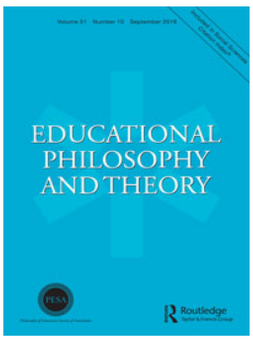

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EDITORIAL

Posthumanism, open ontologies and bio-digital becoming: Response to Luciano Floridi's *Onlife Manifesto*

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ABSTRACT

In *The Onlife Manifesto: Being Human in a Hyperconnected Era* Luciano Floridi and his associates examine various aspects of the contemporary meaning of humanity. Yet, their insights give less thought to the political economy of techno-capitalism that in large measure creates ICTs and leads to their further innovation, development and commercialization. This article responses to Floridi's work and examines political economy of the blurred distinction between human, machine and nature in the postdigital context. Taking lessons from early history of the Internet across the Eastern and the Western Bloc, it examines ideological underpinnings of development of information and communication technologies. The paper points towards the postdigital challenge of the rising importance of biological sciences, their mutual connection with information sciences, and the society at large. It introduces the concept of bio-informational capitalism, and closely examines the relationships between biology and information. Based on authors' previous works the chapter introduces the concepts of *homo economicus* and *homo collaborans*, and claims that their mutual differences do not make a case for a dualist philosophy—instead, the two concepts should be understood as opposite poles of a continuum. However, it shows that the biological challenge is not a mere continuation of our existing (research) questions, and that it introduces new postdigital ways of understanding our reality. In conclusion, the chapter calls for developing a new, postdigital language of inquiry, which reinvents the digital challenge and invents its relationship to biology.

KEYWORDS

Human being; postdigital; philosophy; techno-capitalism; bio-informational capitalism; posthumanism; homo economicus; homo collaborans; internet history; bioscience

Introduction

In his Introduction to *The Onlife Manifesto: Being Human in a Hyperconnected Era*, Luciano Floridi provides a summary of the project, suggesting that "ICTs are not mere tools but rather environmental forces that are increasingly affecting: 1. our self-conception (who we are); 2. our mutual interactions (how we socialise); 3. our conception of reality (our metaphysics); and 4. our interactions with reality (our agency)." (Floridi, 2015, p. 2) In some ways, the nomenclature information and communication technology (ICT) is unfortunate because it is an extensional term that assumes a converging unified linked system incorporating telecommunications, computers, software and audio-visual systems. Etymologically, the phrase 'information and communication technology' has been used at least since early 1980s, and the abbreviation 'ICT' has become popular following a UK educational report (McKinsey & Co, 1997) that details the revised national

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curriculum. While the term is used by professionals in many fields including education and information and communication technology, it is not exactly a neutral philosophical term that transcends its own context. In our recent research, therefore, we prefer to use the term 'postdigital' which encompasses both the digital and the analog, together with complex and often invisible relationships between these rough historical generations of technology (Jandrić et al., 2018; Peters & Besley, 2018).

In spite of this terminological imprecision, there is no doubt that Floridi and his associates provide a brave and influential conception that works to broaden our understanding of "being human in an interconnected era", and we think the project undoubtedly helps us to conceptualize recent developments in our understanding of (the nature of) human being. The first characteristic concerns the self, the second characteristic concerns the society, and the third and fourth characteristics concern reality and our interactions with it (clearly, a realist ontology). What is missing from this early statement is the political economy of techno-capitalism that in large measure creates ICTs and leads to their further innovation, development and commercialization (Jandrić, 2017; Peters & Jandrić, 2018). Floridi then extends his analysis by listing four major transformations caused by ICTs, much referred to by various contributors to *The Onlife Manifesto: Being Human in a Hyperconnected Era* (Floridi, 2015):

i. the blurring of the distinction between reality and virtuality;
ii. the blurring of the distinctions between human, machine and nature;
iii. the reversal from information scarcity to information abundance; and
iv. the shift from the primacy of entities to the primacy of interactions. (Onlife Initiative, 2015, p. 7)

We would argue that the first could be regarded as a consequence of the second, and that mutual relationships between the first and the second are symptoms of the postdigital condition which encompasses "human relationships to technologies that we experience, individually and collectively, in the moment here and now" (Jandrić et al., 2018, p. 896). Furthermore, we would argue that the third is of a different logical order—being largely an economic consequence of digitization based on the notion of information economics and the challenge to an economy of scarcity of neo-classical economics. Simply put, information does not become depleted like other commodities; its use value may actually increase upon sharing and distribution (Peters & Jandrić, 2018, p. 106). The fourth is more of a meta-principle that describes process ontologies.

> Process philosophy provides us with what Whitehead called 'a philosophy of the organism' – it is a form of speculative metaphysics that privileges the event and processes over and above substance with the consequence that we are released from the mechanistic, deterministic universe that is a product of classical physics. It is also a clear rejection of scientific realism substituting a relation process ontology that points towards a indeterministic universe at the sub-atomic level and a form of quantum philosophy based on quantum mechanics and computing characterizing an era we are just entering. (Peters & Besley, 2018)

In order to get to the (philosophical) heart of the question, in this article we shall focus on the most fundamental of the four transformations: the blurring of the distinction between human, machine and nature.

The blurred distinction between human, machine and nature

Our early misgivings might seem like nit-picking: the subtitled seems odd to us in that it focuses on 'being human' in 'an interconnected era' where 'being human' is what is open to change in a way that implies radical ontological difference. The term 'becoming human' seems more appropriate given the kinds of 'blurring' referred to but what will "the blurring of the distinction between human, machine and nature" imply in the next 50 or 100 years? Can we also

contemplate the obverse: becoming less human in an exo-somatic and biological sense? Will the blurring continue to a point, for example, where it is virtually impossible to tell the ontological difference between humans and humanoid robots or androids? Should we "understand personal human-robot relations as alterity relations if and to the extent that in these relations appear to humans as another or 'quasi-other'?" (Coeckelbergh, 2010, p. 198).

The demarcation line between humans and non-humans can be drawn in numerous ways. According to Steve Fuller, however, drawing this line is primarily a moral problem.

> 'Human' began – and I believe should remain – as a normative not a descriptive category. It's really about which beings that the self-described, self-organised 'humans' decide to include. So we need to reach agreement about the performance standards that a putative 'human' should meet that a 'non-human' does not meet. The Turing Test serves to focus minds on this problem, as it suggests that any being that passes behavioural criteria that we require of humans counts as human, regardless of its material composition. While the Turing Test is normally presented as something that machines would need to pass, in fact it is merely a more abstract version of how non-white, non-male, non-elite members of *Homo sapiens* have come to be regarded as 'human' from a legal standpoint. So why not also say 'non-carbon' in the case of, say, silicon-based androids? (Fuller & Jandrić, 2018)

Following Fuller's argument, in our recent paper we question: "under which circumstances should we accept living machines as (equal to) human beings?" And we reply: "It is extremely hard to quantify humanity, and it would take genius of (at least) Alan Turing's calibre to give a satisfactory answer" (Peters & Jandrić, 2019). While we wait for such genius to appear, it becomes increasingly clear that we need something more than a techno-anthropological and hermeneutical device for understanding the ontological difference between our own self-understandings and the culture and ontology of humanoid robots. Here we could apply diverse research approaches, yet our choice in this chapter is that of philosophy. Furthermore, the response to this issue may vary greatly depending on cultural histories as in the contrast of Japan and the West. Coeckelbergh (2014) documents the way the Japanese are more likely to accept humanoid and social robots than the West although he chooses to see 'I' as a question of hermeneutics. Social robotics has been defined as a hybrid science that seeks to conceal the ontological difference between humans and social robots, between the artificial and the natural (Carporael, 2000). But these distinctions are harder to entertain when they disappear upon the synthetic creation of new life or when artificial agents become capable of autonomous decisions.

If we agree that there has been a blurring of human, machine, and nature, then we face a welter of other important questions. How is this blurring occurring? Is it just the development of ICTs or does it involve other technologies as well? How quickly is this blurring occurring and, following Fuller and Jandrić (2018), is there a possibility for a new ontological openness for humans who, under technological experimentation, become something different from our original homo sapiens DNA imprint? The fusion of technologies involves developments that blur the lines between the physical, digital, and biological spheres, but these are not limited to ICTs. The new biology and in particular gene editing, while in part a product of biological informatics, are not reducible to ICTs. This blurring, especially between humans and 'nature' pose a threat to the human distinctiveness argument that most robot ethics and anthropology assume. The issue then becomes forces of ICTs or as we prefer to say following Castells (2004) and others, 'informationalism', combined with new biology—genomics. We can call this 'bio-informationalism' or 'bio-digitalism', where forces of biology and information come together in mutually interactive ways (Peters, 2012). In this process,

> The ancient relationship between being and becoming has now acquired an important postdigital turn. While we speculate what kind of future world we will inhabit in coexistence with new forms of intelligent life, we should firmly focus on the questions what forms of intelligent life should be included in our collective decisions about the future and how we might raise them. (Peters & Jandrić, 2019)

These questions are not new although they have been given a different philosophical impetus under technological imperatives in the discourse of posthumanism. While most researchers

recognize that human beings cannot be literally understood as equal to Artificial Intelligences, popular sociomaterialist accounts often talk about a *symmetry*: a concept "which recognizes that the two life forms are radically different and implies one or another kind of respectful gathering between the two" (Peters & Jandrić, 2019). However, even the concept of symmetry—which is obviously much weaker and also stripped of moral concerns—is subject to a lot of disagreement. In 2002, Steve Fuller and Bruno Latour publicly debated the motion: "A strong distinction between humans and non-humans is no longer required for research purposes" (Barron, 2003, p. 78). Latour's position was that "all phenomena should be treated equally, whether it comes from something human, natural or artificial"; placing Latour's position in the context of moral philosophy, Fuller responded that it brings about the "abdication of responsibility" (Fuller & Jandrić, 2018). Latour and Fuller never agreed about accepting or refuting the motion, yet they agreed that "treating people and machines in a symmetrical way reaches all the way to questions of values and morality" (Peters & Jandrić, 2019).

Floridi's ICT-dominant account is obviously missing that the 'biological' is smuggled in as 'nature' (a fluid, dynamical and historically changing concept), thus not enough credence is given to the language and discourses of humanism, posthumanism, and sociomaterialism, particularly in relation to bio-, nano-, and neuro- technologies. Posthumanism is not confined to the work of French poststructuralists after Heidegger's 'Letter on Humanism' (1947/1978) but embraces critical work in the humanities by authors like Donna Haraway, N. Katherine Hayles, Cary Wolfe, Neil Badmington, Paul B. Preciado, and Karen Barad. It also includes Francis Fukuyama's book *Our Posthuman Future: Consequences of the Biotechnology Revolution* (2002) about the importance of new biotechnologies and the works of futurists like Ray Kurzweil, Max Moore, and Vernor Vinge who talk of 'singularity' and predict a new digital species that surpass humans in every intellectual and creative dimension or augment human capacities (Herbrechter, 2013). In educational studies, posthumanism is prominent in several important research traditions including but not limited to networked learning (Hodgson & McConnell, 2018) and critical posthumanism (Fawns, 2018; Jandrić, 2017, Ch. 9; Sinclair & Hayes, 2018).

'Post-humanism' is a term that captures the second of the four fundamental transformations identified by Floridi (2015) to register a profound requestioning of what it means to be human in the twenty-first century in relation to five major themes or motifs:

1. Our technological essence, 'enframing', prosthetic development and possible reengineering (Heidegger; Haraway; Hayles).
2. Our newly discovered fragile (animal) biology that recasts our relationships:
   a. to ourselves, our bodies and the ontology of humanistic anthropocentrism,
   b. to other species with a greater awareness of 'specisms', and,
   c. to the intricate web of nature and the question of eco-logical responsibility.
3. The precarity and promise of human being in a constant and dynamic state of ontological becoming as (merely) part of the material world and subject to the same physical processes.
4. The transformation of the system of global late capitalism from an industrial and 'analog' (humanist, literate, book or text-based) to a 'digital' (posthumanist, code, data or information-based) social, cultural and economic system. (see Herbrechter, 2013).
5. A shift in accordance with these broader changes in a system of ethics from a liberal individualist notion based on human autonomy, free will and self-determination to one that embraces a relational and distributional notion of justice actively taking into account the systems within which humans are in dynamic and constitutive interaction. (see Pötzsch & Hayles, 2014).

We are taken with N. Katherine Hayles notion of 'technogenesis' that views the brain, language, and culture, including technology, as co-evolving together. In the interview with Holger Pötzsch, Hayles thinks even though "we cannot draw a clear ontological distinction between human

beings and their technical surroundings" we are at least 50 years away from "downloading a human personality"; furthermore, "no computational platform (…) approaches the complexity of the human neurosystem' (Pötzsch & Hayles, 2014, p. 96). Hayles' thinking is supported, amongst others, by Maggi Savin-Baden's and David Burden's research of digital immortality and virtual humans which concludes that "much of the current software available to create your own digital immortal lack long-term and in-depth capabilities to learn and manage an effective digital afterlife" (Savin-Baden & Burden, 2018).

In H*ow We Think: Digital media and contemporary technogenesis*, Hayles (2012a) explores how humans and technics are co-evolving with profound consequences for humanity and for increasing the neuroplasticity of the brain especially of young people (see also Hayles, 2010). As she writes in her Digital Companion to the book:

> The central theme of *How We Think: Digital Media and Contemporary Technogenesis* is that we think through, with, and alongside digital media, and that our intense engagements with them have profound neurological, biological, and psychological consequences, as well as obvious social, economic, institutional and political effects. (Hayles, 2012b)

Digital technologies have created infrastructures that interface with humans connecting them more closely to their technical surroundings based on global networks that are increasingly ubiquitous, efficient and dangerous where small perturbations can lead to unpleasant or even disastrous consequences. This has profound embodied, and also socio-political and economic, consequences for socio-technological ecosystems. Human infrastructures have always shaped the way we live, eat, and travel—and digital technologies have taken this shaping one step further and directly into the question of what it means to be human.

The political challenge of 'Bio-Informationalism capitalism'

In this section we refine the claim we made initially about the political economy of techno-capitalism as the system that largely accounts for further innovation in the digital realm and speaks to both a mode of development and power relations within the ongoing process of globalization as interconnectivity. To do so, we look into recent past and examine development of the Internet at both sides of the Iron Curtain described in Benjamin Peters' book *How Not to Network a Nation: The Uneasy History of the Soviet Internet* (2016). In decades surrounding 1950–1960, the Soviet Union was making large investments in mathematics and engineering. These investments resulted in some great technological achievements, some of which surpassed those of the US—in 1961, for instance, Yuri Gagarin's journey into outer space signalled that the Soviets had been winning the space race and caused panic in US military and public. Thus, claims Peters, "the Soviet state had all the necessary motives, mathematics, and means to develop nationwide computer networks for the benefit of its people and society" (Peters, 2016, p. 1)—and yet, in spite of having money and knowledge, the Soviets have not arrived even close to establishing an informational network such as the Internet. So what gave the Americans such an advantage? According to Peters,

> although the American ARPANET initially took shape thanks to well-managed state subsidies and collaborative research environments, the comparable Soviet network projects stumbled due to widespread unregulated competition among self-interested institutions, bureaucrats, and other key actors. The first global civilian computer networks developed among cooperative capitalists, not among competitive socialists. The capitalists behaved like socialists while the socialists behaved like capitalists. (Peters, 2016, p. 2)

Thus, continues Peters, "it is a mistake, as the standard interpretation among technologists and some scholars have it, to project cold war biases onto this history. Our networked present is the result of neither free-market triumphs nor socialist state failures." (Peters, 2016, p. 2)

The relationships between political economy of techno-capitalism and technology development cannot be described by a simple formula: 'capitalism has created and perpetuated the digital realm'. Instead, we need to adopt a much more nuanced approach which understands that capitalism has produced various institutional and social conditions—many of which have been in fact quite non-capitalist—that have contributed to the development and maintenance of digital technologies. More generally, the political economy of techno-capitalism cannot be understood only through the grand narratives of social theory. Instead, we need to combine these with much smaller, much less coherent, and much more fragile, narratives around and conditions for innovation and research, which translate into a myriad of important (and well researched) questions such as intellectual property, ethical design, net neutrality, and others.

As we claimed earlier, the informational challenge based on physics is not the only game in town. According to Michael Peters (2012), the emerging form of capitalism is self-renewing in the sense that it can change and renew the material basis for life and capital as well as program itself. Bio-informational capitalism applies and develops aspects of the new biology to informatics to create new organic forms of computing and self-reproducing memory that in turn has become the basis of bioinformatics. In this context, Peters (2012) also reviews the successes of the 'new biology', focusing on Craig Venter's digitizing of biology and, as he remarks, the creation of new life from the digital universe. In the current stage of capitalist development, therefore, we have surpassed the informational challenge alone. Instead, should be talking about two major interrelated forces—informational and biological—which, amongst many other weaker forces, make the basis of our today's society. As of recently, we have captured these developments in a broader concept of the postdigital (Jandrić et al., 2018; Peters & Besley, 2018), which is especially visible in fields such as neurotechnology. According to Ben Williamson,

> As 'postdigital' hybrids of biological and informational codes, novel neurotechnologies combine neuroscience insights into the human brain with advanced technical development in brain imaging, brain-computer interfaces, neurofeedback platforms, brain stimulation and other neuroenhancement applications. Merging neurobiological knowledge about human life with computational technologies, neurotechnology exemplifies how postdigital science will play a significant role in societies and education in decades to come. (Williamson, 2018)

In the context of today's 'bio-informationalism capitalism', challenges from early days of digital technologies become even larger and more important. For instance, there is no doubt that the struggle between the ethos of free sharing characteristic for early days of computing, and its later appropriation by large capital which created some of the richest corporations in the world, has profound consequences to development of informational capitalism. In the context of bio-informationalism capitalism, the question of owning code translates into the question of owning the blueprint of life, and, with developments such as Venter's, the question of owning life itself. Similarly, questions pertaining to ethical design of networks or interfaces translate and expand into questions pertaining to designing living (human) embryos, and the question of net neutrality translates into the questions of primacy of certain forms of life over others. In this way, shows Dyson,

> It has become part of the accepted wisdom to say that the twentieth century was the century of physics and the twenty-first century will be the century of biology. Two facts about the coming century are agreed on by almost everyone. Biology is now bigger than physics, as measured by the size of budgets, by the size of the workforce, or by the output of major discoveries; and biology is likely to remain the biggest part of science through the twenty-first century. Biology is also more important than physics, as measured by its economic consequences, by its ethical implications, or by its effects on human welfare. (Dyson, 2007)

Forms of the economy which spring from the bio-informational capitalism system of innovation have the capacity to change the very being of human existence, and there is no guarantee that these changes will be for the better. These changes are very hard to predict, because the capitalist system of innovation is so messy and unpredictable, and because we have only started to grasp the political economy of the biological. Our research sometimes benefits from the clash

between ideological and organizational models (as in the case of early computer development, where capitalists behaved like socialists); sometimes it benefits from social and political struggle (as in the case of online publishing, which is by and large driven by the struggle between publishers and copy-right 'pirates') (see Jandrić, 2017, p. 256; Peters et al., 2016); sometimes it benefits from industrial principles of efficiency (as in the case of fully commodified pharmaceutical research). This is a typical postdigital situation, where the present state of affairs "is both a rupture in our existing theories and their continuation" (Jandrić et al., 2018, p. 895). We are aware of strong connections between research in the biological sciences and research in the physical (information) sciences—arguably, however, this knowledge is far from complete. In order to gain a deeper understanding of the political economy of bio-informational capitalism, therefore, we will first examine relationships between its main constituents—biology and information.

The curious interplay between biology and information

Chapter 3 of *The Onlife Manifesto: Being Human in a Hyperconnected Era* carries a telling title: 'Dualism is Dead! Long Live Dualities!' Here, Floridi writes:

> Throughout our collective endeavour, a question kept coming back to the front stage: "what does it mean to be human in a hyperconnected era?" This foundational question cannot receive a single definitive answer, but addressing it has proven useful for approaching the challenges of our times. We think that handling these challenges can best be done by privileging dual pairs over oppositional dichotomies. (Floridi, 2015, p. 9)

Floridi then examines several dual pairs, or dualities, such as Control and Complexity and Public and Private (Floridi, 2015, p. 10). He moves on to examine two contradictory accounts of the self:

> On the one hand, in the political realm, the self is deemed to be free, and "free" is frequently understood as being autonomous, disembodied, rational, well-informed and disconnected: an individual and atomistic self. On the other hand, in scientific terms, the self is an object of enquiry among others and, in this respect, is deemed to be fully analysable and predictable. (Floridi, 2015, p. 11).

Floridi's privileging of the non-oppositional concept of dualities over standard philosophical dualism with is somewhat problematic. In his chapter in *The Onlife Manifesto: Being Human in a Hyperconnected Era*, Yiannis Laouris brings back Floridi's ideas to more fundamental philosophical questions:

> What does it mean to be alive? (Does the concept of life need to be revisited?)
>
> What does it mean to be human? (Is the human really something more than just information? If yes, then what?)
>
> If the processes responsible for the emergence of the mind become immortal, can the mind then be separated from its container?
>
> If humans become immortal, what are the consequences for sustainability? (Laouris, 2015, p. 134)

The first question concerns the self, the second and the third question (to different extents) concern philosophical dualism, and the fourth is of a different logical order—being largely an environmental issue.

Now let us try and apply Floridi's ideas to the interplay between (material?) biology and (non-material?) information. As indicated by Charles Ess (in Floridi, 2015, pp. 92–95), their mutual relationships have a lot in common with eternal questions pertaining to philosophical dualism such as the mind-body problem. Yet, Laouris' analysis (2015) indicates that once we reduce the problem to a more approachable, non-oppositional concept of dualities, a larger shadow of oppositional dualism immediately re-emerges. Floridi's analysis of the duality between individual

freedom and the society seems to offer a way out from this vicious circle. Floridi writes: "in political terms, that our selves are both free and social (…) The contextual nature of human freedom accounts both for the social character of human existence, and the openness of human behaviours that remain to some extent stubbornly unpredictable "(Floridi, 2015, pp. 11–12). Thus, Floridi shows that the political realm provides an escape from persistant oppositonal dualisms, and offer a way forward in our analysis. Therefore, political economy is essential for understanding 'bio-informationalism capitalism'—all the way down to the very basic questions such as what is a human being.

Foucault's *homo economicus* is a being formed by decidedly economic origins and social relations of power (Pierce, 2013, p. 13)—in our recent work on the informational challenge, we show that her key assumptions are rationality, individuality and self-interest (Peters & Jandrić, 2018, p. 82; see also Peters, Jandrić, & Hayes, 2018). However, the rise of (digital) technologies has brought about the new economic logic of peer production, which also brings about radically different power relationships. Here,

> The assumption of individuality is counter posed by collective intelligence (Lévy, 2015; Peters, 2017; Peters et al., 2016), that can take different forms from collective awareness and consciousness, to collective intelligence, responsibility and action. The assumption of rationality is contradicted in a networked environment as the ontological basis is contained in the relations between entities rather than any one self-sufficient entity that is rationally aware and transparent to itself. The network is a very different kind of epistemic set of relations rather than the individual knowing agent. Finally, the assumption of self-interest again tends to be offset or decentred by forms of collective responsibility. In a connected world there are no clear boundaries in either the physical or social worlds. This much is given in the forms of process philosophy. (Peters & Jandrić, 2018, p. 350)

This brings about the contrasting concept of *homo collaborans* who actively participates in collective intelligence and consequently bears own part of collective responsibility.

Our research indicates that the distinction between *homo economicus* and *homo collaborans* is not one more attempt at a dualist philosophy. These two concepts should be understood as opposite poles of a continuum, as theoretical ideals which serve us to position our current state of being within a (hopefully) useful framework. Human beings are always in the between of these poles—we all possess elements of *homo economicus* and elements of *homo collaborans*, which are deeply interwoven in our nature. At an ontological level, this reflects the old philosophical question which, in its contemporary form, is probably best summarized by the contrast between Darwin's theory of evolution and Kropotkin's theory of mutual aid. At a level of political economy, this reflects in the ideologically mixed organizational models which Benjamin Peters calls "the capitalist behaviour of socialists, and the socialist behaviour of capitalists" (Peters, 2016, p. 2). In the context of the informational challenge, we recently concluded "that the struggle between *homo economicus* and *homo collaborans* has always been there, but digital technologies have created a new battlefield and a new opportunity to challenge the traditional order of things" (Peters & Jandrić, 2018, p. 350). Re-examining this conclusion in the postdigital context and through the lens of bio-informationalism capitalism, we cannot help but give it a new reading—asking questions pertaining to information, we end up with questions pertaining to biology.

Towards a new language of communicative biocapitalism

We have now surpassed early stages of development of digital technologies—departing from various determinist approaches characteristic for early critiques, we now know that technological development can be understood only in hand with social development. We are now almost four decades from Haraway's early insights in posthumanism, and we know that *homo sapiens* are simultaneously experiencing evolution and enhancement and that these developments take place within the postdigital "blurred and messy relationships between physics and biology, old

and new media, humanism and posthumanism, knowledge capitalism and bio-informational capitalism "(Jandrić et al., 2018, p. 896). We are also well aware of eternal oscillations between the *homo economicus* and the *homo collaborans*, and their complex interplay in our postdigital age. At this stage of development of human thought, the digital challenge is already a well-read book. 20th century, which created the digital challenge, belonged to physics and engineering; 21st century, with its many challenges about the nature of human beings and our planet, firmly belongs to biosciences, bioengineering (see Dyson, 2007; Peters, 2012) and to the postdigital (Jandrić et al. 2018; Peters & Besley, 2018). Bio-digitalism is code-driven and work in biology based on bio-informatics (only super computers and later quantum computers) can assemble the amino acid equations (millions of letters long) that create new DNA (new synthetic life) and new biology applied to computer now faces the development of organic memory. So, if we are looking long term it really is the intersection of this as our ontological environment or ontological ecology.

The biological challenge needs to be understood as part of the wider innovation of techno-capitalism and can only really be understood in postdigital terms of posthumanism though bio-digitalism—specifically how these two forces between them shape the future of human ontologies of what we can become. Bio-digitalism or bio-informationalism combines that two major technical forces, or force fields, that (amongst many others) determine our social environment. It is the intersections of these two forces, and our interaction with the bio-digital environment, that determines open ontologies. That leaves a lot unsaid and many possibilities which are of course not prescribed—learning from the Frankfurt School of Social Sciences (Feenberg, 2002), our technology is not our destiny.

Luciano Floridi's *The Onlife Manifesto: Being Human in a Hyper-connected Era* (2015) clearly indicates that philosophy is a crucial starting point for this inquiry. It allows us to ask eternal questions, such as what it means to be alive and human, and it provides a theoretical logical framework for approaching these questions. Our insights into the dynamics of capitalist production of nature, and our insights in posthumanism, are all pieces of a larger puzzle of the biological challenge. However, the biological challenge is not either a rupture or a continuation of our existing (research) questions (Jandrić et al., 2018, p. 895)—it provides new postdigital challenges, and new postdigital dynamics between our existent challenges, and new ways of understanding our postdigital reality. In order to respond to the biological challenge, therefore, we need a new, postdigital language of inquiry—a language of simultaneous reinvention of the digital challenge and invention of its relationships to human biology.

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