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Abstract

A current pandemic which has pushed much work online has revealed a lack of literacies in information security, surveillance capitalism, and the unresolved problems of algorithms and control (e.g., Zuboff, Berners-Lee). Yet there is a decades-old tradition of pedagogies that address the complex interactions of the interdisciplinary technoscientific world (Morin, G. Bateson, Rheingold, Dewey, Freire, Cooper) and the need for ethical approaches (Quéau, Markauskaite and Goodyear, Haidt, Gardner). Some of them emerged from the field of cybernetics (Morin, N. Bateson). Recent events show the need for further popularization of digital literacy, interdisciplinary approaches, intellectual and creative rigor, questions of service and liberty, and dialog on what constitutes 'good' professional praxis. This paper considers the always unfinished work of pedagogy to 'rise up' above names—here, of humanist technoscience—to consider what belonging together means. Through a largely hermeneutic approach, the problem of the technoscientific and its history in cybernetics is remembered in such a way as to remind us of features of our shared creative odyssey towards 'something of greater significance' (Dewey) and to show that uncritically downloading the latest app or giving up on the question of taking professional care is for the lotus-eaters.

Keywords Critical pedagogy · Digital literacy · Cybernetics · The two cultures · Interdisciplinary studies · Service and liberty

A recent shift to more work being done online has revealed a dearth of technoscientific literacy and related dialog. At stake are questions not just of liberty and productivity but also of robust intellectual discourse, and individual and collective creative agency. Technology remains a problem as much as an aid.

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The word technoscience is used to describe this problem, as per Edgar Morin's definition to indicate where machine, science, and technique are intertwined, productive of both elucidation and knowledge as well as ignorance and blindness (Morin 2008/2004: 171).

Part of the difficulty in addressing current issues surrounding digital technology is due to its roots in cybernetics and resulting transdisciplinary nature. For example, software and platforms are as much about tech as they are about psychology and emotions (the dopamine of likes), social needs (networking), and culture (group identity, symbols, and the cult of consumption). It is old news for some but the culture industry explained by Adorno and Horkheimer (1989/1944) as the easy pleasures of capitalism, rendering people content and docile, has become even more pernicious. This is to say that the ways in which it is becoming embedded in our lives require continued reflection.

The process by which users of digital technology have become viewed as nothing more than sources of data to be indexed, searched, and traded—optimized for corporations and used as material for products for clients—is 'dark' (Zuboff 2019: 201–202). The choice of this adjective (with respect to its tertiary meaning) should be clear when considering that 'empathy is manipulated and instrumentalized to modify behavior toward others' ends' (Zuboff 2019: 438). But this data is also 'dark' because it is initially unstructured and threatened by that information that cannot be reached—thus 'in the dark' (Zuboff 2019: 201–202) and further because the goals and workings of this new type of capitalism remain unseen by much of the public. The impact of the dark problems posed by Platforms or Software as Service (PaaS and Saas) is documented by works with suggestive titles: *Surveillance capitalism* (Zuboff 2019), *Hooked: how to build habit-forming products* (Eyal 2014), *The black box society: the secret algorithms that control money and information* (Pasquale 2015), *Algorithms of oppression* (Noble 2018), *Zucked: waking up to the facebook catastrophe* (McNamee 2019), and *The attention merchants* (Wu 2016), raising questions about the meaning of service—and liberty.

Further works have documented the impact of this dark digital technology on economics and workers' rights (Stoller 2019), Sadowski (2020), Roberts 2019), and democracy and human dignity (Christl 2017), Taplan (2017), Vaidhyanathan (2018), Stroud (2019), Michel (2019), Berners-Lee (2018), Roberts (2019), Gilliard (2020), Shaffer (2019).[1] Much of the literature predicted these problems decades ago (e.g., Quéau 1998; Rheingold 1993). To reiterate: 'dark' data is used not just for marketing purposes but for human engineering and control. We are now the product (Zuboff 2019). The reductionist thinking that has emerged from the click-bait design of apps now essentially writes the news (Shaffer 2019). More specifically, New York Times editor Bari Weiss claimed in her public letter of resignation that Twitter should be on the paper's masthead as it 'has become its ultimate editor' (Weiss 2020). 'Truth isn't a process of collective discovery, but an orthodoxy already known to an enlightened few whose job is to inform everyone else', she wrote (Weiss 2020). Even Y Combinator co-founder and venture capitalist Paul Graham has observed media 'orthodoxy' (Graham 2020). As Howard Rheingold has observed, while this digital Panopticon affords rich

[1] I would be remiss for not observing that most of these books have been discussed by Mark Hurst on his radio show and podcast Techtonic (2017), though I learned of some of them through other networks.

data on human behaviors, it also leads to a 'loss of privacy and the threat of tyrannical control'. This creates a continued need for 'new literacies around participatory media … and critical discourse necessary for a healthy public sphere' (Rheingold 2008).

Given that there has been awareness of the importance of digital literacy for well over a decade, the Wikipedia entry on the topic having been published in 2006 (Wikipedia 2006), there is clearly a need for continued discussion on digital literacy and practical and interdisciplinary pedagogies to address the embeddedness of the technoscientific. This paper explores relevant pedagogies already in existence and contributes an individual reframing that departs from hermeneutics: not only are we still on this journey, but it is up to each of us to come to our own formulations. To quote mathematical physicist James Clerk Maxwell (and his citation of William Harvey), in a sentiment that we shall see is quite Deweyean though well before Dewey's time, not even discussion of the technoscientific frees us from the task of making it our own through the journey of our own experience:

> The facts are things which must be felt; they cannot be learned from any description of them.
> All this has been said more than 200 years ago by one of our own prophets, William Harvey of Gonville and Caius College:—'For whosoever they be that read authors, and do not, *by the aid of their own senses*, abstract true representations of the things themselves (comprehended in the author's expressions) they do not represent true ideas, but deceitful idols and phantasmas; by which means they frame to themselves certain shadows and chimæras, and all their theory and contemplation (which they call science) represents nothing but waking men's dreams and sick men's phrensies. (in Campbell 1882: 178 emphasis added)

It is not enough to 'merely' know how to use technology efficiently, although this is important. Questioning technology on a deeper level reveals how it is positioned towards creative and participative experience. Existing pedagogies effectively provide ways in which this creativity can not just be safeguarded but flourish. Except not all educational professionals make use of them. As Bernard Stiegler noted, while digital technology can be understood to offer new ways in which the peer-to-peer community constitutes the *res publica*, it is also the case that it is what enables predators to seize 'the personal' (e.g., personal data) and thereby destroy it. What makes this unprecedented, he continues, is that the academic and political worlds do not see their immense responsibility in this new world, with its new conceptions of public action founded on the development of new forms of knowing, that therefore risks becoming polluted, unclean (Stiegler 2014: 78). The fact that multiple pedagogies of technoscientific literacies exist does not undermine his claim as these approaches have not been widely adopted.

It is the role of education to remind us of our creative potential and the responsibility of our social duty that is in service to liberty. We too are called to be like the *polytropos* (*πολύτροπος*) Odysseus, the much-traveled man (or man who could change in many ways/man of many devices/complicated man):

> ἄνδρα μοι ἔννεπε, μοῦσα, πολύτροπον, ὃς μάλα πολλὰπλάγχθη; Tell me, O Muse, of the man of many devices, who wandered full many ways. (Homer 1919: 1.1)

In a world of much travel and even more devices, how do we help each other help ourselves to live lives worthy of being sung, receptive to paths to our complex coexistence?

In an attempt to answer this question, this paper first considers existing pedagogical paths towards digital literacy and information ethics. It then 'comes to terms' with the technosymbolic through a largely hermeneutic reading, providing symbolic explication for professionals who want to work, not do a job, and further suggests the professional practice of learning how to learn again in an augmentative view of knowledge work (Engelbart 2002; Rheingold 2012). Next, it considers cybernetics—which is at once the new form of knowing informing the technoscientific problems listed in the prolog of this paper as well as the subject taken to illustrate the importance of 'hearing out'. Finally, the paper meditates on the forces regulating the co-created life and the benefits of interdisciplinarity which allows practitioners to 'rise above' the naming of disciplinary divides. This ability is the ultimate sign of understanding, as this level of understanding is capable of serving more than itself.

Existing Pedagogies for a Technoscientific World

Rheingold's 'pedagogy for a literacy of literacies' is a comprehensive example of a pedagogy that seeks to cultivate 'the dynamics of cooperation and collective action, the effective deployment of attention and the relatively rational and critical discourse necessary for a healthy public sphere' (2008). His book *Net smart* (2012) outlines practical tips on how to achieve this, such as through mindful use of technology ('infotention'), knowing how to properly use the tools at hand, learning how to find and determine the truth-value of information, and some criticism of digital platforms. For example, his discussion of participatory culture suggests microblogging alongside wiki collaboration and vernacular video. His work *Smart mobs* (2003 /2002), so ahead of its time that it remains relevant, as does his even earlier work *The virtual community* (1993), which explores the democratization potential of technology such as through sousveillance (turning the lens on those usually doing the watching), open source coding, and net neutrality—but also its potential for increased surveillance.

Earlier work that addresses the relevance of digital literacy to an integrated interdisciplinary understanding of the world and life can be found in the works of Gregory Bateson and Edgar Morin, who met for a short period of time and share an interest in what could be called ecological thinking. They will be returned to later in the section on cybernetork is *Steps to an ecology of mind* (1976/1972), which has a section addressing cybernetics and coding. The pedagogical significance of this book can be illustrated through the works it inspired, like Tim Ingold's *Perception of the environment* (2000), whichics. Bateson's most famous w considers skill in such a way as to present it as a holistic part of experience. Bateson's work, while not strictly pedagogical, is being cited in this section as support for views on education that see education as more than

compartmentalized job training. It is noted that there was no such compartmentalization in classical education, either (Jaeger 1945).

Morin's work is directly related to pedagogy, and his *Seven complex lessons in education for the future* (1999) was published by the United Nations Educational, Scientific and Cultural Organization. The work can also be described as holistic and addresses a wide range of topics including ethics, earth identity, uncertainty, egocentrism, and ethnocentrism. In a more recent work, he reflects on the process of globalization, catastrophic trends in technoscience and the economy (for example, through biospheric degradation, nuclear arms, and speculative finance), and robotic transhumanism. With regard to the latter, he explains that without moral and intellectual progress, the project of subsuming the human to an algorithm is doomed (2011).[2]

It is this last point that can be directly related to digital literacy which, as per Rheingold's definition, involves participatory media, collective action, healthy attention, and intelligent, civil, and critical discourse 'for a healthy public sphere'. Rheingold's definition can be further related not just to a Freirean reading of 'literacy' but also to a constructivist Deweyean pedagogy. It therefore shares the same theoretical foundations as networked learning, into which it can be integrated. Networked learning will be outlined after a brief review of some of Freire and Dewey's ideas.

The true purpose of literacy is inherent to any effective pedagogy and is defined by Freire as the power, by way of reflection, to transform the world (Freire 2005: 75, also cf. Dewey 1916: 45–46). In Dewey's words, '[s]chools require for their full efficiency more opportunity for conjoint activities in which those instructed take part, so that they may acquire a social sense of their own powers and of the materials and appliances [i.e. tools] used' (Dewey 1916: 48, also see 115). Literacy effectively calls on multiple ways of being, knowing, doing, and thinking. It can be considered in terms of epistemic fluency, particularly where it seeks to cultivate consci(enci)ous action (Markauskaite and Goodyear 2017 in Goetz 2020). Education should provide all students with some experience in this, as such experience on the individual level is critical to the collective social good:

> A society which makes provision for participation in its good of all its members on equal terms and which secures flexible readjustment of its institutions through interaction of the different forms of associated life is in so far democratic. Such a society must have a type of education which gives individuals a personal interest in social relationships and control, and the habits of mind which secure social changes without introducing disorder (Dewey 1916: 115).

It is relevant and important to note that although predating the digital age, Dewey laid important pedagogical foundations for it. For example, he points out that an effective pedagogy addresses aspects of the world that the young interact with. For this is what shapes 'their interests, minds and characters—either educatively or mis-educatively' and forms the 'unorganized and casual forces' (Dewey 2007/1934: 99) that they will be at the mercy of if not addressed. In 2020, these aspects will necessarily involve

[2] A Less Wrong post (Armstrong 2010) popular among some in Silicon Valley (e.g., Lewis-Kraus 2020) depicts a thought experiment with a similar conclusion.

something of digital culture—which is central to networked learning (Beaty, Cousin, and Hodgson 2010; Hodgson and McConnell 2019: 587).

But there is a second important contribution Dewey made that can clarify our understanding of new media. 'Every step from savagery to civilization is dependent upon the invention of media which enlarge the range of purely immediate experience and give it deepened as well as wider meaning by connecting it with things which can only be signified or symbolized', Dewey writes. The danger is that the 'media of representation will become an end in themselves' (Dewey 1916: 272).

Finally, Dewey brings up a point about utilitarianism that is relevant when considering the design potential of a project-based networked learning class. Namely, he writes that culture is just as important as utilitarianism and he had a vision of transforming education in such a way as to heal the 'inorganic composite' that these subjects form. This can be corrected by teaching cultural subjects in such a way as to reveal socially serviceable aspects and by teaching utilitarian (or specialized) subjects in such a way as to reveal their capacity to liberate the imagination and thinking power (Dewey 1916: 301).

Networked learning can be seen as an application of Deweyean approaches to the digital learning environment of today. It has most recently been defined as involving:

> processes of collaborative, co-operative and collective inquiry, knowledge-creation and knowledgeable action, underpinned by trusting relationships, motivated by a sense of shared challenge and enabled by convivial technologies. Networked learning promotes connections: between people, between sites of learning and action, between ideas, resources and solutions, across time, space and media. (Networked Learning Editorial Collective 2020)

Networked learning is designed to expose students to information, communications technologies, peers, tutors, and communities with which they are to communicate and act, in this way giving students experience in human agency (Hodgson and McConnell 2018). Networked learning has not only developed theory that supports reflective, reflexive interactive praxis but has gained decades of experience in it. It has deliberately sought to promote 'e-quality' based on collaboration and co-creation among students and teachers (Beaty et al. 2010; Beaty, Hodgson, Mann, and McConnell 2002) and aims to foster 'inclusion and democracy in learning community' (Beaty et al. 2010: 587), including conscientious focus on the importance of dialog (Sorensen 2010). This is related to its other focal points of critical reflexivity and responsibility (Beaty et al. 2010: 589) and time and context (Hodgson and McConnell 2019), acknowledging that 'grafting on technological advances does nothing to mitigate this need for maturity in formal learning environments' (Beaty et al. 2010: 590). Developed through research conducted by the Economic and Social Research Council aiming to understand the implications of networked learning for higher education (Beaty et al. 2002), it is robust and flexible enough to provide the basis for an approach to teaching digital literacy in the humanities, where students at once use the technology in participatory and networked action-based learning but also reflect on its cultural significance and effects (Goetz 2020).

Hélène Trocmé-Fabre is an example of a thinker who has explored variations of 'networked thinking' to pedagogical design. In her work *J'apprends donc je suis*, she considers the multiple roles and environments of the contemporary student and professional and the need to develop appropriately multidimensional educational formation (1992/1987: 253–258). In *Réinventer le métier d'apprendre*, she uses cybernetics to inform some of her thinking on education, such as how to adapt feedback loops so as to factor in value systems and systems of representation with the aim of improving pedagogical models (Trocmé-Fabre 1999: 110–111). She also draws support from writers such as Norbert Wiener, who will be mentioned later (Trocmé-Fabre 1999: 217–224). She quotes Philippe Quéau, philosopher and former director of the French National Audiovisual Institute, whose definition of cyberculture she describes as 'perfect' for remembering the etymological root of the word cybernetics in connection with his definition of this culture: he understands that the navigation through the immense information resources that constitute cyberculture involves governance on both individual and collective levels (Trocmé-Fabre 1999: 196–197).

Quéau (1998) writes that cyberculture requires discovering what constitutes the universal in order to establish an 'ethics of the universal'. He explains in the section cited by Trocmé-Fabre (1999: 196–197) that the technological problem of cyberculture requires enormous effort to protect human dignity in the new information society and its transfrontier flux of givens. The work Trocmé-Fabre cites by Quéau is directly concerned with information ethics, cognizant of the cultural implications of virtual abstractions (Quéau 1998). Quéau writes that the de-materialization of the economy takes place at the hands of 'symbol manipulators' who are responsible for the de-localization or 'glocalization' of enterprises, institutions, and nodes of power (Quéau 1998).

This can be compared with Stiegler's understanding of the technosymbolic milieu (developed through his school of philosophy, Stiegler 2010–2020), associated to individuals only insofar as it is the medium and vector of a person's individualization, which, though involving the technosymbolic, is effected through the associated milieu of individuals. In other words, an associated milieu is one of co-individuation in which individuals produce, not consume, symbols. Where this ceases to be the case, it becomes a dissociated milieu (Stiegler 2014: 78 footnote 18).

The tome on epistemic fluency and professional education by Peter Goodyear and Lina Markauskaite (Markauskaite and Goodyear 2017) also puts emphasis on the importance of coordinating, integrating, and assembling an actionable consci(enci)ous approach to professional work. The final chapter (Markauskaite and Goodyear 2017: 595–612) explores how development through epistemic projects should lead to a final project in 'grounded actionable knowledge', drawing previous projects together 'by grounding human knowledge and knowing in the physical environment and the embodied conscious and consciencious self' (Markauskaite and Goodyear 2017: 596). Drawing on the work of Ingold (2000)—whose 'holistic' interpretation of 'skill' has already been noted as important to the ecological thinking to come out of cybernetics via Bateson—they consider the insights of an epistemic inquiry that would foreground craftsmanship, song, and imagination instead of technology, language, and intelligence (Markauskaite and Goodyear 2017: 597).

Two more authors who have written on ethics should be briefly mentioned here for their interdisciplinary reach. The first is Jonathan Haidt (2012)—social psychologist and professor at NYU's Stern School of Business—who is perhaps most famous for insisting that young minds be exposed to that which will make them stronger and encouraged to see beyond binaries (Haidt and Lukianoff 2018). An essential part of this ethics is exposure to that which is other (cf. Weiss 2020 and Graham 2020). Haidt is the founder of the Heterodox Academy (Haidt 2015–), which acts to bring together educators, administrators, and students who value diverse viewpoints and open inquiry in research and learning. Secondly, Howard Gardner—Professor of Cognition and Education at the Harvard Graduate School of Education and the author of the theory on multiple intelligences—has himself contributed to a similar initiative through founding the Good Project (1996–), which provides tools for promoting excellent, ethical, and engaging work.

This paper does not seek to replace the work in pedagogy and literacy listed here. But given the persistence of problems despite the successful development of constructivist pedagogies that take a socially responsible view of the use of digital technology and the technoscientific (e.g., Rheingold 2008; Networked Learning Editorial Collective 2020), there is a need to continue to actively and openly cultivate the educational approach that Dewey outlined over a century ago. This laid the foundations for practical, critical engagement with contemporary concerns, encouraging the use of our 'own senses' (Harvey in Campbell 1882: 178) through emphasis on practical (personal) experience. This paper can also be read as a response to the invitation put forward by the Networked Learning Editorial Collective, to continue to contribute to efforts to find 'just transitions to more suitable ways of living' (Networked Learning Editorial Collective 2020).

Coming to Terms with the Technoscientific

It was established above that there are multiple existing pedagogies and interdisciplinary approaches that champion sociocultural values in technoscientific networks. This section will attempt, as per Harvey's urging, to relate it to this author's own intellectual journey, largely derived from hermeneutics, to create steps towards a 'further alternative' (De Bono 1995) to pedagogies of technoscientific literacies.

If it is true that the workings of global capitalism via big tech can threaten democracy and individual empowerment, it is also possible to 'rise up' above the names defining this perception, such as 'technology' and 'the social', to imagine other ways of belonging. This is to follow Hans Georg Gadamer, who wrote about the play of words that is iterated out of our attempt, as learners, to reach an understanding of the things, world, meaning around us:

> The weight of the things we encounter in understanding plays itself out in a linguistic event, a play of words playing around and about what is meant. Language games exist where we, as learners—and when do we cease to be that?—rise to the understanding of the world. (Gadamer 2004: 482–483)

This section takes as its point of departure Gadamer's idea of language as the meeting place (or medium) of subjects, objects, and ways of being that outlines preconditions for and ways in which understanding can be reached among all of these 'Is' and 'worlds' (Gadamer 2004: 407–471). It also draws on both Quéau's point (after Riccardo Petrella) that the only feasible 'info-ethics' for a global, interconnected world is one that makes the other exist (Quéau 1998) and Stiegler's 'associated milieu' in which mutual individuation is realized even where it includes the technosymbolic milieu (Stiegler 2014: 78 footnote 18).

Co-participation in an associated milieu is reflected in the Greek word *aoide* (ἀοιδή), which can mean the art of song, the act of singing, the thing sung, the theme of song/person sung of, incantation. It is why the *Odyssey*, which was sung, was invoked at the start of this paper: to point to the medium of language which holds the symbols of our experience on our journey towards greater understanding. By encompassing the very act of singing and others too, the word shows that acting and being acted on can be the same if we engage in a type of verbal interaction. It can be compared with the psychological flow state, in which a person becomes completely absorbed by what they are doing—becomes one with it—which further transforms the experience of time (Csikszentmihályi 1990: 8, 3).

True being is participatory, which is to say that the knowing subject belongs to the object of knowledge (Gadamer 2004: 455). True being cannot be possessed by an external, abstracted viewpoint. Yet this is the claim of the technoscience that seeks to use and manufacture data and behavior as described in the prolog to this paper. Where it is an ideology, technoscience claims to have achieved certainty by having abstracted itself from the fundamental relation to the world although this is an illusion because we belong to a history, class, nation, culture, or one or many traditions (Ricoeur 1991b: 267).

Again, while technoscience does not necessarily make certainty claims, this paper is concerned with 'dark' applications which share the objectifying principles Gadamer explains that science can use to organize its knowledge of the world: condemning as heresy all knowledge that is not as certain and does not serve the domination of predictive being (Gadamer 2004: 471).[3] What is lost in the methodology of modern science where it enters 'into the illusion of a critical theory elevated to the rank of ideological knowledge' (Ricoeur 1991b: 269) is 'a passion, an understanding, an event that happens to one'; in short, the hermeneutical experience (Gadamer 2004: 460): participation (Gadamer 2004: 455). Gadamer writes about the power of thought that pursues what consistently follows from subject matter, bringing out what lies in it if we disregard appearances and opinions—which of course Francis Bacon was also wary of, describing them as 'idols' (Bacon 1902/1620). In hermeneutic terms, understanding involves a rigorous, uninterrupted listening (Gadamer 2004: 460–461): hearing things out.

What is at issue is the human experience of the world. This experience is verbal in nature (Gadamer 2004: 444), which is to say that while the artificial languages of programming and mathematics also use symbols, the explanation of the symbolic meaning of these languages largely takes place in natural language [the operational levels of language figure into the cybernetics of Gordon Pask's conversation theory (1975)]. The limitations of comprehending programming language outside of a shared

[3] Yet the supposition that a finite human can hold an objective viewpoint (characteristic of second-order cybernetics)—can see from an atemporal perspective—is problematic (Gadamer 2004: 471). Ricoeur calls this the problem of belonging (Ricoeur 1991b: 267).

context—with limited communication of meaning in natural language—are well documented (most significantly Naur 1992/1985: 37–48). Gadamer explains the indispensability of human experience in terms of how symbols are 'blind':

> human imperfection precludes adequate knowledge a priori, and that experience is indispensable. Knowledge acquired through these symbols is not clear and distinct, for a symbol gives nothing to the senses to perceive; rather, such knowledge is 'blind,' inasmuch as the symbol is a substitute for a real piece of knowledge, merely indicating that it could be acquired. (Gadamer 2004: 415)

This is to say that the understanding of artificial languages and their longevity remains bound to the mediation of human experience. AI expert Francois Chollet explains this in terms of the 'situational' nature of intelligence, which cannot be general because a person's brain belongs to a system including their body, environment, other humans, and culture as a whole—which has been functioning as a self-improving system for a long time. 'Recursively self-improving systems, because of contingent bottlenecks, diminishing returns, and counter-reactions arising from the broader context in which they exist, cannot achieve exponential progress in practice.' (Chollet 2017)

This can be put another way. Gadamer considers that the problem of 'metalanguage' may be impossible as it is only conceivable in terms of a language that introduces its conventions, which is to say that it necessarily involves a reiterative regress. 'But the interminability of this process constitutes no fundamental objection to accepting the ideal it approaches.' (Gadamer 2004: 414–415)

These explanations acknowledge the importance of the human context. What is problematic are those approaches that seek to divide it. In Stiegler's terms, an associated technosymbolic milieu is the medium and vector of individuation, which is only made possible because this milieu is understood to associate individuals. In a dissociated milieu, only certain people are the producers who emit symbols (like those who control the service economy through their conception of services): 'others' are made to consume them (Stiegler 2014: 78 footnote 18).

And yet natural language is not only unifying but despite its limitations can also teach something about transcendence.

To rise above the names of things—technology, science, the mechanical, society, culture—to see what is common to them is to perceive that the truth of the thing being named is not contained in the name itself. This is to say that to understand the true nature of something requires passing through nominal intermediaries that are themselves susceptible of improvement (Plato in Gadamer 2004: 428). This can also be rephrased in a Deweyean sense to mean a direction towards 'something of greater significance' (Dewey 2007/1934: 98).

The importance of the associative (in its broadest sense) in understanding can further be understood as interdisciplinary: looking for similarities that broaden our experience.[4]

[4] The search for similarities is metaphorical in nature: 'Even disregarding all formal similarities that have nothing to do with the generic concept, if a person transfers an expression from one thing to the other, he has in mind something that is common to both of them; but this in no way needs to be generic universality. Rather, he is following his widening experience, which looks for similarities, whether in the appearance of things or in their significance for us.' (Gadamer 2004: 428)

But this can be difficult because the language as we use it today has lost its unity and its permanent (poetic) power to disclose possible worlds (Ricoeur 1991a: 489–490).

Seeking commonality challenges us to relinquish false presuppositions and ask 'open' and meaningful questions in order to arrive at authentic, meaningful answers (Gadamer 2004: 357–358). In this, it is also ethical: it reserves a space for that which is other and the possibility of an encounter. If we allow ourselves to be 'bound to one another' in the encounter afforded by the 'new community' where all interlocutors 'come under the influence of the truth of the object' to reach an understanding, we do more than assert ourselves through our point of view but become 'transformed into a communion in which we do not remain what we were' (Gadamer 2004: 371). Not only does common understanding, mutual sympathy, and goodwill ward off a return to barbarism (Dewey 2007/1934: 101) but also it affords space for individuals supported by intelligent, informed conviction to make beneficial contributions to society (Dewey 1946: 61). This may be compared to Morin's 'cognitive democracy', described in his tome on ethics, which is a system that is nourished by antagonisms while regulating them (Morin 2008/2004: 173). To belong means continuous pedagogical work in expanding personal horizons among the unknown and others. This involves transformative learning: 'the challenge for us is to create harmony based on reason and choice … [authentic] choices are free', not imposed (Csikszentmihályi 1990: 7).

To say that we need a creative, not predictive, vision is to say that life is something more than *boulot, metro, jeux vidéos, dodo, zéro* (work, metro, video games, sleep, zero) to adapt a French idiom coined after a 1951 poem by Pierre Béarn.[5]

Professionals Anew?

The title for this section is to reflect on the need today for new skill sets, or peripheral skill sets, to be developed, if needed, from scratch, by professionals who wish to grow alongside the continual growth of knowledge in the bid to effect co-individuation. It is hard to know where or how to begin again because the speed at which our lives have been increasingly regulated by digital technology is such that it has been difficult to find the time and/or distance required for meaningful reflection (e.g., Newport 2019; Odell 2019). On the one hand, as relevant literacies continue to change, non-IT professionals who download and use the latest software and platforms could afford to learn to question their habits where these habits lack critical reflection. On the other hand, the prevalence of the lack of literacy even among Web developers and practitioners can also be profound. To give one example from the field of privacy, the premise of an upcoming book was discovered almost by accident, through interactions at conferences that led to the observation that: 'you can work full time on online privacy and still not actually understand it' (Burns 2020).

A commonality among professionals from all fields pertains to changes in publishing trends. In addition to the increasing popularity of publishing under Creative Commons licenses and with Open Access, there is a new movement to reclaim ownership over

[5] The continued relevance of this simple trope describing the daily grind, restricting personal creativity, can be seen in an updated version of the poem in Montenegrin Ekrem Jevrić's 2010 hit song, 'Kuća-poso' (Homework).

authorship and data control. The rss feed is seeing a resurgence, promoted in part by trends in having a domain of one's own, micro-blogging, and the IndieWeb, particularly among professionals and learners (e.g., Sott 2017; Groom et al. 2019). There are spaces for imagining more organic networks in the digital ecosystem, free from vendor lock-in and protective of content ownership. Professionals who are themselves uncritical of their SaaS or PaaS use can explore sites like https://switchingsoftware.com, https://ethical.net/resources/, https://www.privacytools.io/operating-systems/, https://ssd.eff.org/en, https://deletefacebook.com/, and https://degoogle.jmoore.dev/, which assist in 'continuing education' efforts. The Creative Good newsletter and blog also provides a critical take on industry news that can be used to supplement learning materials (Hurst 2012; the series notably began before the term 'blog' was coined, see Hurst 1997).

We remember that Dewey observed that 'sometimes learned, erudite persons, as having parted with the capacity to grow, are not educated' (2007/1934: 96). This is to say that where there is growth, there will be a periodic need to 'begin again'. In other words, it is expressly acknowledged that changing habits and practice require time and reflection that might not be afforded in workplaces, especially if they already require overwork. Yet, despite the infringement on 'personal time' that growth requires, it is only by facing the challenge that it can be overcome.[6] Put another way, this unpaid service is the cost of democratic liberty—yet the alternative, to extrapolate from the current status quo, is that we be reduced to servants whose 'psychopower' is captured (Stiegler 2013/2010: 55), our creative potential unfulfilled.

It can be hard in the middle of a career in Web development or education to keep realizing that one is beginning again, in need of more learning, more vision. Beginnings are difficult—but if we do not accept the call for creative direction, which is only possible if we can first come to terms with reality as it is, someone else will, and will manipulate it. We will be returned to Plato's cave (Plato 1969: 7.514a–7.520a), to a virtual life of passive reception. It does not make sense to first use the machine and only then to think about living, to adapt Lewis Mumford's famous quip.[7]

In the case of Web users, uncritically downloading and using digital applications and services are eroding the liberty, as always, of those on the margins: those who have to watch and filter YouTube videos (Roberts 2019), for example, or those who are more likely to be misidentified by an algorithm (Stroud 2019), or media exposure designed to influence political decisions (Taplan 2017; Vaidhyanathan 2018).

In the *Odyssey*, this uncritical mode of behavior was expressed in terms of lotus eating: those who eat of the honey-sweet fruit no longer have a wish to 'bring back word or to return' home (Homer 1919: 9.91–97 emphasis added). In Aldous Huxley, this is expressed in terms of soma, which calms anger, reconciles a person to their

[6] What does it mean to be a progressive who largely writes off mechanisms of surveillance and control as being as old as the sun—yet still expect social justice to be effected in this brave new age? What does it mean to say you 'have nothing to hide' when information security (infosec) professionals are adamant that that is not the issue (e.g., Hughes 2019; Lopp 2018; Peck 2019)? For an example from the IT world, see Burns (2020). Paying attention to how the digital environment has changed can be viewed as an exercise in flow: 'staying in touch with what is going on' (Csikszentmihályi 1990: 6). Specific places to start staying in touch would be the Electronic Frontier Foundation (e.g., EFF 2019) and for IT and business the International Association of Privacy Professionals (e.g., Leach and Donahue 2020).

[7] Mumford wrote: 'For mark this: only those who live first and who keep alive have earned the right to use the machine. Those who use machinery because they are incapable of facing the stream of life and directing it ... [become] mere attachments to a mechanical contrivance.' (Mumford 2007: 52)

enemies, makes them patient, virtuous—but absent (Huxley 1932: 158). The problematic nature of reality, which can block a person's journey—causing anger, involving enemies, tempting patience and virtue—is hard to accept, which means that accepting it also requires reconciliation with the impulse to escape.

The underlying theme in the prelude above is that of the discomfort of beginnings, so real as to provoke a wish to avoid them, though they are fundamental to the creative act. There is no creative act without first (re-)learning how to deal with the difficulty of beginning (Cameron 2002).

The increasing prevalence of the cult of professionalization, predictability, and certainty that can be found in recent years would stifle the creative impulse—which by its nature involves imperfection. It is important to note that many of today's (sometimes disillusioned) Web programmers got a start to their digital careers because twenty plus years ago, it was possible to experiment, to also make mistakes, online, with fewer consequences. These were the days of the small Web, a time when computers were seen as tools for a collaborative utopia and personal liberation (Turner 2006). In the meantime, to follow Stiegler's assessment and some testimony, 'software activists … engineers and technicians, [are] subjected to the proletarianized condition that has been imposed upon them by the cybernetic division of their labor, which thereby ceases to be work and becomes merely a job' [Stiegler 2013/2010: 54–55; also see—for illustrative purposes—discussion of this in terms of 'VendorOps' (Rachel 2020)].

It is also relevant to note that higher education teachers were not expected to publish as much before the age of digital technology—but are now tacitly expected not only to have mastered this form of communication but also to contribute profusely and meaningfully to it, possibly all the time. Certain professors have demonstrated a talent for this type of exchange (e.g., Galloway 2017–), the uneven distribution of support from assistants or production teams notwithstanding.

As complexity is ostensibly lost through the predictive sheen of user design, so is the creative capacity for programming. In an observation that can be compared to the state of affairs in Huxley's *Brave New World* (1932: 146–147), in which cultural complexity and difficult questions of liberty have been displaced by a popular culture of ersatz ease and happiness, computer legend Alan Kay opines:

> Perhaps it was commercialization in the 1980s that killed off the next expected new thing. Our plan and our hope was that the next generation of kids would come along and do something better than Smalltalk around 1984 or so. We all thought that the next level of programming language would be much more strategic and even policy-oriented and would have much more knowledge about what it was trying to do. But a variety of different things conspired together, and that next generation actually didn't show up. One could actually argue—as I sometimes do—that the success of commercial personal computing and operating systems has actually led to a considerable retrogression in many, many respects. … In the last 25 years or so, we actually got something like a pop culture, similar to what happened when television came on the scene and some of its inventors thought it would be a way of getting Shakespeare to the masses. But they forgot that you have to be more sophisticated and have more perspective to understand Shakespeare. (Kay 2004)

Yet there are cultural examples of moves to eschew retrogression by engaging individuals' 'own senses' (cf. Harvey in Campbell 1882: 178). These even include important rudimentary attempts to safeguard experimental spaces online to reverse the standardization and appropriation of creativity in recent times.[8]

Specifically, to return to the resurgence in blogging mentioned above, the IndieWeb movement expressly defends 'live' redesign, which is to say an ongoing online process that can be conceived of as an unfinished space as the Web page is consistently being iterated (not unlike pedagogical design). 'Selfdogfooding' is defined as 'the act of using your own creations and depending on them personally yourself … using your creations on your personal site as an aspect of your primary online identity, day to day. Build what you need. Use what you build.' It defends the iterations of the creative act and encourages bloggers to simply begin with what they need, and then work from there (IndieWeb 2020). To put this more explicitly: such an approach safeguards the process of the creative experience. One can live first, then use the machine.

Much of this resurgence can be summed up in the suggestive title of a recent blog post: 'Rediscovering the small web' (Satyal 2020). It is noted that while the Web began small, though it has grown in the past two decades, it has actually effectively shrunk in that it is now controlled by fewer players (Garron 2020). This is not the only illusion: there is also the problem inherent to the word 'self-hosting' which should simply be called 'hosting', in line with how Internet service was initially built on self-hosting. This is to say that the name used for hosting should reflect the fact that self-hosting used to be the norm and that third-party hosting came later. Hosting (or self-hosting) in this understanding should be contrasted with 'outsource hosting' (Garron 2020), which puts emphasis on how hosting on other people's servers involves something 'other', something 'outside' of our domain. The naming is of cognitive importance (just as the 'cloud' is not really a cloud but, again, a third-party server). The naming in this particular instance is also particularly 'rich' when we remember that the word 'economy' is etymologically related to the ancient Greek word *oikos* (*οἶκος*), which refers to a family, the family property, the family house—which is where hosting traditionally takes place.

This can be confusing. But the prologetic focus of this paper concerns the ostensibly growing number of walls and locks designed through the feedback loops of cybernetics that cap our creative capacity and ownership. I write ostensible (again) because we are free to write 'discovered' life themes as opposed to accepting the 'predetermined' one (Csikszentmihályi 1990: 7) and realize creative co-individuation.

'Hearing Out' Cybernetics

It was stated above that the creative vision that is concerned with the essence, not just appearance, of things begins with rigorous listening. Things have the potential to involve a complex combination of both good and bad, which is another way of

[8] A specific example of new forms of appropriation is that of walled-gardens like Instagram. It is us who provide the content that generates content fed to us. But this content is locked in: woe to the artist who tries in some years' time to easily export all they have uploaded and produced there. An example of the attempt to safeguard creative space is Neocities, particularly if it is used as a platform to learn the basic programming to write and later host one's own site. Something in between is Balkan's 'small web' (Balkan 2020).

explaining Aristotle's Golden Mean (1944). This Golden Mean is not a 'pocket rule' (Campbell 1882: 74), but rather a complex assessment that is required ever anew as circumstances change. Therefore, the full human potential is not represented if things are merely passively 'subscribed to', if I may be afforded a play on words to indicate the non-critical subscription to applications, platforms, and content and adoption of the status quo: *metro, boulot, dodo*, devoid of creative agency. This is to say that while the creative vs. predictive approach involves a critique of the technoscientific, this does not imply a categorical rejection of it, but just a shift in relational qualities.

If the predictive landscape in which we find ourselves—and which is in need of creative vision—was largely created through iterations of cybernetics, we shall explore it, very briefly.

As set out by W. Ross Ashby (1957: 219) and the Macy conferences (Wiener 1948: 18–19), cybernetics is a transdisciplinary approach that seeks through the system and causal chains of the feedback loop to achieve desired goals, including control in machines, organizations, and living organisms. While the Macy conferences had the larger goal of achieving communication among different disciplines, it is associated with cybernetics, which was only one of the topics it covered, as it laid the groundwork for transdisciplinary exploration of the scientific study of 'control and communication in the animal and the machine' (cf. part of the title, Wiener 1948). It is the superficial view of this history that gives cybernetics a bad name: linking it to the feedback mechanisms of pervasive control such as in the algorithms that involve psychology in the machine.

The role of science, technology, social communities, mind, and communication was explored in the Macy 'meetings' (Wiener 1948: 18). One participant was Kurt Lewin, who developed his understanding of feedback mechanisms in the field of social psychology, which he explains should not be confused with 'social science "technocracy"' as it is not to be understood as diagnostic and prescriptive; rather, both diagnosis and treatment are to draw on a repertory of knowledge and experience, requiring skill to determine the laws in a given society. He further gives a moral warning that social scientists ought to be motivated by the good (Lewin 1948: 213). This is 'the other side' of cybernetics: its complexity (or 'gray area'). And along these lines, both Norbert Wiener and Ashby also regarded social regulation to be immensely complex: Wiener in his reluctance to apply the mathematics of cybernetics to the human sciences (1948: 25) and Ashby in his concept of the black box (1957). Importantly, Lewin's work (e.g., Lewin 1948) has greatly influenced networked learning [particularly via Kolb and Fry (1974), e.g., Levy (2003)] and collaborative learning methodologies. An iteration of this work can be found in participatory action research (e.g., Kindon, Pain, and Kesby 2007: 9–10, 181).

It is therefore critical to appreciate how almost from its inception, cybernetics also inspired 'ecological' complexity models. Bateson's work has illuminated the complex interconnection of social and behavioral sciences to epistemology (e.g., Bateson 1976/1972: 309–337), forming the basis for a diverse range of later applications [e.g., Ingold (2000); Pringle (2019: 53); Haraway (2016/1985)].

That it is not possible to subscribe to a single view of cybernetics is further illustrated by the person of Aldous Huxley, author of the dystopian novel *Brave new world* and outspoken opponent to large-scale human engineering (1961, 1962). Although Huxley worked with Bateson in exploring the effects of drugs (Pickering 2010:

436), not only did his novel depict drugs as decidedly negative but he also delivered a famous university address in which he cautions about a 'pharmacological method'—which he later explicitly says was depicted in his novel—that would encourage humanity to adopt a painless, voluntary servitude:

> There will be in the next generation or so a pharmacological method of making people love their servitude and producing dictatorship without tears, so to speak; producing a kind of painless concentration camp for entire societies, so that people will in fact have their liberties be taken away from them but will rather enjoy it, because they will be distracted from any desire to rebel by propaganda, or brainwashing, or brainwashing enhanced by pharmacological methods. And this seems to be the final revolution. (Huxley 1961)

The work of detailed study and 'hearing things out' raises interesting questions. But to the point of this paper, to categorically disparage cybernetics and reject the work of detailed study and 'hearing things out' would be to disregard the ecological concerns of Bateson and Morin, which inspired the holistic approach of influential later works, such as that by Ingold (2000). Incidentally, the term cybernetics has been largely replaced by the term 'systems theory' (Wolfe 2016: vii).

More recent (and elaborate) thought on organic, ecological pedagogical approaches can be found in Morin (e.g. 1999, published by the UN). It can also be found in the work of Bateson's daughter Nora in what she terms 'symmathesy' (2015, 2016), which can be seen as a robust networked alternative to the dark side of cybernetics. Bateson defines symmathesy as 'contextual mutual learning through interaction' (2015: 2). It recognizes the interconnected relationship of the living and complex world, and as such all of the 'vitae' (organic parts of the whole) that comprise it are always learning together, forming and informing each other—towards pathology or towards health. Understanding the facets of our interactions requires consideration of consequences. It requires reflective and reflexive praxis and stems from an ethos that can help us learn our way through the structure of the systems of soma that threaten to make us forget ourselves and capabilities—both good and bad. This is part of the point and the problem facing humanity today, as this paper hopes to suggest.

Creative Regulation

To return to the problems listed in the prolog of this paper, there are attempts being made to engineer social behavior, or, in Heideggerian terms, cause us to forget our creative essence (Heidegger (1977/1949: 27). To see this as antagonistic can afford recollection of Morin's definition of cognitive democracy whereby democracy is nourished by antagonisms while regulating them (Morin 2008/2004: 173). One of the critical issues at this time for those seeking to safeguard democracy of all kinds is the question of how centralized/decentralized the Web should be: a question with pedagogical implications particularly if we take a systems-theory-inspired view that we are all learning how to learn together.

It is well-documented how the Web has afforded the realization of new forms of robust participatory organization: the peer collaboration of Wikipedia being a textbook example. A central manifesto of the decentralized vision is *The cathedral and the bazaar* (Raymond 2000). Yet, as Stiegler has noted, institutions of all kinds—at least thus far—dissimulate how they depend on top-down organization, which he illustrates through the example of Facebook. Facebook exploits the personal information that it systematically calls forth in a covert top-down system that destroys (psychic) collective individuation, making the platform not social but antisocial (Stiegler 2014: 78). That this practice is covert renders it problematic to social existence. He defines society as:

> an associated milieu in which all members of the group contribute in one way or another in the evolution of rules, and a political society, in principle constituted by the formation of rational spirits, is founded on the explanation and organization of these rules through public debate which assembles various forms of *bottom up* and *top down* … between diachrony and synchrony, between multitude and unity. (Stiegler 2014: 78)

Stiegler's view of society can be compared with Deweyean principles according to which democratic freedom is bound to regulation—of citizen rights but also the intellectual responsibility of individuals towards society (Dewey 1946: 61).[9] We remember that by 'associated milieu' Stiegler means the individuation of an individual psyche through co-individuation with another or many other psychic individuals constituting a collective individuation that contributes to the individuation of the technosymbolic milieu. This can become dissociated where the technosymbolic milieu is formed at the expense of the individuals comprising it (Stiegler 2014: 78 footnote 18). In Quéau's terms, the de-materialization of the economy takes place at the hands of 'symbol manipulators' who are responsible for the de-localization or 'glocalization' of enterprises, institutions, and nodes of power (Quéau 1998). But I want to interpret these symbols in another way.

Douglas Engelbart, who laid the groundwork for much of the interactive computing taken for granted today, tirelessly advocated all his life that we 'augment the very human skills that people bring to bear on difficult problems.' He further explains that a cornerstone of his work is based on the feature of humans:

> that makes us human [namely] our ability to create and use *symbols* … The ability to look at the world, turn what we see into abstractions, and to then operate on those abstractions, rather than on the physical world itself, is an utterly astounding, beautiful thing (Engelbart 2002 emphasis added).

[9] The emphasis on top-down/bottom-up organization is comparable to the views of Donald Norman, a proponent of complexity design. Norman writes: 'we are proposing to combine experts and community workers. Instead of recommending solutions, experts should be facilitators, guides, and mentors. We need an approach that is top-down, the expert knowledge, and bottom-up, the community people. This method will have to differ from community to community around the world.' (Norman 2019) Also see Willinck and Leif (2018).

This is manifest 'in beautiful ways, through music, through art, through our buildings and through our language - but the fundamental act of symbol making and symbol using is beautiful in itself' (Engelbart 2002). Put in these terms, symbol making is a capacity for the esthetic and the good [in line with Plato in Gadamer (2004: 475, 484)].

It is of particular importance to our understanding of this human capacity that Engelbart—the pioneer of the online system and almost all of the elements of fundamental modern computing, like windows, hypertext, graphics, and a collaborative real-time editor—asked: 'Doesn't anyone ever aspire to serious amateur or pro status in knowledge work?' (2002). Engelbart continues:

1 We are still not able to address critically important problems—particularly if those problems demand high-performance ability to collect and share knowledge across groups of people.
2 This inability is not an accident, but emerges from values and approaches that are 'designed into' our approach to addressing innovation in computing. (Engelbart 2002)

He suggests institutions and individuals address the essentially reductionist biases, through, for example, group work, improving the environment for innovation, and changing regulations regarding copyright (Engelbart 2002).

Engelbart's critique emphasizes the importance of creative productive praxis. Aristotle writes that nobility *based on a person's activities* leads to success even in times of misfortune (1932: 1.10.13). Education can be understood, in part, as practice in such good activities, giving preparation for uncertainty through experience in being nourished by antagonisms while regulating them (Morin 2008/2004: 173) and in self-direction.

The ability to manage situations in which little or nothing is known has become an employable skill. Its contemporary articulation has its origins in soft skills, which can in turn be related to the management of complex situations or environments in cybernetics (Burger 1972: II-31). It trains people entering into new situations to consider what resources they will have available; who their colleagues will be; what the parameters of their job are; what their interfaces are; what kind of communications system they need for continued operability; and which procedures and tools are used in given situations (Burger 1972: II-32). This is an example of a metacognitive skill or epistemic fluency that is also demonstrative of self-directed (and lifelong) learning. For instruction in the theory and applications of epistemic fluency in professional learning, see Markauskaite and Goodyear (2017).

To be clear, guided approaches to information and the mentorship of experience in how to obtain and apply information in situations of uncertainty remain irreplaceable. Rather, the point here is how much of the 'explanation and organization of … rules through public debate which assembles various forms of *bottom up* and *top down*' (Stiegler 2014: 78) considers how much individuals are being augmented by the systems of organization in place, and whether they are wary of the manipulation of symbols in Stieglerian 'dissociated milieus' that covertly function at the expense of the individuals constituting it. Rules that honor the augmentative potential would enable us as individuals to creatively and productively bring out of concealment and into

appearance that which is completed through the crafts or arts (Heidegger 1977/1949: 11) as we rise to the 'play of words playing around and about what is meant' (Gadamer 2004: 484) as *polytropoi* (πολύτροποι), and not reduce us to consumers or users. The latter is particularly oppressive as a pedagogy.

Interdisciplinary Belonging Together

It was suggested above that a pedagogy of literacies would aim to redress the 'inorganic composite' of utilitarian and cultural subjects (to follow Dewey), and be attentive to the interconnection of ways of being, ideas, tools, actions, people, resources, etc. We also considered Ricoeur's view that language has lost its original unity—and with it, its constructive, creative potential:

> Today it is fragmented not only geographically into different communities but functionally into different disciplines – mathematical, historical, scientific, legal, psychoanalytics, etc. It is the function of a philosophy of language to recognize the specific nature of these disciplines and thereby assign each "language game" its due (as Wittgenstein would have it), limiting and correcting their mutual claims. Thus one of the main purposes of hermeneutics is to refer to the different uses of language to different regions of being – natural, scientific, fictional, etc. But this is not all. Hermeneutics is also concerned with the permanent spirit of language [by which we intend] the capacity of language to open new worlds. Poetry and myth are not just nostalgia for some forgotten world. They constitute a disclosure of unprecedented worlds, an opening on to other possible worlds which transcend the established limits of our actual world. (Ricoeur 1991a: 489–490)

The fragmentation of areas of study has been noted by other thinkers in other contexts. C. P. Snow famously wrote of the emergence of 'two cultures' in which those espousing the culture of scientists are not versed in the culture of humanists and vice versa (Snow 1959).

Inspiration for establishing networks of affinity between the 'two' cultures can be found today in STS (e.g., Irwin and Michael 2003; Helmreich 2011; Fischer 2005, 2006—Fischer 2005 being especially apt with respect to COVID). A seminal work is Donna Haraway's *Cyborg manifesto* (2016/1985), notably another work to be influenced by Gregory Bateson and a reminder of the transdisciplinary approach of cybernetics.

Affinity between the 'two' cultures can also be found in work written by classicist Lane Cooper on the teaching methods of scientist Louis Agassiz. Cooper suggests that all works be perceived in terms of their 'organic structure' and notes how Aristotle and Plato compare tragedy and discourse (respectively) to living forms (Cooper 1917: 3). To be generally cultured means knowing one thing 'from the bottom up'—yet pursuit of special investigation must give thought to 'the *prima philosophia* that gives life and meaning to all particular knowledge' (Cooper 1917: vi). (This does not mean striving to be competent at everything; also this is another way to consider the top-down/bottom-up dichotomy described in the section above.)

An organic education, according to Cooper, means 'sympathy' and 'contact' between subjects (1917: v). It means developing the skill of observation: to 'look again, look again' (Cooper 1917: 42).

The arts and sciences share this act of intense scrutiny, or observation. Literary critic Guy Davenport has pointed out that were it not for the strictures of specialization, scientific writing could be read for its literary qualities:

> The place scientific writing might claim among the corpus of imaginative writing zoned off as literature by unstable rules for admission and rejection is a strong one, allowing for the inevitable airs of condescension from the protectors of letters. The spirit of our age has been curiously denying, although its search for purity is understandable. (Davenport 2005: 234–235)

He demonstrates how the unity of language can be regained if an individual has a broad base of knowledge:

> *Helenium autumnale* bears its original Greek name, aligning flower and woman in the deep tradition that awed and pleased John Ruskin, and a nineteenth century botanist added *autumnale*, specifying both its flowering season and the botanist's world-weary nostalgia over classical culture, so that one cannot distinguish between the poetry and the science of the name; they are fused – a name fitted with precision into a universal nomenclature for all the flora and an image of a tall, aging heroine. (Davenport 2005: 234–239)

Davenport explicitly mentions breadth of knowledge when he writes that '[r]eligion, science, and art are alike rooted in the faith that the world is of a piece, that something is common to all its diversity, and that if we knew enough we could see and give a name to its harmony' (Davenport 2005: 270).

It is the role of the teacher to periodically suggest the interdisciplinary interconnection of the subject matter, to encourage specialization as well as breadth (cf. Cooper 1917: vi). To return to the subject of technoscientific literacy, no matter what its primary subject, a course can include digital networked components (through technological resources, distance-collaboration…) that further includes a focus on these literacies. This can give students preparation for the constantly changing terms of service of the digital world. Including digital literacy as an 'other' component to a subject like law or writing gives students an opportunity to truly look at a subject. Students do not necessarily need any background knowledge in the 'new' subject they are being exposed to to follow the teaching style of Agassiz that so impressed Cooper:

> In reforming the mind it is well to begin by contemplating some structure we never have seen before, concerning which we have no, or the fewest possible, preconceptions. (Cooper 1917: 4)

It is notable that Agassiz would not allow students to consult any external literature during this encounter: they were to rely on the inquisitiveness and inspiration of their own minds. This direct pedagogical encounter can be contrasted with dissociated milieus, in which everything has already been made, and the only role left is that of consumer and user (Stiegler 2014: 78 footnote 18). Merely asking students to 'use Zoom' and consider that something has been achieved in terms of digital literacy can be understood in this context to be seriously wanting. This section therefore raises the questions of how to relate the technoscientific with the humanistic and also how to better look at what is worth 'bringing forth'. Such looking also has the potential to inspire awe—which is another approach that is gaining traction in a wide range of theory and professional practice. According to Stiegler, a work is good if its goal no longer involves:

> a transcendental nucleus of criticism, but the *everyday ordinary capacity for discernment of the extra-ordinary* that supports the individuation of those who, each ensconced within the mystery of their skill or their craft, their *métier*, and of its ministry (including those of the mother and her child), have creative and normative access to transitional space, and who thus learn – for themselves and for others – why and how life is worth living. (Stiegler 2013/2010: 55–56).

Another example is the field of appreciative inquiry, which has roots in Albert Schweitzer's concept of 'reverence for life' (Schweitzer 1965). It focuses on the root causes of success, not failure. If, for example, a company has problems, the dialog would begin with what is working well in that company, in a shared discovery of positive potential:

> It is not about implementing a change to get somewhere; it is about changing … convening, conversing and relating with each another in order to tap into the natural capacity for cooperation. (Ludema and Fry 2008: 281)

A humanistic journey to developing technoscientific literacies could take a similar approach by finding appreciation for computer scientists like Paul Graham and Peter Naur, or tech humanists like Howard Rheingold and Mark Hurst, whose clear writing creates bridges of comprehension. To end with another *polytropos* (πολύτροπος) (Homer 1919: 1.1), programmer Rich Hickey, author of Clojure, delivered a brilliant presentation that demonstrated the programming applications of some of the philosophical concepts developed by Alfred North Whitehead (Hickey 2009). Examples like this can form the kernel of networked learning classes bringing together students from disparate disciplines (in this last example, mathematics, computer programming, and philosophy) to work together and explore aspects of languages and values that they share.

Conclusion

This paper departed from Edgar Morin's definition of the term 'techno-science' to indicate where machine, science, and technique are intertwined, productive of both elucidation and knowledge as well as ignorance and blindness (Morin 2008/2004). It was suggested that there is, especially at this time of increased online engagement, a need for relevant 'literacies'—understood as the reflective power to change the world (Freire 2005). Such literacies were understood throughout the paper to be related to both the creation and use of technoscientific applications. Multiple existing pedagogies that promote literacies or aspects of literacies that involve and/or reflect on the technoscientific were briefly reviewed. Central to the paper was the idea of the journey towards (complex) mutual individuation and inclusive co-creation (Stiegler 2014). As the specifics of how to achieve this are always changing, and as the precise understanding of literacy will be slightly different for each individual in terms of how an individual 'makes sense' of it in their own knowledge work (cf. Harvey Campbell 1882), this too was acknowledged in this work that included a section drawing from the author's current reading of hermeneutics. The hermeneutic approach reveals the linguistic essence of belonging, which 'makes the other exist' (Quéau 1998), and the constraints of symbols—a trait of both natural and artificial languages. 'Dark' applications pertain to the symbolic exchange in which the conception of the services designed fail to live up to the augmentative capacity of knowledge work (Engelbart 2002; Rheingold 2012), in which 'others' consume and use the pre-designed; stripped of the contributive capacity of work, reduced to doing jobs. This reveals a need for continuing education in literacies enhanced by interdisciplinary perspectives. Broad knowledge work, in which we 'rise up' to an understanding of the world through language games, requires continuing education and practice in how to regulate its composite forces, including within the individual self. The craftsmanship or artistry in life depends on the ability to take a granular view—to become, like Odysseus, individuals 'of many devices' (Homer 1919), while grounded in one discipline (Cooper 1917)—so as to make the best of that which is worth appreciating.

Compliance with Ethical Standards

Conflict of Interest This is topically related to material being prepared for my manuscript.

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