

« 10 » To sum up, VE has in fact no latent commitments to anthropomorphism. This is also underlined by recent VE-accounts, which either treat human cognition as a particular kind of sense-making (Froese & Di Paolo 2011) or seek to come to terms with human language (Cuffari, Di Paolo & De Jaegher 2014). VE needs to evoke a distinction between different kinds of intentional directedness in order to be successful in these attempts, as sense-making is a necessary but not a sufficient condition for human cognition (Harvey, Gahrn-Andersen & Steffensen 2016).

Teleology and human cognition

« 11 » Despite these specific points of disagreement, we think that W&V are right that enactivism in the Varelian tradition has problematic implications that pose a serious challenge to the paradigmatic aspirations of VE research. As we see it, the problem is twofold (see Harvey, Gahrn-Andersen & Steffensen 2016 for detailed exposition of both points). First, VE's core concepts (including "autonomy" and "sense-making") reflect strong assumptions about the closed organization of living systems, and thus cannot account for all types of living phenomena. It is doubtful that precarious operational closure is a necessary requirement for life. Second, when it comes to explaining interactional dynamics, VE is restricted by its simplistic notion of intentionality, which traces everything that determines agent-agent and agent-environment interactions to the immediate situation. For this reason, Varela-inspired enactivism ends up focusing predominantly on localized routines, values and actions.

« 12 » With regard to human cognition, we argue that agents make sense of what is given in local situations on the basis of certain non-local factors that normatively influence the situation as well as the agents. Bert Hodges provides several examples of

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how non-local norms affect cognition. For instance, he mentions that values including accuracy and safety are essential for driving a car (Hodges, 2009: 631). Non-local rules and norms impact everything from solitary thinking and problem-solving to social encounters. Normativity plays a crucial role in that it reduces contingencies. For instance, social norms prescribe behavior in relation to given contexts whereby individuals behave in accordance with the expectations of others.

« 13 » However, we wish to explore a different path rather than blindly accepting Hodges' ecological account, which suffers from being overly descriptive. Because a variety of norms and values can be inferred from any given situation, and Hodges's holistic theory gives no way to choose among them, it has little explanatory value. Furthermore, it ignores the phenomenological dimension of human cognition, conceiving of values as determined by the situations in which people find themselves. On our view, the constitution of norms and values cannot be explained by exclusive reference to individual predispositions and capacities (VE's claim) or to a transcending situation (Hodges's claim). The sense-saturated nature of human cognition (or: *interactivity*, cf. Harvey, Gahrn-Andersen & Steffensen 2016) is neither bound to the agent nor the environment. Rather, it involves both of them, thus implying that normativity arises in situated agent–agent and agent–environment encounters.

« 14 » We think that the non-localized and norm-constituting aspects of human cognition should be amongst the focal points of a more heterogeneous enactivist paradigm. The prerequisite for such a science is a constructive questioning of VE's foundational commitments to strong operational closure and immediate sense-making. This is needed in order to achieve what V&W propose, namely "a new way to integrate phenomenology and cognitive science" (§38).

Rasmus Gahrn-Andersen's areas of research include phenomenology, process philosophy, distributed cognition, and theories about social organizing. His PhD project seeks to outline a theory about social organizing based on an epistemologically clarified phenomenological outset as well as a critique of the analytical concept of context.

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Matthew Isaac Harvey's main interests are the relation between distributed and enactive theories of language and the philosophy of agency and techniques. His PhD is focused on replacing representations (that's the catchphrase) in linguistic theory, both as a concept and as a suite of terms and associated ways of thinking. With that in mind, he explores the use of agent-based modeling as a research tool in distributed and ecological linguistics, where the aim is to produce emergent phenomena that are recognizably language-like but cannot be traced directly to representational capacities of individual agents.

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Living (in) Different Enactivist Worlds: A Mathematics Education Researcher's Point of View on Enactivism

Jérôme Proulx
Université du Québec à Montréal, Canada • proulx.jerome/at/uqam.ca

> Upshot • Villalobos and Ward's distinctions between Varelian theories and Maturanian ones about anthropomorphism give rise to questions about what is or is not enactivism. This leads to recognition of an enactivist theoretical multiverse, and to embracing it as a way to advance theorizing along, and beyond, post-positivist lines.

« 1 » As my title states, I write this commentary as a mathematics education researcher. I am interested in studying the processes engaged with/in when solving mathematical problems mentally, that is, without paper and pencil or any material aid. This personal focus obviously colors the meaning that I give to ideas that researchers associate with enactivism, and this is the case for those shared by Villalobos and Ward. This is reminiscent of a quote from Maturana, given in an interview for a family therapy journal:

> "Systems theory first enabled us to recognize that all the different views presented by the different members of a family had some validity, but systems theory implied that there were different views of the same system. What I am saying is different. I am *not* saying that the different descriptions that the members of a family make are different views of the *same* system. I am saying that there is no one way which the system is; that there is no absolute, objective family. I am saying that for each member there is a different family, and that each of these is absolutely valid." (Maturana, in Simon 1985: 36)

« 2 » What I take from this is that I live (in) a different enactivist world. While reading Villalobos and Ward's article, I had to keep reminding myself of this enactivism multiverse, as Humberto Maturana would have it. If I had not done so, scientific frustration would have crept up on me: there are so many assertions that simply do not fit my understanding of enactivism that this would have made their article unintelligible to me (some of these I refer to explicitly in this commentary). Thus, my intention here is mainly to account for the boundaries of what is, or is not, enactivism, and to remind ourselves of the histories that we embody as we read scientific research so that these boundaries soften. There is no single enactivist theory spread out in various versions or interpretations that is improved or that develops: there are many theories that live and develop (and die) through the work of researchers.

« 3 » Research fields have histories, and these histories are lived through their researchers. To some extent, it amounts to being his- and her-stories. The story that some of we researchers in mathematics education tell ourselves is the following. For most, if not all, mathematics education researchers, enactivism is traced back to and grew out of Tom Kieren's University of Alberta group in the 1990s. Whereas it is probably widely recognized that Francisco Varela coined the term *enactive* (see, e.g., Varela's afterword in the revised version of *The Tree of Knowledge,* Maturana & Varela 1992: 255; or in *The Embodied Mind*, Varela, Thompson & Rosch 1991), many mathematics education researchers cherish the thought that Kieren's group coined expressions such as *enactivism* and *enactivist*, its "members" having referred explicitly to these in their writings (e.g., Davis 1996; Reid 1996). Therefore, for us, enactivism has a deep-rooted history in mathematics education research, and people have developed a common understanding of its meaning and of who is inspired by it.

« 4 » However, here lies the discomfort. At the same time as enactivism traces its path as a discourse in mathematics education research, it is also recognized that, in contrast to a number of theories and discourses, a difficulty emerges when one tries to identify which texts belong to the enactivism discourse. From one researcher who claims to be inspired by enactivism to the next, there are quite varied references to scholars, articles, books, chapters, and so forth that must, for any particular author, be representative of the enactivist literature. And, Villalobos and Ward's inclusion of Hans Jonas's work in the enactivist literature (through Evan Thompson's 2007) is an example of this. One might be puzzled by the clear, affirmative and direct link they established between enactivism and Jonas's work. But again, similar claims have been made elsewhere between enactivism and George Lakoff's work on metaphors, Erwin Schrödinger's quantum mechanics memoirs, and even Jacques Lacan's psychoanalysis or Jacques Derrida's deconstructionism. So Jonas is now simply added to the list of writers that some researchers insert into their inspirations. But another issue is the main one.

« 5 » Of most importance in relation to the literature is that enactivism offers us, as mathematics education researchers, a way to develop continually a non-objectivist view of the world and a view of knowledge issues that can be used productively in mathematics education in particular. Therefore, the relationships and distinctions that can be traced from inspiring oneself from the "enactivist literature" are not to be seen as the "things-in-themselves," as the *ding an sich*, but as issues that have been occasioned for us as researchers in relation to this literature. In this sense, and significantly, the elements and issues outlined and addressed in our research work are not necessarily explicitly outlined in those works and texts we refer to: "inspiring from" thus means that we take what we can, hence we make more of it, but also less. The main point is that those texts have made these possible, they have made possible the distinctions that we make and explore as researchers: as researchers, we are creators who are inspired by ideas, not tech-

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nicians who "take" outsiders' ideas from a book and "apply" them. That other researchers be puzzled by how we push forward some ideas, or agree or disagree with our ways of doing research and being inspired from the literature is not important: it then becomes a means of engaging in rich discussions and debates on meaning-making issues (in mathematics education). In short, it is an opportunity to push forward the collective thinking in the field, and especially to avoid the reification of enactivism as a single rigidly bounded discourse.

« 6 » In this sense, even if most of us in mathematics education research recognize some possible difference in focus and acknowledge the discontinuity of Maturana and Varela's collaborations, they are not conceived of as completely dissociated: in fact, *The Tree of Knowledge* (1992) and *Autopoiesis and Cognition* (1980) are often referred to as significant texts for enactivism in mathematics education research (as is *The Embodied Mind* 1991). The various works that Maturana and Varela have jointly authored are about both of them. Thus the constant split in Villalobos and Ward's article between Maturana and Varela is recognizable and interesting, but also of little interest to a mathematics education researcher interested in meaning-making processes engaged with/in by solvers. At the same time, and paradoxically, this split is important. The works that they authored alone are also different (even those from the same time period as those authored together). To my knowledge, only Varela used and referred to expressions such as *enaction* or *enactive*, whereas Maturana talked more in terms of *bringing forth a world* and of *objectivity in parenthesis*. Hence placing both under the same *enactivism* umbrella is always accompanied by some unease – this unease could explain Fritjof Capra's (1996) deliberate use of the expression "Santiago theory of cognition." But what about when Varela was in Harvard, and later in France? Is the Santiago theory of cognition reified? Is it fixed? So when the expression *enactivist* is used, one might wonder who is being targeted by it. Again, to deal with this situation, a number of mathematics education researchers avoid saying that their work is in enactivism or that they are "enactivists" and mainly say, as I have done myself in this commentary, that their work is "*inspired by*

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what is referred to as the enactivist theory of cognition."

« 7 » In a connected way, Villalobos and Ward's reference to the word *dangerous* to describe what they call a "strategy" of enactivism for taking over cognitive science appeared surprising to say the least. As a researcher, I kept wondering what this "danger" to which they seemed to refer meant. Dangerous for what? How? For whom? And when? This led me to also wonder about the significance of research for Villalobos and Ward (and collaterally for myself).

« 8 » As I explain in Proulx (2015), I conceive of the role of the researcher as that of one who develops distinctions for thinking about and understanding phenomena. In short, the role of the researcher is to generate, using Gregory Bateson's (1972) words, differences that make a difference or, following Antoine de Saint-Exupéry, to "mettre des forces en mouvement." In short, I conceive of research as about meaning-making, about generating ideas, *and not about a quest for truth*. At the core of the research activity is the fundamental importance of deepening ideas and concepts: to push them, to explore them, to extend them. One can think of *nature mortes*/still lifes realized by painters such as Van Gogh, Cézanne, Renoir, and others; or think of Monet's series of haystack paintings. I do not believe that these paintings, these *œuvres*, were meant to show us what apples, onions, knifes or tables (should) look like! My understanding is that they were aimed at studying, attempting perspectives, techniques, ideas, to work them out, to imagine ways of doing, and so forth; and often to continue, push, or develop a "movement," an understanding. I suggest borrowing this as a metaphor for conceptualizing research and the researcher's role. Through their studies, researchers are also attempting ideas, testing them, offering and creating distinctions, generating ideas, discarding them; directing attention to these proposed distinctions/differences that they as observers consider worthy of attention. Research studies aim to provoke thinking, to make people reflect, to offer ways of thinking. And, I see this as valid for any type of researcher. The role of research is to inspire, to generate thoughts, to make us think of/about phenomena. But keep in mind that I am a mathematics education researcher, and a romantic one, so they

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say. With this position, the significance of *dangerous* is of another order, and the inadequacy of one theory or idea over another is not a question of danger, but a question of paradigm as Thomas Kuhn would say (1962).

« 9 » In short, as a researcher I live (in) this research world. My understanding is that Villalobos and Ward live (in) a different one. This is another multiverse, the one of scientific research. I started with Maturana, and I end with a similar view from Varela in Varela and Bernhard Poerksen (2004): "Truth is what works."

Jérôme Proulx is a professor of mathematics education in the mathematics department of the Université du Québec à Montréal (UQAM). His work focuses on studying epistemological and cognitive aspects of mathematics teaching and learning. His current research programme is focused on mental mathematics and solving processes.

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Authors' Response

Enactivism, Cognitive Science, and the Jonasian Inference

Dave Ward &
Mario Villalobos

> Upshot • In our target article we claimed that, at least since Weber and Varela, enactivism has incorporated a theoretical commitment to one important aspect of Jonas's philosophical biology, namely its anthropomorphism, which is at odds with the methodological commitments of modern science. In this general reply we want to clarify what we mean by (Jonasian) anthropomorphism, and explain why we think it is incompatible with science. We do this by spelling out what we call the "Jonasian inference," i.e., the idea that we are entitled, based on our first-person experience of teleology, to take the appearance of teleology in other living beings at face value.

« 1 » We are grateful for this insightful set of commentaries, and thank the authors for taking the time to address some of the issues raised in our target article. Many of the responses are contributions to exactly the kind of conversation within and around the enactive community we hoped our article would start; one that aims at clarifying the complicated set of relationships between the theoretical and methodological commitments of enactivism, phenomenology, and cognitive science. Reading the commentaries together also suggests that, at a couple of crucial stages, we could have presented ideas of our target article more clearly, and we are thankful for the opportunity to try to do that here.

« 2 » What are the points we wanted to make in the target article? Put briefly, we intended to claim that:

- at least since Andreas Weber and Francisco Varela (2002), enactivism has incorporated a theoretical commitment to aspects of Hans Jonas's philosophical biology;
- Jonas's philosophical biology is theoretically committed to an anthropomorphism that is at odds with the methodological commitments of modern science;
- there is thus a tension that needs to be addressed between enactivism's commitment to Jonas's philosophical biology and its aspirations towards becoming a new scientific paradigm.

In the second half of the article, we used ideas from Humberto Maturana's autopoietic theory (MAT) to provide an example of an alternative way we might construe the relationship between cognitive science and the lived experience of humans and non-humans.

« 3 » Though some commentaries (Maturana and Shigeru Taguchi) raised helpful comments and questions about the part of our target article concerning MAT, this will not be the main focus of our reply. We think we can express the most common themes raised by the commentaries in terms of three questions:

- What is *anthropomorphism*?
- Is it something to which enactivism is actually committed?
- Why should it be understood as incompatible with the scientific study of nature?

We will use this reply to say something about each of these crucial questions for our target article in turn.

What is anthropomorphism?

« 4 » Clearly, we left ample room for readers to wonder exactly what *anthropomorphism* refers to in our target article. Is it, Paulo De Jesus asks, the attribution of *any* mentality to non-human entities (see also Jean-Luc Petit's commentary), or only the attribution of *human-like* mentality to those entities? Are the problems we see for anthropomorphism still problems for a *modern anthropomorphism*, as proposed by Peter Gaitsch? Or for the *zoomorphism* in terms of which (as Steve Torrance points out) Jonas sometimes characterises his own position?

« 5 » The main objective of our target article is to highlight a tension between the theoretical commitments of enactivism and the methodological commitments of modern science. Given this purpose, what matters for whether a methodology, theory, or argument is *anthropomorphic* in our terms is not the *range of properties* attributed to non-human entities, but rather the *way in which our attribution of mental properties is grounded*. The aspect of Jonas's philosophical biology we find problematic is (as Taguchi discerns) what we call the *Jonasian inference* (henceforth "JI"). This is the inference involved when we "take the presence of purposive inwardness in one part of the physical order, viz., in man, as a valid testimony to the nature of that wider reality that lets it emerge" (Jonas 1966: 37). In simple terms, we infer from our first-person experience of teleology that we can take the appearance of teleology in other living organisms at face value.

« 6 » In a chapter of *The Phenomenon of Life*, where Jonas is discussing the incompatibility of modern science (Jonas 1966: 72–74) with understanding metabolism as entailing self-perpetuating unities imbued with "needful freedom" (ibid: 80), he asserts that the "[o]rganic identity" of a living organism must be different from the tautologous identity of bits of inert matter with themselves. He asks:

> "But what kind of inference is this? And by whom? How can the unprepared observer infer what no mere analysis of the physical record will ever yield? The unprepared observer cannot […] The observer of life must be prepared by life. In other words, organic existence with its own experience is required of himself for his being able to make that inference […]" (Jonas 1966: 82)

This is the sense of Jonas's claim that life can only be known by life – "happening to be living material things ourselves, we have in our self-experience, as it were, peepholes into the inwardness of [organic] substance […]" (ibid: 91). We might – perhaps should – have written our target article without reference to anthropomorphism, focusing only on the problematic status of JI, and left its central claims intact.

« 7 » In a moment we will say more about the role of JI in contemporary enactivism, and the tension between JI and modern science. Before doing so, let us note that making the role of JI explicit allows us to respond to several of the questions about anthropomorphism raised by the commentators. To De Jesus's question of whether our concern is with the attribution of *human-like* mentality or *any* mentality to non-human entities, we can answer: it depends. JI is most likely to be employed in grounding attributions of human-like mentality, but

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the questions our target article attempts to raise apply to *any* attribution of mental properties grounded in JI. The compatibility of the *modern anthropomorphism* proposed by Gaitsch with modern science depends on whether such an anthropomorphism avails itself of JI. Finally, Torrance is right to note that Jonas was motivated precisely by a concern to avoid *anthropocentrism* in our conception of mind, and thus sometimes speaks of *zoomorphism* instead of anthropomorphism. But such a zoomorphism is equally problematic insofar as its attribution of mental properties is grounded in JI.

Enactivism and the Jonasian inference

« 8 » In the next section, we try to clarify why we find a tension between a commitment to JI and an aspiration to become a new scientific paradigm. But is it actually the case that enactivism grounds its attributions of mentality in JI? Rasmus Gahrn-Anderson & Matthew Harvey rightly note that contemporary enactivists argue that the roots of mentality are to be located in dynamic organisational properties such as autopoiesis, autonomy, and adaptivity. Does enactivism not attempt to legitimate its attributions of mental properties via appeal to these features, rather than via JI? Jérôme Proulx finds no such commitment in his own enactivist work on mathematical cognition, nor in the related work of his colleagues.

« 9 » However, contra Gahrn-Anderson & Harvey, we think that the commitment to a deep continuity between life and mind that is characteristic of much contemporary enactivism is more often motivated by JI than by a belief that reductive explanation of teleological phenomena in terms of autopoietic or adaptive dynamics has been provided. To repeat a quote from our target article, consider Weber and Varela's claim that:

> "[B]efore being scientists we are first living beings, and as such *we have evidence of our intrinsic teleology in us*. And, in observing other creatures struggling to continue their existence – starting from simple bacteria that actively swim away from a chemical repellent – we can, *by our own evidence, understand teleology as the governing force of the realm of the living.*" (Weber & Varela 2002: 110, emphasis added)

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Here, and in the rest of Weber and Varela's paper, a teleological understanding of living systems is grounded in the evidence of our own experience, via JI, and it is only in light of this phenomenological evidence that autopoietic or adaptive dynamics present themselves as plausible dynamical underpinnings of teleological properties. Similarly, Evan Thompson holds that:

> "[T]he theory of autopoiesis provides a naturalistic interpretation of the teleological conception of life originating in experience, but our experience of our own bodily being is a condition of possibility for our comprehension of autopoietic selfhood." (Thompson 2007: 164, emphasis added)

And in Ezequiel Di Paolo's influential paper "Autopoiesis, adaptivity, teleology, agency," he departs from Weber and Varela (2002) in arguing that enactivists should ground teleology in adaptive rather than autopoietic dynamics, while sharing their commitment to JI:

> "[T]he attribution of teleology to metabolism is justified partly by means of intuition outside scientific discourse. Jonas implicitly admits that establishing in metabolism the breaking point between extended neutral processes and concernful identity is a matter of appropriate choice. How are we to justify this and further choices, or question their sufficiency, when the criteria of validation are, at least partly, outside science? The answer must be: by the use of phenomenological insight or other disciplined intuitions." (Di Paolo 2005: 431f)

« 10 » Each of these quotes make clear that, at least for these canonical enactivist thinkers, JI is called upon to do important work *before* autopoietic or adaptive dynamics can appear as candidate explanations of teleological properties. Might enactivists dispense with JI and attempt a straightforward reductive explanation of teleological properties in terms of dynamical organisation? This question deserves more discussion than we can provide here. But a common theme in recent work on enactivism is the provision of arguments that autopoietic or adaptive dynamics are ill-suited to this explanatory role (see, e.g., Villalobos & Ward 2015; De Jesus 2016; Barrett 2015; Barandiaran 2016).

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« 11 » Philosophers of mind and cognition have spent much of the past five decades attempting to explain teleological properties of our mental states in terms of structural, functional, or dynamical properties. It is fair to say that the consensus is that these attempts have yet to succeed, and it is not clear how adaptive or autopoietic accounts can help with the problems they have faced – for example, how can an account in terms of structure, function, or dynamics adequately specify success conditions for teleological states? How can such an account accommodate the normativity that separates the genuinely teleological character of some mental states from a mere covariation relation between a state of an organism and a state in the world? It may be that the conceptual apparatus already at the disposal of enactivists can yield satisfactory responses to questions such as these – but further work is required to show this. For the enactivist authors quoted above, however, these questions are misplaced. None of these authors aim at the reductive explanatory goal of showing how teleology emerges from non-teleological properties of structure, function, or dynamics. Instead, via JI, they argue that we should understand particular forms of dynamical organisation as imbued with immanent teleology. We think it is fair to say that these authors have set the research agenda for most contemporary enactivist work. Might enactivism nonetheless dispense with JI? We will return to this question below. But now that we have clarified our conception of JI and the use enactivism makes of it, we can say more about its problematic relationship with modern science.

Cognitive science and the Jonasian inference

« 12 » Several commentators (De Jesus, Gaitsch, Petit, Torrance) raise questions about why employing JI should be understood as incompatible with the scientific study of nature, and others (Maturana, Taguchi) suggest specific ways in which the relationship between phenomenology and science might be understood that go beyond the discussion of our target article. Hopefully, the above clarifications about the role of JI in our argument and in enactivism already suggest responses to some of these questions. For example, in response to Petit (and to parts of the com-

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mentaries of De Jesus and Torrance), it should now be clear that our concern in our target article is not with the attribution of teleological properties to non-human organisms *tout court*, but with grounding that attribution in JI.

« 13 » So, just what is the incompatibility we see between the methodological commitments of *modern science* and a commitment to JI? In our target article, we mainly rely on pointing towards Jonas's own case for this incompatibility – one reason for this is to encourage enactivists who make use of Jonas's work to address this issue. If we take Jonas's work seriously enough to absorb a commitment to JI from it, then they should also engage with the parts of Jonas's work dealing with the tension between endorsing immanent teleology on the basis of JI and modern science. Another reason for our relying on Jonas for this purpose is simply that specifying the methodological commitments of modern science is a difficult task – perhaps an impossible one, due to the heterogeneity of the research programmes we are willing to classify as scientific. One response to this difficulty is to meet it head on, by engaging in the kind of reflection on scientific method found in Maturana's interesting commentary. However, we do not think that the case we present in our target article requires us to do this.

« 14 » When we speak, following Jonas, of *modern* science, the intended contrast is with a *pre-modern*, Aristotelian conception of science, which conceives of the natural world as populated with irreducible intrinsic teleology. As we noted, an Aristotelian explanation of why rocks fall through air while fire rises proceeds by attributing a natural *telos* to these entities, so that rocks *strive* to be close to the earth while fire strives for the heavens. We also noted that the unacceptability of such an explanation by the standards of modern science is not due to the choice of particular elements in this theory, or in the particular *telos* that characterizes each of them. Rather, it is in attributing *irreducible* natural purposes to entities in our explanation; that is, purposes that receive no further explanation in terms of structure, function, or dynamics. Above, we left the question of whether enactivism might, in future, provide such a further explanation open. But we also claimed that

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enactivists such as Varela (Weber & Varela 2001), Di Paolo (2005), and Evan Thompson (2007) do not see the provision of such explanations as their task. When autopoietic or adaptive dynamics are identified with immanent purposiveness by such enactivists, this is not because an explanation of the emergence of natural purposes from non-teleological dynamics has been given. Rather, JI has been employed to allow us to understand the relevant dynamics as already imbued with teleology.

« 15 » We find it difficult to add much more to this by way of explaining the incompatibility between modern science and the acceptance of intrinsic natural purpose, or immanent teleology, that is the result of JI. This is because we agree with Jonas's assessment that this rejection is not an empirical result obtained by science, but rather a methodological presupposition that demarcates the boundaries of scientific inquiry. This is why mainstream philosophy of cognitive science has been preoccupied for the last fifty years by trying (and failing) to provide reductive explanations of teleological properties of mental states in terms of structural and functional properties. Examples include Fred Dretske's (e.g., 1981) information-theoretic theory of content and Ruth Millikan's (e.g., 1984) teleosemantics. A genuinely naturalistic explanation of teleological phenomena, such thinkers believe, must explain them in terms of non-teleological states, structurally and functionally construed. Above, we have tried to clarify that enactivism's endorsement of JI absolves enactivism of the responsibility for providing such further explanations, and it is this that puts it in tension with modern scientific method.

« 16 » However, is this not to ignore the very fact that our target article is supposed to concern: that enactivism frequently presents itself as a *new paradigm* for cognitive science? As Taguchi and Torrance rightly point out, a belief in the need for the reciprocal circulation of ideas between phenomenology and cognitive science is one of the founding principles of enactivism. So is the conception of cognitive science and its methodology just sketched, where we aspire to explain every phenomenological property or structure reductively in terms of structure, function, or dynamics, not just what

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enactivism has always sought to rid us of? We agree that we did not say enough about enactivism's commitment to a *reciprocal* interplay between phenomenology and cognitive science. Similarly, when we presented the quotes from Weber and Varela, Di Paolo, and Thompson above, we did not mention that each of them occurs in the context of the authors stressing the need for a *dialogue* between phenomenology and cognitive science. The way we have presented things in our target article and in this response has so far been in terms of an opposition between science, which begins with structure, function, and dynamics and attempts to explain further properties and phenomena in these terms, and phenomenology, which begins with our lived experience and invites us to view the material world in these terms. But is the appeal of enactivism as a paradigm not supposed to lie in its showing us a middle way between these two extremes?

« 17 » Once again, we cannot attempt to address this important issue fully here (nor do we know how to do so). But we think that considering the nature of the interplay between phenomenology and cognitive science, and the delicate task of reconciling the methodological commitments of each, is where the enactive community should focus its efforts. Here is one way we can restate the central claim of our target article in light of this: contemporary enactivism's conception of the relationship between phenomenology and cognitive science is not sufficiently reciprocal. As we see it, phenomenology is calling the shots in this relationship in a problematic way. In endorsing JI, contemporary enactivism begins with our own experience, then demands that the structural, functional, and dynamical properties that are the explanatory materials of cognitive science be reconstrued in its terms. Consider an alternative relationship, where science calls the shots. Science would begin with non-sentient and non-teleological structures and processes, then demand that the subject matter of phenomenology be reconceived in these terms. Instead of taking our experience of teleology at face value and reconceiving the material world in light of this, we would be guided by science's non-sentient, non-teleological conception of material reality, and conclude that our experience of teleology and subjectivity is illusory.

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This conception of the priority of scientific understanding is incompatible with a genuinely *reciprocal* relationship between cognitive science and phenomenology. Likewise, we think that in relying on JI, contemporary enactivists commit themselves to a conception of the priority of phenomenological understanding that is incompatible with the reciprocal relationship between phenom-

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enology and cognitive science at which enactivism originally aimed.

« 18 » There are many other important, insightful, and interesting points in the commentaries on our target article that we have not been able to address here. We apologise for this, and hope to take up some of these issues in future work. Nonetheless, we hope this response has served to clarify the

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most important points we wanted to make in our target article, and that it will motivate some readers to take up the challenges we have tried to pose for enactivism.

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