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Abstract	<p>The enactive approach is becoming increasingly influential within the philosophy of cognition, to the extent that it is now one of the dominant models of embodied cognition—an umbrella term for a varied set of discourses sharing the view that our minds don't just happen to be 'in' bodies, but are enabled, shaped and (at least partly) constituted by the specifics of our physicality. This chapter will argue that the rise of enactivism is particularly relevant to transhumanist discourses, and vice versa, because their concerns intersect and conflict in vital ways. The discussion will use three core enactivist themes—organisational integrity, embodiment, and precarity—to draw out the kinds of tensions and intersections that enable enactivism and transhumanism to problematise one another. Enactivism defines life and cognition in terms of autonomy; that is, it posits that living systems generate and maintain themselves as porous yet bounded self-unities. This sets up a delicate balance—both for the enacting system and for enactivism itself—between the dual imperatives of adaptive self-creation and homeostasis. The system must change constantly in order to sustain itself, yet there is a limit to the system's flexibility. Beyond a certain point, change means disintegration, and disintegration means death. This balance itself resonates within transhumanist discourses, in the tension between the promise of radical self-transformation and the concern about taking this too far. These discourses, however, also challenge enactivism's potential to capture the full potential of the kinds of systems it describes. How do we determine the limits of morphological flexibility for cognisers as complex as ourselves? Are those limits fixed or malleable—and must integration always mean death, or can it facilitate redefinition?</p>
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Chapter 3

Beyond Disintegration: Transhumanism and Enactivism



Marilyn Stendera

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3.1 Introduction

The enactive approach is becoming increasingly influential within the philosophy of cognition, to the extent that it is now one of the dominant models of embodied

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26 cognition—an umbrella term for a varied set of discourses sharing the view that our
 27 minds don't just happen to be 'in' bodies, but are enabled, shaped and (at least partly)
 28 constituted by the **specifics of our physicality**. This chapter will argue that the rise of
 29 enactivism is particularly relevant to transhumanist discourses because their concerns
 30 intersect and conflict in vital ways. The discussion will use three core enactivist
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34 Enactivism defines life and cognition in terms of autonomy; that is, it posits that
 35 living systems generate and maintain themselves as porous yet bounded self-unities.
 36 This sets up a delicate balance—both for the enacting system and for enactivism
 37 itself—between the dual imperatives of adaptive self-creation and homeostasis. The
 38 system must constantly change to sustain itself, yet there is a limit to the system's
 39 flexibility. Beyond a certain point, change means disintegration, and disintegration
 40 means death. This balance itself resonates within transhumanist discourses, in the
 41 tension between the promise of radical self-transformation and the concern about
 42 taking this too far. These discourses, however, also challenge enactivism's ability to
 43 capture the full potential of the kinds of systems it describes. How do we determine
 44 the limits of morphological flexibility for cognisers as complex as ourselves?¹ Are
 45 those limits fixed or malleable—and must disintegration always mean death, or can
 46 it facilitate redefinition?

47 According to enactivism, moreover, the specificities of a cogniser's embodiment
 48 matter. **The system's physicality shapes the concerns it will pursue, the world it enacts**
 49 **for itself, and the means by which it does so**. On the one hand, the enactive approach
 50 thus opens up another way of conceptualising why changing the parameters of our
 51 embodiment matters. Not only enhancements but any significant modifications to
 52 our bodies can change, enrich, enlarge, reduce, threaten our world, possibilities, and
 53 cognitive processes—which makes issues of regulation and access that much more
 54 poignant. On the other hand, the enactive approach amplifies the concern that we
 55 may no longer be who we are if we change our embodiment too radically; there may
 56 be limits to the circumstances under which we can cognise in recognisably human
 57 ways.

58 The enactive definition of cognition and life also means that both are characterised
 59 by an inherent precariousness. The system maintains its unity against the threat of
 60 disintegration. It must actively strive to maintain homeostasis because there is the
 61 continued possibility that it will fail, that external forces will disrupt its organisa-
 62 tional unity. It is mortal by definition; for enactivism “life is precious because it is
 63 precarious” (Froese 2017). This forces us to ask how the kind of cogniser we are
 64 and the kind of world we enact would change if we were to change the limits of our

¹ A cogniser is a system that is capable of cognition. For enactive approaches, this means that it must be able to undertake the kind of sense-making outlined in Sect. 3.2, which requires autonomy and adaptivity (at least according to those who accept Di Paolo's work on the latter; see Di Paolo 2005). These terms will be defined later in the chapter. For now, it is worth noting that the enactive model of cognition is particularly broad, embracing a vast range of different types of systems, arguing for what Thompson calls a “deep continuity of life and mind” (2007, p. 222).

65 precariousness, whether by radically decreasing it or even by seeking to transcend
 66 it altogether. If enactivism captures something true about what we are—if we are
 67 self-generating and self-sustaining systems—what happens if the processes involved
 68 in the latter change radically in scope? And what if precariousness is only redefined
 69 for some of us?

70 3.2 What Is Enactivism?

71 Enactive approaches are part of a broader set of discourses that, while heteroge-
 72 nous, share the view that cognition cannot be adequately captured in computational
 73 terms. According to classical computationalism, cognition consists in the manip-
 74 ulation of atomistic elements of symbolic systems according to syntactical rules,
 75 such that complex processes can be analysed into simpler constituents. The basic
 76 elements modified by these rules are representations as traditionally conceived, that
 77 is, context-independent in two ways.² Firstly, they codify context-independent infor-
 78 mation about properties, states of affairs, and so forth. Secondly, such representa-
 79 tions are not taken to be significantly dependent upon or shaped by the cogniser's
 80 non-neural context. The cogniser's specific forms of embodiment, environment, or
 81 socialisation are taken to be (at most) 'quirks of the hardware' that are not essential to
 82 understanding the representation itself, nor contribute to the representation in a way
 83 that would prevent a cogniser with different specifications from working with the
 84 representation. Proponents of what are now often referred to as 4E views of cogni-
 85 tion—encompassing not only enactive, but also embedded, embodied, and extended
 86 models of mind—reject this model and instead view cognition as a process that is
 87 shaped by, and can only be understood with reference to, the cogniser's particular
 88 non-neural bodily and environmental context.³ In light of this, the four 'Es' tend to
 89 view cognition as primarily action-oriented, with an interest in explaining cognisers'

² I emphasise 'as traditionally conceived' here because there are other models of representation that do not include these characteristics; many of them have been proposed by proponents of 4E approaches. There is some controversy over whether any of these types of representation might be compatible with enactivism.

³ Since all four 'Es' share an emphasis on the role of the non-neural body in cognition, it might seem strange that 'embodied' cognition is given an 'E' of its own, so to speak, or that enactivism is then also referred to as a type of embodied cognition at the beginning of the chapter. On the one hand, all of the Es do give the body a greater role than computational approaches to the mind, making all of the Es 'embodied' to some extent (for this reason, 'embodied cognition' and '4E cognition' are sometimes used interchangeably in the literature). On the other, each E treats and weights embodiment differently. Enactivism, for example, tends to assign a greater importance to the material specificities of particular types of bodies, while extended cognition is more closely aligned to functionalism. There are also models of embodied cognition that are neither extended nor enactive—hence the separate 'Es' here.

90 purposive and flexible responsiveness to salience in terms of their specific capacities,
91 needs and ends.⁴

92 What, then, characterises the ‘E’ that is the focus of this chapter? Enactive
93 approaches to cognition arose out of Humberto Maturana and Francisco Varela’s
94 work on defining life. They proposed that we can characterise living systems in
95 terms of what they called autopoiesis. An autopoietic system continuously generates
96 and specifies its own organisation through its operation as a system of production of
97 its own components, and does this in an endless turnover of components under condi-
98 tions of continuous perturbations and compensation of perturbations. (Maturana and
99 Varela 1980, p. 79).

100 Such systems are autonomous, meaning that “they subordinate all changes to
101 the maintenance of their own organisation” (p. 80) rather than to the achievement
102 of an externally defined end. Their unity and identity are self-produced rather than
103 being defined by an external observer or designer, and their complex responsiveness
104 to changing circumstances cannot be reduced to a simple correspondence between
105 inputs and outputs (pp. 80–81).

106 Autopoietic theory was initially targeted at the most basic living system, the cell.
107 Recognising the broader value of its insights, however, core aspects of this approach
108 were scaled up to allow their application to domains like cognition. The most signif-
109 icant step in this process was arguably taken by Varela himself, along with Evan
110 Thompson and Eleanor Rosch, in their landmark 1991 work *The Embodied Mind*.
111 This book wove together autopoietic theory with influences from the phenomeno-
112 logical tradition, cybernetics, developmental psychology and Buddhist philosophy
113 to construct the framework for what is now known as enactive cognitive science.
114 Three key aspects are worth highlighting for our present purposes. Firstly, the book
115 shifted the focus to autonomy (of which autopoiesis is the most fundamental type).⁵
116 Secondly, it argued for the ineluctable entanglement of perception and action.

117 Cognitive structures and processes emerge from recurrent sensorimotor patterns
118 of perception and action. Sensorimotor coupling between organism and environment
119 modulates, but does not determine, the formation of endogenous, dynamic patterns
120 of neural activity, which in turn inform sensorimotor coupling (Thompson 2005,
121 p. 407).

122 That is, the cogniser is always “structurally coupled” (Varela et al. 2016, p. 156)
123 to its environment, and its cognition is characterised by multiple feedback loops that
124 are enabled and shaped by its embodiment, by the particular sensorimotor capacities
125 it has and the needs it is required to fulfil in order to maintain itself. Finally, in a
126 point closely related to this, these cognitive processes do not reveal a predetermined
127 world that merely impinges upon the cogniser from the outside. Instead, cognition
128 is “a history of structural coupling that brings forth a world” (p. 209, my italics).

⁴ My account of the opposition between computationalism and 4E approaches here draws primarily on Dreyfus (1972), Newen et al. (2018), and Thompson (2007).

⁵ This point is still controversial within enactivist scholarship. Some couch their analyses primarily in terms of autopoiesis, while others emphasise autonomy (at least at the level of human cognition). This chapter will focus on autonomy mostly in order to circumvent these discussions.

129 Through its coupling with its environment, the cogniser enacts a world of significance
 130 defined in relation to its needs and ends; there is no cogniser without a world and
 131 no world without the cogniser. Only through the latter's particular capacities and
 132 projects do specific physical, chemical and biological aspects of the environment
 133 become nutrients or poisons, obstacles or tools, risks, opportunities, threats.

134 The three decades since the first publication of *The Embodied Mind* have seen a
 135 variety of developments to the enactive approach.⁶ One that is especially significant
 136 to the intersection between it and transhumanist perspectives is Ezequiel Di Paolo's
 137 proposal that cognition also requires adaptivity, that is, the ability to respond to self-
 138 generated norms of flourishing (Di Paolo 2005). According to Di Paolo, a genuinely
 139 cognitive system must do more than produce and maintain itself; it must also be
 140 able to track whether it is doing better or worse at meeting its needs and staving off
 141 disintegration, and adjust accordingly. Another development worth noting here is the
 142 growth in the number and variety of analyses that draw on the enactive approach to
 143 some extent. Aspects of the enactive framework are being applied to the analysis
 144 of, among other things, educational design (e.g. Li et al. 2010), entrepreneurship
 145 (e.g. Fenwick 2010), nursing practices (e.g. Ousey and Gallagher 2007), neurodiver-
 146 gent experiences (e.g. De Jaegher 2020), musical performance (e.g. Høffding 2018),
 147 assistive technologies (e.g. Froese et al. 2012), narrative (e.g. Caracciolo 2014), art
 148 (e.g. Carvalho 2019) and film (e.g. Rhym 2018). While some encounters between
 149 transhumanist and enactive perspectives have already occurred, the latter's diversity
 150 of scope and influence means that these conversations are bound to proliferate. Given
 151 what enactive approaches say about the enabling conditions of our cognition—of our
 152 very being in the world—this dialogue is both urgent and likely to reveal productive
 153 tensions. The rest of this chapter will trace out three core aspects of enactivism that
 154 generate such points of intersection and conflict.

155 3.3 The Whole and Its Parts: Organisational Integrity

156 The first critical junction that I want to explore here is the enactive approach's
 157 emphasis on the maintenance of organisational integrity. An autonomous, adap-
 158 tive system must navigate a delicate balance between two equally vital imperatives.
 159 On the one hand, it is an inherently dynamic system. In order to keep itself alive,

⁶ A further development that has become especially relevant in the past decade is the 'splitting', for lack of a better word, into three main strands of enactive discourse: One, associated with figures like Thompson and Di Paolo, has continued the focus on the key themes of *The Embodied Mind*. (This is usually labelled 'autopoietic enactivism', although Thompson points out that this is inaccurate due to the focus being on autonomy in general rather than just the basic autopoietic variety. See Thompson 2018). A second approach deals almost exclusively with the structures of perception. The third and most recent type—'radical enactivism'—is mainly concerned with providing an account of what it calls 'basic minds', which involves extending the rejection of traditional representations to representations of all types as well as to content itself (Ward et al. (2017) provides more details about the relations and divergences between the three). This chapter will only engage with the first approach.

160 it must constantly track and respond to changes, not only in its environment and its
 161 own wellbeing, but also in the relation between them. Moreover, there will be other
 162 systems like it—ones with needs and aims and projects, forming not only potential
 163 threats or allies, but co-world builders with whom it can engage in “participatory
 164 sensemaking” (De Jaegher and Di Paolo 2007; De Jaegher 2019). On the other hand,
 165 such a system is defined by its need to maintain its unity and individuality, to persist
 166 as itself. It is a relational entity, and its boundaries are porous, yet they are real and
 167 essential nonetheless. If a change exceeds the system’s ability to “compensate”, in
 168 Maturana and Varela’s terms, the result is “disintegration” (1980, p. 81). The rupture
 169 of boundaries, the loss of identity and individuality, lead to dissolution, to death. The
 170 enacting cogniser, then, must always change, yet never too much; both stasis and
 171 radical disruption are fatal. This tension recalls a familiar theme within debates about
 172 the benefits and risks of transhumanism. Many proponents of radical body modifi-
 173 cation and enhancement position these endeavours as an expression of autonomy, a
 174 continuation of the kinds of capacities that have positively shaped human develop-
 175 ment so far—the ability to adapt, the need to improve, the desire to thrive as well
 176 as survive (See e.g. Bostrom 2013; More 2013; Sandberg 2013). These claims, of
 177 course, face the well-known concerns about whether there is a point at which these
 178 transformations start to undermine something that defines us (Ross 2020). There
 179 are worries about drawing lines, about being able to recognise the transition from
 180 desirable to undesirable change, especially if the very processes that alter us also
 181 re-shape our views about what we are (and our ways of gauging how much change
 182 we are prepared to accept). In a sense, these debates enact on a large scale a question
 183 that, if enactivism is right, defines us—along with all other autonomous, adaptive
 184 systems, down to our very own cells: What is the right amount of change, the level
 185 that will let us survive without dissolving us?

186 This might make transhumanism and enactivism particularly congenial interlocu-
 187 tors, especially if each can learn from the other about different ways to address the
 188 question. Cary Wolfe’s work on autopoietic theory and posthumanism is illustrative
 189 here.⁷ Wolfe focuses on the distinction that Maturana and Varela draw between a
 190 system’s organisation and its structure. The former refers to “those relations that
 191 must exist among the components of a system for it to be a member of a specific
 192 class” (Varela and Maturana, cited in Wolfe 1995, p. 52). The latter, meanwhile, is
 193 the “components and relations that actually constitute a particular unity” (p. 52).
 194 That is, a system’s organisation cannot be altered without it losing its identity and
 195 dissolving, while its structure is more flexible and can undergo significant modifica-
 196 tions. Indeed, it must do so; these are the kinds of changes that a system undergoes
 197 due to its coupling with its environment as well as its interactions with others like it.
 198 Autopoietic systems, in Wolfe’s words, are “both open and closed” (p. 52) a way that

⁷ Wolfe explicitly focuses on post-, rather than trans-, humanism. The distinction between them is, of course, controversial. I follow Wolfe (1995, 2010) and Harfield (2013) in viewing posthumanism as focusing more on a critique of humanism (especially in terms of anthropocentrism and the privileging of a certain model of rationality). However, I don’t take this to be a hard and fast distinction, and follow Ross (2020) in thinking that these vast, disputed, heterogenous regions of discourse are close enough that insights about one can apply to the other.

199 he claims resonates deeply with the posthumanist critique of distinctions between
 200 the human and the non-human, nature, and culture, self and body and world. On
 201 the one hand, Wolfe argues, the way that such a system enacts its world—and the
 202 consequence that differences in organisation will lead to differences between such
 203 worlds—renders “the environment [in the sense we have been using world], and
 204 with it ‘the body’ [...] a virtual, multidimensional space” (2010, p. xxiii). On the
 205 other, what was previously a rigid, uncrossable ontological boundary between two
 206 sides of the distinction—between nature and culture, between the biological and the
 207 mechanical, and so on—is now made dynamic and, as it were, portable in the sense
 208 that the same formal mechanism may now be used to think, and link, across what
 209 were in the past discrete ontological domains (p. 206).

210 This means that for autopoietic theory, just as for posthumanism, “there can be
 211 no talk of purity” (p. xxv).

212 On this level, the potential conceptual sympathies between the two perspectives
 213 may go even further than Wolfe proposes here. One of the key consequences of
 214 autopoietic theory and the enactive approach founded upon it is that all cognitive
 215 systems—from the most basic to the most complex, whether organic or artificial—
 216 share the same fundamental structures: Autonomy and adaptivity. This means that
 217 enactivism aligns, not only with the posthumanist critique of boundaries and hier-
 218 archies but also with its rejection of anthropocentrism and concomitant affirmation
 219 of non-human importance (See Hartfield 2013). We are more complex than single-
 220 celled bacteria, but we share something fundamental with them—something more
 221 concretely defined than a mysterious essence of life. More than this, we are already
 222 machines: Living, autopoietic machines that are in turn comprised of concatenations
 223 of systems; we are, as in the title of one of Varela’s essays, “a meshwork of selfless
 224 selves” (cited in Froese 2017, p. 38).

225 However, the very distinction that Wolfe focuses on—between organisation and
 226 structure—also constitutes a point of potential tension if we shift the lens from
 227 posthumanism to transhumanism. This is because differentiating between organisa-
 228 tional and structural integrity does not dissolve the concern about how much change
 229 a system can take; it just gives it a more precise target. The concept of organisational
 230 integrity asserts that there is such a limit; regardless of how structurally malleable
 231 and adaptive a cogniser may be, there are some types of transformations that will lead
 232 to disintegration. For someone interested in modifying and augmenting the body, the
 233 question then becomes how we can decide whether a particular change would be
 234 structural or organisational for the type of cogniser that we are. It seems that at least
 235 some technological enhancements of our physiological capabilities would be the
 236 former rather than the latter. The enactivist approach itself has been used to develop
 237 technologies allowing sensory substitution (e.g. the enactive torch, which provides
 238 haptic and auditory feedback to compensate for reduced vision—see Froese et al.
 239 2012). More radical alterations to perception, however, might raise questions about
 240 whether the cogniser’s world—enacted through its sensorimotor couplings—remains
 241 the same. These concerns would be amplified for technologies that go ‘deeper’, so to
 242 speak, and reach the heart of our self-producing, self-maintaining processes. Would
 243 certain types of gene therapy, for example, inaugurate organisational changes if

244 they alter how the “selfless selves” (Varela 1991) that comprise us produce their
 245 components?⁸ How much of our materiality can be replaced with radically different
 246 substances before a structural change becomes organisational? There is also the
 247 question of maintaining ourselves as auto—rather than allopoietic systems. Recall
 248 that, for autopoietic theory, the unity and individuality of a living system must be
 249 self-generated. Its ends and its boundaries must originate from itself, rather than
 250 being determined by the perspective of an external observer or designer. If this is
 251 the case, then we might wonder whether it is possible to compromise this—for
 252 example, that some types of implants or interfaces would mean that our boundaries
 253 are no longer self-originating; or that we might alter parts of ourselves to suit a
 254 specific purpose to the extent that we start to have externally-defined and designed
 255 ends. These questions, of course, do not only run one way. The enactivist, too, might
 256 wonder whether changes in the way that we relate to ourselves, and in the capabilities
 257 we have for transformation, should motivate a re-conceptualisation of organisational
 258 and structural terms. Perhaps we need to leave space within our models for a type
 259 of disintegration that leads to redefinition rather than annihilation—for example, by
 260 defining different levels of organisation change.

261 3.4 Bound(ed) Flesh: Embodiment

262 These concerns about classifying various modifications to ourselves as either struc-
 263 tural or organisational also give us cause to look more closely at the enactive model of
 264 embodiment, which brings us to the second facet of enactivism that I want to explore
 265 here. As noted earlier, for enactivism, cognition is embodied in a radical way. The
 266 specificities of a cogniser’s embodiment—its sensorimotor capacities, its needs, its
 267 specific means of motility and orientation—not only affect but enable cognition; that
 268 is, embodiment does not just have a contributory role, but a necessary, constitutive
 269 one.

270 This puts enactivism at odds with some of the more radical proposals under
 271 discussion in various transhumanist discourses, such as mind uploading. For one,
 272 the enactive approach denies the possibility of disembodied cognition—indeed, it
 273 makes this a conceptual impossibility—and therefore rejects any models of cogni-
 274 tive augmentation that see as their end goal the existence of a consciousness with
 275 no boundaries or sensorimotor feedback loops, the free-floating streams of virtual
 276 data familiar to us from science fiction versions of mind uploading. Of course, many
 277 contemporary models of the latter do not advocate for this, and instead suggest

⁸ Varela’s memorable descriptor “selfless selves” comes from the title of a 1991 chapter and refers to what Froese calls the “nesting” (2017, p. 38) way in which many small, basic autonomous systems can comprise larger, more complex ones (e.g. the way that cells form structures within our bodies, and these structures all add up to form us). Within these networks of overlapping processes and concerns, each autonomous unit is a ‘self’ (in the sense that it is a self-maintaining, self-preserving unity) and yet also ‘selfless’ (it does not possess a traditional sense of personal identity, and it is not isolated; its role within larger interlocking systems is important to making it what it is).

278 processes such as the gradual replacement of neurons by artificial neuron-like structures, the creation of a virtual body, or the transfer of neural processes to an artificial
 279 brain (or sufficiently brain-like artefact) connected to an organic or synthetic body
 280 (See Cappuccio 2017; Ross 2020 for discussions of these proposals). However, these
 281 do not resolve the tension. The enactive approach also challenges the general “neuro-
 282 centrism” (Cappuccio 2017) of approaches that downplay the role of the non-neural
 283 body in cognition, as if cognition could be ‘unlocked’ through the brain and every-
 284 thing else were just a secondary issue of finding the right matter to enable the transfer.
 285 As Cosmelli and Thompson argue, for the enactive model, the well-worn thought
 286 experiment of the ‘brain in a vat’ would simply not be plausible unless said ‘vat’
 287 were a body like ours anyway, obviating the point of the exercise (2010). Even if we
 288 were able to secure a body much like ours for the uploaded mind, however, a deeper
 289 problem remains.
 290

291 Cappuccio has argued that the real core of the conflict between embodied cognition
 292 and mind uploading lies, not in the issue of finding the right kind of material substrate
 293 for the mind, but in the assumption that the mind is the kind of thing that can be
 294 transferred between material substrates at all (2017). Enactivism—like other forms
 295 of embodied cognition—allows that minds can be instantiated in different types of
 296 materials; Maturana and Varela emphasised this right at the start (1980). However,
 297 Cappuccio argues, it must reject the claim that a mind instantiated in one type of
 298 material assemblage can be moved into another type of materiality while remaining
 299 qualitatively and numerically the same (2017). Mind uploading “posits criteria of
 300 continuity and identity of a mind that are extrinsic to its physical and functional
 301 constituents, and unrelated to the specific contextual integration of the mind–body-
 302 world system” (p. 438). For embodied models of cognition meanwhile, especially
 303 enactivism:

304 The patterns of these body-world interaction loops have a constitutive valence for
 305 the cognitive system but at the same time are merely relational in nature, i.e. situated,
 306 context-sensitive, non-exportable. Therefore, they are essentially irreplaceable in the
 307 unique way they are individuated in relation to neuronal and extra-cranial bodily
 308 interactions and to the beyond-the-skin world: that is why [embodied cognition]
 309 implies that the concrete instantiation of the mind in a contingent flow of material
 310 circumstances doesn’t only define its functionality and phenomenology, but also its
 311 very conditions of ipseity and, therefore, the historically determined modes of its
 312 existence and persistence through time (p. 440).

313 Here, more than perhaps at any other point, we find a fundamental incompatibility
 314 between core enactivist claims and one type of transhumanist endeavour. Whether
 315 either side here is right will perhaps ultimately have to be determined in practice; if
 316 a version of mind uploading takes place, a host of discourses will need to re-evaluate
 317 critical aspects of their framework. This possibility in itself raises questions about
 318 how we would determine the success of such an event. How would we know it
 319 worked? Would we ask the uploaded one (presuming the result of the procedure is
 320 capable of responding)? This recalls the old concern about whether a mind deeply
 321 affected by artificial processes would be able to tell what it is. If the process destroyed
 322 the original system and created a new type of cogniser, the latter might nonetheless

323 believe itself to be identical to the former. Ezequiel Di Paolo considers a similar
324 issue in a recent paper, applying the enactive framework to the replicants of Ridley
325 Scott's *Bladerunner*—some of whom famously are not aware of what they are (2020).
326 Focusing on a point that the quote by Cappuccio also highlights—the historical
327 determination of the mind—Di Paolo argues that the enactive approach ultimately
328 speaks against the feasibility of implanted memories being sufficient to convince a
329 replicant that they are human. This is because embodiment is historical. For Di Paolo,
330 “these activities [of ‘bodies in action’] do not only leave traces in (many) brains but
331 practically everywhere. In my body and yours, in my surroundings, my shoes, my
332 desk, my digital pursuits, and so on” (p. 22). This means that, while it is possible
333 to create artificial bodies, “the idea that a full real bodily history can be faked” is
334 “implausible” (p. 23). This suggests that it is not only embodiment but the history of
335 embodied action, the temporal fabric of sensorimotor coupling, that is constitutive
336 of cognition. Severing the link between a cogniser and its embodied history thus
337 fundamentally alters, and possibly destroys, the former. Bringing this back to mind
338 uploading, we can see here another way to support Cappuccio's claim about the
339 non-exportability and irreplaceability of a mind's particular material instantiation.
340 Moreover, we also find a hint of how the result of an upload might respond if the
341 process did not work. Di Paolo finds it “hard to imagine” that Roy Batty would
342 speak about his impending demise as he famously does in *Blade Runner* despite
343 only having been alive for four years, and suggests that a mind lacking an embodied
344 history may not even be able to engage in language, at least not in a way that we
345 would understand (2020, p. 23). Perhaps this would also apply to the product of a
346 mind upload. It might try to say that it is the same mind, but do so in a way that
347 reveals it cannot be.

348 Of course, mind uploading is only one particularly drastic way of modifying bodily
349 cognition. Would enactivists be similarly concerned about less radical changes? One
350 response is that the enactive model of cognition at the very least gives us another way
351 of understanding why altering our bodies matters. It decisively rejects the notion that
352 such transformations are merely superficial or cosmetic. Recall that, for enactivism,
353 cognition is “[a] history of structural coupling that brings forth a world” that works
354 “[t]hrough a network consisting of multiple levels of interconnected, sensorimotor
355 subnetworks” (Varela et al. 2016, p. 206). If cognition and the cogniser are inherently
356 embodied in this way, then changing that embodiment not only changes who the
357 cogniser is, what their projects might be and how they think, but also their world
358 itself. This might seem like it would entail a negative response to body modification,
359 yet it is important to remember that the cogniser's world is not static anyway. Just as
360 the cognitive system can never stay still, so must its world remain dynamic, reshaped
361 continuously in light of shifting significances generated by the cogniser's needs, ends
362 and capacities, as well as its responsiveness to its physical and social environments.
363 Structural change is, as we saw in the previous section, almost an imperative for
364 the autonomous, adaptive system. Changing ourselves and our world is a defining
365 feature of what we are, something we share with other cognisers; perhaps, then, those
366 transhumanist voices who view body modification as an expression of deep-seated
367 drives are onto something after all. On the other hand, this raises concerns for the

368 impact upon our shared worlds. After all, our worlds are not ours alone; we enact
369 them together.

370 Sensorimotor bodies, moreover, are enacted together. [...] There are in social
371 encounters situations where the sensemaking of a participant is literally modulated
372 or enabled by the activity of others, and in some cases, sensemaking is constituted
373 jointly in co-authored social acts (Di Paolo 2020, p. 17).

374 In altering my embodiment, then, I am not only reshaping my world, but also
375 ours—and the ability to make it ours. At what point, then, do changes to the bodies
376 of some disrupt their ability to generate and navigate significance in concert with
377 others? This adds another layer of urgency to questions about equity of access to
378 augmentations. The concern that only some will be able to utilise such advances,
379 entrenching existing axes of disadvantage and potentially creating new ones, is a
380 familiar trope in transhumanist debates (Ross 2020; Sandberg 2013). Enaction opens
381 up a further way to conceptualise what is at stake—namely, our ability to participate
382 in shared world-building. Of course, we have always shared and made worlds with
383 cognisers of different embodiments, so it seems that there is a certain amount of
384 flexibility to ‘participatory sensemaking’. The question then seems to be, again, one
385 of finding a way to draw a line, of asking when our worlds are at risk of becoming
386 irreconcilable.

387 3.5 Life as Perpetual Struggle: Precariousness

388 The final aspect of enactivism that I want to place in dialogue with transhumanist
389 concerns is one that is already suggested by the idea of an inherently embodied
390 system striving to preserve its organisational integrity. That is, the enacting cogniser is
391 characterised by precariousness in a way that, I want to suggest here, both challenges
392 and is challenged by transhumanist attitudes to the limitations of the human condition
393 (See also Di Paolo 2020; Froese 2017). As noted earlier, the autopoietic, adaptive
394 system is by nature dynamic, constantly adjusting in response to shifting relationships
395 between environmental circumstances and its needs, capacities, and projects. These
396 relationships, however, cannot be finished or perfected; there will always be gaps
397 between what the system needs and what its environment supplies, between risks
398 and rewards; even if circumstances are favourable, they can always change. Even
399 the processes through which the system produces and maintains itself come with an
400 inherent risk; complex cognisers especially need to keep their own components in
401 check, lest they become, for example, cancerous threats to the whole. This perpetual
402 threat of disintegration, however, is more than a constraint. After all, the very project
403 of self-maintenance only makes sense if it is possible for that process to fail; self-
404 individuation requires something against which and in the face of which the system
405 must unify itself, bound itself, keep itself going. This is a life that defines itself
406 through the possibility of its own end. To that extent, we might almost say that
407 enaction is founded upon a perpetual negation.

408 If the enacting cogniser is characterised by precariousness to this extent, then it
409 becomes difficult to reconcile this model of cognition with transhumanist endeavours
410 aimed at radically reducing or even transcending such limitations. At first glance, this
411 may seem like just another version of the familiar concern that struggle is what makes
412 life worth living, that the inevitability of death somehow gives human life value (Ross
413 2020). While this rings true to some extent, there is nonetheless more to the enactivist
414 angle here. Tom Froese, for example, argues that the precariousness of the enactive
415 cogniser is what enables it to have any concerns or projects in the first place—to
416 enact significance, to bring forth a meaningful world (2017). For enactivism, “to live
417 is to always be concerned with something, most fundamentally with the continuation
418 of one’s individual manner of living” (p. 24). It is the imperative to survive in the
419 face of potential annihilation that lets the system generate the most basic meanings—
420 nutrition, lack, threat, and so forth. The struggle with precariousness generates the
421 first and ultimate endogenous ends; it is the reason that anything at all can matter
422 to the system. According to Froese, this means that taking seriously the biologically
423 embodied mind cannot avoid bringing us face to face with the inevitability of our
424 own finitude, which conflicts with the transhumanist goal of defeating death by
425 engineering our bodies to stay forever young (p. 47).

426 It is important to clarify here, of course, that the transhumanist perspectives to
427 which Froese is referring here are not advocating for immortality as such. Even
428 Aubrey de Grey frames his goals in terms of ‘amortality’, not only to avoid the
429 conceptual baggage that the more familiar term brings with it, but also to acknowl-
430 edge that the augmented individual could still die (Ross 2020). The issue, then, is
431 not so much one of escaping precariousness as of radically modifying its param-
432 eters. Indeed, one might say that a human cogniser who seeks to extend their life
433 is only expressing the fundamental self-maintaining striving that characterises all
434 autonomous, adaptive systems; perhaps amortality is taking enaction to its limits.
435 One concern here might be that this is a self-undermining endeavour. If precar-
436 iousness is an enabling condition of cognition, then the cogniser that successfully
437 eliminates it thereby brings to an end its way of being. This is a recurring theme within
438 a vast range of discourses—that we are characterised by a lack whose overcoming
439 would be our destruction, that “nothing finished can live” (Jaspers 1970, p. 200).
440 Di Paolo articulates this in terms of the incompatibility of perfect self-production or
441 individuation with life.

442 In neither case, maximal self-production or maximal self-distinction, do we have
443 a living system. The dialectical resolution of this tension is the regulated deferral of
444 openings and closings to environmental influences that keep the system viable. Such
445 regulation with respect to viability conditions is what we have called sensemaking
446 (2020, p. 16).

447 The transhumanist could still respond here that even significant extensions to
448 one’s lifespan would be reducing and reformulating, rather than eliminating, this
449 vital precariousness. As Nick Bostrom writes, the “posthuman could be vulnerable,
450 dependent, and limited” (2013, p. 48). However, at least two concerns would continue
451 to generate tensions between this perspective and the enactive approach. On the one
452 hand, we face another version of the point about irreconcilable worlds that was raised

453 at the end of the previous section. Precariousness enables, shapes, and constrains the
 454 enaction of a world of significance, which means that changing the former changes
 455 the latter. As noted before, we make worlds with cognisers whose embodiment differs
 456 from ours; surely, this also applies to the specifics of precariousness. However, as
 457 with embodiment, we might wonder whether there is a point at which modifications to
 458 our precariousness interfere with our ability to make and navigate meaning together,
 459 where our projects become more difficult to weave together with the interests of
 460 those whose lives are much more or less precarious than our own. On the other hand,
 461 there may be what Froese calls a “mismatch at the conceptual level: Transhumanism
 462 views mortality as a burden to be removed or at least as something to be postponed
 463 indefinitely by scientific progress, rather than as constitutive of a meaningful way of
 464 life” (2017, p. 47). We can extend this beyond mortality to other limitations, which
 465 transhumanist discourses tend to cash out as something to be overcome, even if they
 466 cannot be left behind altogether (e.g. More, 2013; Bostrom, 2013). Striving beyond
 467 them is an imperative, something that we should at least try to do. For the enactive
 468 approach, meanwhile, limitations are often also enabling conditions. In saying this,
 469 it is important to avoid relegating enactivism to what More calls “apologism—the
 470 view that it is wrong for humans to attempt to alter the conditions of life for the
 471 better” (2013, p. 14). As detailed in the first section, continuous change, as well as
 472 the aim to do well and better according to its own standards of flourishing, define the
 473 autonomous, adaptive system; the cogniser must engage in structural modifications
 474 in pursuit of these. Even in light of this clarification, we might still worry that the
 475 emphasis on precariousness could lead to the veneration of suffering and hardship.
 476 However, we must not confuse the basic limitations of cognition with particular forms
 477 that they might take at the ‘macro’ level. The former do not necessitate or legitimise
 478 the latter. Moreover, the claim is not that it is ‘good’ or ‘right’ that cognisers must
 479 maintain a fragile unity in the face of internal and external threats, that they must
 480 operate by means of imperfect feedback loops to resist disintegration. Rather, these
 481 are simply the necessary conditions for us being in any way at all. Limitless cognition
 482 is an oxymoron.

483 3.6 Concluding Remarks

484 Does all of this mean that enactive approaches to cognition are by nature bioconser-
 485 vative? One point worth considering is that enactivism’s resistance to some transhu-
 486 manist endeavours is grounded in very different concerns to those of more familiar
 487 critiques. That is, the enactive perspective outlined here does not proceed from the
 488 assumption that humans are fundamentally different to all other entities, nor does
 489 it argue for some mysterious human essence or telos that must be preserved (See
 490 Harfield 2013; More 2013; Ross 2020). Instead, it takes the opposite approach. The
 491 tension with transhumanist imperatives is not generated by what sets us apart, but
 492 by what we share with all cognisers—autonomy and adaptivity, the need to preserve
 493 organisational integrity while negotiating structural changes, the coupling of body

494 and world, precariousness. This arguably makes the prospect of a sustained dialogue
 495 between the perspectives particularly promising. On the one hand, the enactivist
 496 challenge is couched in terms that are themselves at least minimally congenial to
 497 transhumanist (and posthumanist) discourses. Both perspectives suggest that we are
 498 dynamic rather than static creatures, that our bodies matter and that distinctions
 499 between the human and non-human are neither straightforward nor rigid. On the
 500 other hand, transhumanist projects are well-suited to function as test cases for enac-
 501 tive models of cognition. If the former can achieve something that the latter claim
 502 should not be possible, then the autonomy and adaptivity, organisational integrity,
 503 embodiment, and precariousness may need to be radically reconceptualised.

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