

# Epoch-Making Changes in the Cultural Evolution of Communication: Communication technologies seen as organized hubs of skillful human activities

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## Abstract

This paper applies methodological relationalism, leaning on a pragmatist theory of action of classical Deweyan origin, supplemented among other things with Alva Noë's enactivism, to analyze the development of communication technologies as a part of human cultural evolution. Tool-use and technologies are understood as skillful human activities that form hubs of organized activity in developed human communities. Appreciating the quite slow pace of evolution, the article adopts, all told, a two million year time frame. Six epochs of cultural evolution are distinguished, linked to the introduction of communication tools and technologies as skillful human activities that serve the members of growing communities in the ecological niche at hand. The first two epochs arose from forms of communication serving local, small-sized hunter-gatherer bands; the second couple arose with technologies apt for building nation-wide communities and culture; and the latest two have been propelled by global communication networks, having an impact on billions of people. Finally, certain peculiarities of the presently unfolding World Wide Web epoch, connected in particular to this era's exceptionally efficient behavior modification, are compared with earlier epochs.

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## 1 | A PRAGMATIST CONCEPTION OF HUMAN ACTION, COMMUNITY AND CULTURE

Any living organism has a biological imperative to organize its activities to get along with its environment. Compared to other living beings, humans manifest the unique feature that they also organize their communities with various cultural tools and technologies that allow the members of the communities to deal with the problems and utilize the prospects they encounter in their environment. According to our pragmatist view, human cultural technologies, like knowledge-related inquiry and learning, are tools of action that form hubs of organized activity, and as such are evolving with growing communities to serve human transactions with the changing environment (See Dewey, 1916/1985, pp. 4–13, 1934/1987, chap. 1, 1938/1991, chap. 2 and 3; Noë, 2015).

Evolving cultural tools change both the environment – reconstructing the ecological niche – and the humans themselves, giving rise to novel behaviors and kinds of transaction, as well as to new needs and new problems to solve. Understanding it here in a classical pragmatist, Deweyan vein and much like Alva Noë (2015) recently, tool-use and technology are skillful human activities. According to Noë (2015, p. xiii), technologies make us what we are. Human evolutionary history can be seen as a history of evolving cultural tools (e.g., Henrich, 2016; Richerson & Boyd, 2005; Sterelny, 2012a), which are carried by the likewise evolving community as its hubs of organized activity that have at some point in time found to serve the community members' transactions with the environment.

A crucial means to keep human community advancing is communication. It is the means to articulate and share purposes, organize and coordinate actions in a community, as well as pass skills and wisdom from one generation to the next. All human communication technologies are by definition communal tools, and an important source of developmental and selection pressure for them has been population growth. Emerging types of community set pressures to making communication technological innovations, which in turn bring about changes in human thinking and behavior. Referring to Marshall McLuhan's (1964) famous slogan “the medium is the message,” it is good to keep in mind that introduction of novel communication technologies offers parties fresh ways to reach and influence people. Such actions will of course have both intended and unintended consequences, as novel technologies alter the media environment, for instance by stretching communication in space and in time, thereby changing people's opinions and social relations, even in the scale of the whole global world, as the Internet at the latest has shown (e.g. Couldry & Hepp, 2017; Fuhse, 2018; Thompson, 2020).

The co-evolutionary cycles of changing socio-cultural conditions and communication technological innovations may give rise to significant changes, properly to be evaluated retrospectively by reverse-engineering the outcomes step by step in their socio-cultural context and ecological niche. In this paper, our analysis seeks to pick out some of the most noteworthy, interconnected changes in the developments of communication technologies in communities and the related changes in human habits and behavior over no less than a 2 million year period.

## 2 | A SOCIOLOGICAL NICHE-CONSTRUCTION APPROACH TO HUMAN EVOLUTION

Let us clarify our research approach with a brief comparison to certain other perspectives on human evolution. Our approach connects pragmatism of a Deweyan origin, Noëan enactivism, and methodological relationalism following in Bourdieu's (see Bourdieu & Wacquant, 1992, p. 15; Kivinen & Piironen, 2006) footsteps. From this standpoint, the basic method to understand any research object is to understand its relations to other things; the object is not thought to have any intrinsic essence outside all its relations. The human mind as one possible research object is something to be explained with reference to the organism's transactional relations to its environment. This view shares commonalities with the non-reductive "social behaviorism" of Mead and Ryle, as well as with the presently popular "4E" (embodied, enactive, embedded, and extensive) theories of the mind (e.g. Chemero, 2009; Clark, 1997, 2008; Clark & Chalmers, 1998; Gallagher, 2017; Neven, de Bruin & Gallagher, 2018; Noë, 2009). Sharing with them such commendable ideas as anti-Cartesianism and the conceptualization of human action and knowing-how in terms of learned habits, our approach avoids the weaknesses of the traditional, Cartesian, internalistic perspectives. Reminiscent of 4E theories, for example, our view rejects the cognitive-scientific approach that would explain mind with internal, computational brain functions, ignoring the role of transactions with the environment, and the body too (Neven, de Bruin & Gallagher, 2018, p. 4). We join theorists like Noë (2009) and Chemero (2009) who reject the Fodorian type of "old school cognitivism" that sees minds as internal representations of a distinct external world, as well as the closely connected mainstream, modularistic neuroscience which has inspired nativist evolutionary psychology and Chomskian linguistics.

Noë in particular is a 4E theorist close to our framework, pursuing a rather Deweyan, pragmatist theory of action. In a sense, Noë (2009, 2015) offers a twenty-first century version of certain aspects of Dewey's philosophy, which already contained in outline each of the four Es (Kivinen & Piironen, 2019; see Dewey, 1896, 1922/1983, 1925/1988). For one thing, there is a distinctive Deweyan (see 1934/1987, 1938/1991) feel to how Noë sees human culture as a natural continuation of the biological, evolutionary imperative to get organized to cope with the environment, and accordingly conceives any human tool as a hub of organized activity, technologies as evolving patterns of organization of skillful human activities (Noë, 2015, p. 19). Also like Dewey (1925/1988, chap. 5, 1938/1991, chap. 3), Noë (2009, chap. 4, also 2015) appreciates the importance of communication to the human mind and shares the view that the secret of the most distinctively human meanings is that they are accomplished by a community of people with symbol systems, in social relations and practices (Kivinen & Piironen, 2012). Here we agree with the Hilary Putnam's (1975, p. 144) slogan: meanings ain't in the head.

4E theorists make use of the ecological psychologist James Gibson's term "affordance" – meaning the opportunities arising in organism–environment transactions, conceptualized in a way that refers to both the organism and the environment and entails a substantial "complementarity" of the two (Gibson, 1986, p. 127). Gibson clearly appreciated the point made already by Dewey (e.g. Dewey, 1896) and recently by 4E theorists, that perception belongs to a context of action, that there is no passive subject but active explorers of the environment. The concept of affordances is also directly related to the twenty-first century understanding that evolutionary theory includes the notion of "niche construction" (Odling-Smee et al., 2003; see also, e.g., Heras-Escribano, 2020). As Gibson (1986) himself put it, "a niche is a set of affordances" (p. 128).

All organisms do niche construction, changing their environment in ways that may support their adaptation to the environment, thereby affecting their selection pressures, but humans are by far the "supreme niche constructors" (Buller, 2005, p. 101; see Odling-Smee et al., 2003, chap. 6), the one

species capable of more or less systematically building, altering, and reconstructing its environment, filling it with cultural tools, affordances that transform habits and customs in functional ways. Only humans live in a specifically cultural niche, making use of distinctively cultural affordances, including tools of meaningful action such as words and numbers, maps and books, microscopes and computers, which crucially contribute to human reasoning and to its operationalizations into doings in transactions with the environment (e.g., Chemero, 2009; Clark, 2008; Dennett, 2017; Noë, 2015). Human brains evolved mainly to enable more apt adaptation of organisms' behavior to the environment, and evolving brains allowed more malleable adaptations, enabling individuals to adopt the knowing-how needed to use a variety of socio-cultural tools and technologies (e.g., Greenfield, 2014, chap. 1). The brains do what they do only as a part of an organism's body, engaged in codependent transactions with the environment; they are but one “node in patterns of dense reciprocal exchange binding brain, body, and world” – predictive engines serving active embodied agents in their empowering webs of material and social affordances (Clark, 2016, p. xvi).

Our research on cultural evolution is sociological – and stands in stark contrast to the orthodoxy of brain- and gene-centric, internalistic and nativistic evolutionary psychology (e.g., Barkow, Cosmides & Tooby Eds., 1992), which is closely associated with traditional cognitive science and oftentimes fixated on the Pleistocene period. Our niche-construction appreciating approach, meanwhile, leaning on a combination of transactional naturalism and methodological relationalism (Kivinen & Piironen, 2018, 2019, see also 2006, 2012), allows research into the social mechanisms of intensifying human evolution in its proper ecological niche, to specify notable changes as well as things that have remained constant. It also allows understanding human awareness in congruence with 4E theories, as a relational affair that coevolves with the human niche, as changes in awareness go together with changes in habits and skills, meanings and knowledge, and have resulted in human, sapient consciousness, as opposed to mere sentience (Kivinen & Piironen, 2012).

### 3 | SIX EPOCHS OF HUMAN COMMUNICATION AND CULTURAL EVOLUTION

In what follows, we will be analyzing the long timeline of human cultural evolution in terms of certain technological hubs of organized activity that, we argue, gave rise to specific epoch-making modifications in the evolving patterns of organization of skillful human activities (see Noë, 2015, p. 19). The invention and establishing of novel communication devices will in turn be understood with reference to the socio-cultural niche, in which the technology in question will have proved useful in serving the evolving community's members' transactions with their environment. Significant changes in transactions with the environment can be taken to mark the beginning of a new epoch in cultural evolution.

An epoch change does not mean that everything changes. For example, Robin Dunbar (2016a) argues that the natural limits of the sizes of human communities have not widened since the Pleistocene, even with the latest forms of electric communications, social media. He estimates that the size of each layer in a person's social network grows in 3:1 ratio. The “innermost” layer consists of at most five people; the number of “best friends” is about 15; “good friends,” 50 (a typical headcount of hunter-gatherer camp groups, incidentally or not); “friends” we have ca. 150 (which used to be the size of a “clan” or “bonded community”); and the number of one's “acquaintances” is ca. 500. After that, the next layer is not personal anymore, consists of just “people whose faces we can give names to,” which is about 1,500 people (the size of a traditional tribe) (Dunbar, 2016b, pp. 78–81, 292–301.). Although today people have quite large formal networks, they still invest most of their energy in, have by far the densest relations with, just the few people closest to them, and spend a minuscule amount of

time with individuals outside their 150 closest people. So although in Facebook's parlance even thousands of connections are called friends, it is just common sense that they are mostly not one's actual friends but, at best, acquaintances, or faces one can put a name to (Dunbar, 2016b, chap. 3, 2016a.).

Nevertheless, novel communication technologies can spark wide-ranging changes. Couldry and Hepp (2017), for instance, apply the term “mediatization” to capture various media-technology-related social and cultural processes of transformation. Their idea is to distinguish certain “waves of mediatization” to describe key changes in the interwoven media environment, society and culture. However, the timespan they investigate is only the past five to six centuries, over which they see three particularly momentous waves of mediatization – “mechanization,” “electrification,” and “digitalization.” In this paper, by contrast, our analysis begins from a much earlier time. The time frame here is 2 million years, and our research distinguishes six epochs over that period: the epoch of (1) proto-symbolic communication; (2) early symbol systems – most crucially, full spoken language; (3) the evolving culture of reading and writing; (4) the printing press; (5) electric communication; and (6) the World Wide Web.

#### 4 | THE EPOCH OF PROTO-SYMBOLIC COMMUNICATION

The beginnings of cultural niche construction that ended up producing human distinctiveness, long predate the species *Homo sapiens*. It got started already some 2 million years ago, around the time of the appearance of the genus *Homo*. By that time, early tool technology and culture had already become a significant enough factor in the selective environment of hominin groups to have set off an increasingly pivotal, self-fueling cycle of gene–culture coevolution (Henrich, 2016, p. 57.).

The communication systems of earliest hominins did not leave many traces, but a known fact is that the incremental increase of the hominin brain size began around those times, 2 million years ago, as likely did the progress of laryngeal descent. This has been taken to suggest that, from very early on hominins made use of at least a crude proto-language. It may have included some vocal sounds, but probably consisted at first mostly of gestures and body language. It was not grammatical, or a full language or symbol system yet, but such systems would later evolve from the proto-symbolic beginnings – due to a co-evolutionary, incremental development driven mainly by socio-cultural factors, not by singular key mutations (See Bickerton, 2009; Deacon, 1997, pp. 358–370; Donald, 2001, chap. 7; Sterelny, 2012b, 2016b.).

Proto-symbolic communication would have been a pivotal factor in what we conceive as the first significant cultural-evolutionary phase – which began roughly 2 million years ago and ended ca. 100,000 years ago. Here it is named a proto-symbolic epoch, but it could be called, following Merlin Donald (2001, pp. 260–269), a “mimetic” epoch too, as the communications involved likely consisted to a considerable degree of body language, gestures and imitation.

Like all communication tools, proto-symbols evolved to serve social life in communities, more specifically small groups of hunter-gatherers. They coevolved, increasingly sophisticated proto-symbolic communications allowing more elaborate division of labor and other novel ways of coordinating of actions, and those in turn putting selection pressure on the proto-symbols and the individuals using them. The buildup to and development of the proto-symbolic epoch can be said to have gone together with significant changes in behavior and technology: it seems plausible that the transition from the cruder Oldowan tools to the more advanced Acheulian tools, around 1.7–1.8 million years ago, took place with the help of at least some sort of proto-symbolic communications; and the subsequent sophistication of the Acheulian culture was no doubt fueled by – and, in turn, invited further – increasing sophistication of proto-symbols (Sterelny, 2012b).

Yet for a long time, cultural evolution was slow: populations of *H. erectus* (or *H. ergaster*), or even those of the quite recent *H. antecessor* (ca. 1.2–0.8 mya), made only patchy, local and periodic advances. That means their communication tools must have been rather rudimentary, certainly proto-symbolic as opposed to fully symbolic. More pronounced and consistent cultural developments came only with what we conceptualize as the second cultural-evolutionary epoch, that involving fully symbolic communications, especially full-fledged spoken language.

## 5 | THE EPOCH OF DEVELOPING SYMBOL SYSTEMS

There would not have been any clear and distinct transition point where proto-language turned into language: such developments are known to be gradual (e.g., Deacon, 1997; Sterelny, 2016b). The epochs of proto-symbolic and fully symbolic communication overlapped. *H. heidelbergensis* (700,000–200,000 years ago) likely already had a proto-language of notable complexity, considering that they were able to produce certain remarkable, although still sporadic technological and behavioral innovations (projectile weapons and composite tools, systematic use of fire, and large game hunting) which arguably would have required relatively elaborate communication capacities (Sterelny, 2016a, pp. 176–180; see Henrich, 2016, pp. 294–295; Wilkins et al., 2012.). Donald even speculates that the proto-language in those days, starting from around 500,000 years ago, would have been sophisticated enough to allow the beginnings of what he calls the “mythical” culture of oral traditions and narrative thought (Donald, 2001, pp. 260–261). However, truly incontestable material evidence of the second, symbolic epoch come only after the emergence of the biological species *H. sapiens*.

Some theorists have suggested that (full-fledged) language was chiefly a biological product, but we join those who see it as an outcome of largely cultural-evolutionary developments across several hominin species, and something that requires a niche explanation (e.g., Bickerton, 2009; Deacon, 1997; Donald, 2001, chap. 7; Sterelny, 2012b, 2016a). Language evolved because it was vital enough for the members of a community in its ecological, socio-cultural niche. No other species today has even simple linguistic or proto-symbolic forms of communication; a niche explanation of this fact would be that no other existing species has had a community for which (proto-) language would have served vital enough functions in its niche (Bickerton, 2009; Deacon, 1997). A corollary of this niche explanation is that, unlike nativist reductionists such as Chomsky and the orthodoxy of evolutionary psychologists, we do not find it plausible to think that language evolved – due to some genetic mutation or just the growth of the brain – for voicing pre-linguistic conscious thoughts that had first emerged in the brain. On the contrary, we would say, human consciousness only came with symbol systems such as language: it is a symbolic affair, one that emerged due to this very special kind of communication tool, which in turn evolved to serve social behavior in a community (Kivinen & Piironen, 2012; see Dewey, LW1: chap. 5; also Dennett, 2017, chap. 9). In our pragmatist framework, human consciousness cannot be of innate origin, for the simple reason that, like the symbol systems it depends on, it involves human action in the environing world, including a community.

The first signs of symbol systems appear in the archaeological record around the same time with “behavioral modernity” – involving a host of novel advanced tools for hunting and fishing, for example, and leaving traces of systematic engagement in ritualistic practices such as burial ceremonies – in the Late Pleistocene (see, e.g., Sterelny, 2011). The first known artwork-like artifacts and cave paintings are from those times, and are in themselves especially clear indications of advanced communication by means of symbols. To be sure, there is also crude iconicity, resemblance-based meaningfulness to early art, to painted pictures for instance, as “tools for showing things,” putting

them on display and “standing in for” those things as their “visual models”; but as Noë (2015, p. 147, chap. 13) stresses, their use and interpretation nevertheless depends on contexts of socio-cultural settings of communicative exchanges. Picture-use in social practices can be said to imply a symbol system serving social functions, for instance supporting the members of the community organizing their social life, the shared landscape of action in the community, more aptly. And, with such systems, whatever apparent naturalness or straightforward understandability there is to a given token, including any picture, it comes partly from how their history of use in human communities has optimized these tools and sensitized their users to a variety of communicative contexts of use, made them user-friendly (Noë, 2015, pp. 156–161).

Now, behavioral modernity did not appear immediately after the emergence of the anatomically modern *H. sapiens*, or very quickly at all. Nor did it proceed in a linearly progressing manner, as one would expect if the key had been some genetic trigger – a mutation that suddenly increased cognitive capacities (turning on “a new and especially bright light” inside the head) – for such a doubtlessly useful mutation would have spread quickly and linearly through the population (Kivinen & Piirainen, 2012; Sterelny, 2011, pp. 813–815, 818–819.). Cultural and behavioral changes accumulated gradually and involved also backtracking at times: there are signs of losses as well as gains detectable in the archaeological record, new tools appearing, disappearing, and reappearing periodically – exactly as we should expect if the transition was highly dependent, not on some genetic, physical trait but, on the local and often fragile socio-cultural niche (Sterelny, 2011). So behavioral modernity any more than symbolic language was not a product of sudden cognitive revolution. It was an incremental development taking place slowly between ca. 100,000–40,000 years ago, at the same rate with demographic changes such as increase in population density (See Sterelny, 2011, 2016a; also Noë, 2015, pp. 20–22.).

Until then, incipient innovations had not caught on or gotten passed along because people had lived in small nomadic bands. “A small increase in density of populations would change the rules of the game,” Noë points out: “In larger groups with more contact with other groups, it would be possible for trade and specialization to emerge.” (Noë, 2015, p. 21; also Sterelny, 2016a.) There will then be more opportunities, support, and material resources for innovating, and better chances for the innovations to catch on, spread, be improved, and build upon other innovations (not least because of the adaptability of the uniquely human apprentice-like social learning model to specialized trades) (Noë, 2015, pp. 21–22; see Kivinen & Piirainen, 2018; Sterelny, 2012a, 2016a). Invented technologies that prove useful in the niche become a part of people's living environment, affordances that enhance and organize both a multitude of unthinking skillful activities and oftentimes many thoughtful ones too, creating opportunities for new innovations. So the cultural evolution of behavioral modernity was less a case of smart people inventing and making technologies, and more a case of technologies organizing communities in ways that make people collectively smarter (Noë, 2015, pp. 22–28.).

Symbol systems, especially full-fledged language, have of course been particularly impactful such organizing technologies, ever since they gradually emerged from a several-hundred-thousand years long evolutionary process (Bickerton, 2009; Deacon, 1997; Sterelny, 2012b, 2016a; see also Donald, 2001, chap. 7; Kivinen & Piirainen, 2012; Laland, 2017, chap. 8). By the Late Pleistocene, increasingly elaborate language would have contributed to human communities coming up with increasingly sophisticated artifacts, behaviors, and social organization. While proto-language had evolved as a tool for small bands, full-fledged language evolved as tools for organizing larger populations (Sterelny, 2016a, pp. 178–183). Dunbar (1996) proposes that language evolved primarily to allow social life, the negotiating and maintenance of social relations, in communities of over 150 (“the Dunbar's number”) heads.

## 6 | THE EPOCH OF THE EVOLVING CULTURE OF READING AND WRITING

It took another 50,000 years before there came what we see as the third communication-technology-related epoch-making phase in the evolution of human culture, the one tied to the invention of writing, 5,000 years ago. It, too, was a thoroughly socio-cultural-ecological affair: writing and numerals were invented for the needs of certain early, agriculture-based empires where surplus prosperity had started cumulating, with more and more goods for merchants to trade, rulers to tax, and offspring to inherit. And the technology of writing gave rise to increasing division of labor, as well as to new kinds of specialization that involved intellectual skills and institutions dealing with more exact and externally storable propositional knowledge. Educated upper class people could now become experts in law, religious doctrines, philosophy, or in the early sciences such as mathematics and astronomy, for example. Written text was a precondition for institutions of higher education, too (See Kivinen & Piironen, 2018, pp. 124–125; Kivinen & Poikus, 2006.).

As Noë (2015, p. 24) reminds us, “technology” comes from the Greek word *techne*, meaning skill or craft; and at bottom, any technology is indeed skillful human activities, it is organized ways of doing things, a hub of activity organized by skills. When a technology becomes our “second nature,” our activities flow effortlessly using it; we have the knowing-how needed. And sometimes, when there are symbol systems involved, knowing-how takes the form of propositional knowing-that. In Noë’s words, a technology can “carry a deep cognitive load.” It can enable us to think thoughts and understand ideas we could not otherwise think or understand (Noë, 2015, p. 25.). Changes in technology may accordingly change not only what people can do, but even what they can think about doing. And technologies change, they are not static: “They both invite and incite refinement and improvement.” (Noë, 2015, p. 26.) This goes to reading and writing, too; like all technologies, these communicative tools have evolved quite a bit through the years, entailing new kinds of transaction, new habits of mind and action. With those, there have been changes in how literate people materialize propositions in a concrete form and analyze the world with those, make sense of anything, including themselves. For reading and writing affects how people converse and reason; it changes argumentation – or, indeed, the very notion of rationality (See, e.g., Noë, 2015, chap. 4.).

However, for a long time – well into the modern age – the percentage of literate people in the global human population remained low, the culture of literacy being restricted to small elites. This started to change only with the fourth phase of communication technology-related cultural evolution, that involving the printing press, which enabled mass production of written texts and their rapid dissemination.

## 7 | THE EPOCH OF THE PRINTING PRESS

By itself, the technology of the printing press would not have been all that consequential – just consider the fact that it had already been invented in China in the eleventh century. However, the circumstances at the beginning of the modern age in Europe were exceptionally fertile for this technology to have a massive impact. Those circumstances included increasing prosperity and a broadening educated citizenry, or middle class, as well as such emerging institutions as the Protestant Church promoting the idea that also lower class people are worth educating. Later on, from the late-eighteenth century onwards, a growing number of nation states eventually established the institution of compulsory education, thereby further increasing literacy rates, giving rise to (mostly) literate societies where

books became usable affordances for and indeed constituents of not just some select few privileged minds, but most minds (See, e.g., Kivinen & Piironen, 2018, p. 126; Postman, 1982, chap. 2.).

Intertwined with the said communication-technological and institutional developments were a number of social (including political) and cultural (for instance, ideological), as well economic and ecological modern age developments, including but not limited to the Reformation, the rise of capitalism, and the emergence of experimental science and such new ideas as nations of people who shared a common culture and standard language – democratic republics perhaps, where each individual was to have certain fundamental and inalienable rights. Therefore, the members of societies, how people behaved, what and how they would think, were prone to be influenced by the newly mass-produced affordances of books and newspapers; for example, national identity and standard language emerged in many countries, along with increasingly widespread literacy and book wisdom (See Eisenstein, 1979; also, e.g., Anderson, 1983; McLuhan, 1962; Postman, 1985.).

Vicariously at least, Gutenbergian printing press technology also contributed to the (series of) industrial revolution(s) that began with the invention of steam engine in the late-eighteenth century. And industrialization, in turn, would shape the technology and industry of printing, as well as call for increasingly literate workforce and create wealth that would further gentrification, thereby broadening the customer base for books and newspapers. From then on, as is well known, there have been huge cumulative developments in technology, including communication technology, and respective transformations of human behavior and society. Among other things, it has been said, this has made the world, in a sense, “smaller” – even if not a “village” (cf. McLuhan, 1962; Postman, 1985). Steam engines already reduced travel times, and then, by the late-nineteenth century, came what is sometimes called “the second industrial revolution,” centered upon the inventions of gasoline and electricity, which would shrink the world even more radically, initiate a countdown to full-scale globalization.

## 8 | THE EPOCH OF ELECTRIC COMMUNICATION

Electricity soon found uses in communication technologies (first in the form of telegraphy). The main novelty involved was that it allowed information to travel huge distances at lightning speed. Electricity played an integral part in the phase leading to the fifth epoch of cultural evolution. Electric tools of communication benefitted – and would soon be demanded by – the workings of many sectors of society, such as economy and governance for instance, because they enabled faster nation-wide and even global discourses. These tools would be increasingly built into and become constituents of the socio-cultural-ecological niche of any industrialized country, increasing their dependence on electricity. Meanwhile, according to some unconventional theorists like Neil Postman (1982, 1985), electric means of communication had a marked negative impact on the human mind, for starters because they gave rise to the phenomenon of trivial “news of the day” – to people being constantly and superficially informed about various events from all around the world that had little relevance to their lives. Postman thought this development could be good for entertainment only, launching an empty-headed “Age of Show Business,” creating a society eager to “amuse themselves to death” – especially since the electric communication started making use of the age-old medium of pictures (TV being the medium that drew most of his fire) (Postman, 1985).

It was an unprecedentedly global epoch, most essentially because electric communication technologies can reach and potentially modify the behaviors of global audiences, and can be used in attempts to build global communities and enterprises. A still more thoroughgoing change along those lines of globalization was soon to come, however, with the harnessing of electricity to power yet another, radically novel type of communication devices, those based on digital data-processing by means of

binary computing, which was invented in the 1940s and saw increasing use for military, governmental, scientific, and business purposes over the next few decades, before being introduced, in the form of increasingly affordable and user-friendly home computers, to the industrialized world's middle income homes in the 1980s. Yet what interests us here is not the underlying technology per se but its uses in communication devices, which began in earnest only after the introduction of the World Wide Web and digital cellular networks, in the 1990s. From there, a development began that would introduce a growing multitude of new ICT affordances, whose features would pervasively shape human transactions over the coming decades.

## 9 | THE WORLD WIDE WEB

The latest, presently dawning phase of cultural evolution, characterized by the Internet and other ICT affordances, appears to have certain distinctive features that distinguish it from all the previous epochs, although some of those features may be hard to see with clarity now, when living in the middle of them. The benefit of hindsight, which we have when discussing the other epochs, would no doubt offer a clearer view, but let us still try and articulate what seem like some of the most striking peculiarities of the currently unfolding age, in light of what trends can be detected at the moment. Setting the peculiarities of this age against the backdrop of evolutionary history could prove useful for social scientific understanding: technological design in every field depends on its cultural-evolutionary history: software designers as well as the engineers who design bridges, for example, may be unfamiliar with the history of their practices, but the things they can do and the things they can think about – the possibilities and problems they will find interesting and important – are determined by that history (Noë, 2015, p. 26).

The Internet has not only enabled a booming platform economy, boosted the world economy, and further tightened global interdependence, but also opened up a variety of brand new transactions, which are, for good or for ill, impacting people's emotions, behavior and habits, social practices and interrelations, as all of these are tied to changing affordances. Already the fact that these affordances grant people a quick access to vast data depositories and ways to communicate without delay with others even on the other side of the world, cannot but fundamentally change human life. It has enabled whole new trades and professions, and changed the working life in many others too, for instance made remote work possible for many. The Internet allows individuals to reach a large audience directly, without editorial interference, and to listen to thousands of total strangers' likewise unedited ideas, as well as to try and form groups with them, even over great distances. This stands in stark contrast to how earlier media allowed individuals to communicate directly only to a singular recipient, or to a local group presently in attendance, and to reach larger audiences only through institutionally arranged organizations such as a book publishing house, the editorial staff of a newspaper, a broadcasting company, or a government's public communications division. (See, e.g., Fuhse, 2018; Thompson, 2020).

Some rather striking worries have been voiced about the alleged mental effects of ICT-penetrated lifestyle (e.g., Greenfield, 2014; Rosen, 2012; Wolf, 2018). For example, it has been claimed that this technology, or the habits of Web surfing and search engine use it induces, is compromising some of people's intellectual abilities, such as their memory and capacity to sustained concentration or comprehensive thinking and understanding – giving rise to increasingly restless and superficial minds. It remains to be seen if and to what extent this might be so, and to what measure people's novel transactions with the available ICT affordances will in fact change or deteriorate their intellectual habits and skills.

One particular concern voiced by several authors (see, e.g., Greenfield, 2014, chap. 16 and 18) is that, digital technology might be eroding people's grasp of contexts. This is nothing new: Postman (1985) already worried about the loss of contextual understanding, which he thought was happening because of the electrification of media, especially when those media conveyed mostly pictures, as is the case with TV. Such media are simply not as suitable as written books and articles for describing, developing, and helping people understand the context; pictures in particular set no context at all, Postman thought: they are open for everyone to interpret in their own way (cf. Noë, 2015, pp. 147, 156–161), and so are good for entertainment only, not for promoting serious, rational discussion or argument, analysis or knowledge. However, if the TV-dominated-1980s in America that troubled Postman so were an age of picture-based entertainment, then our days are doubly that; today, in addition to TV, much of people's other communications also take place through screens often filled with still or moving, perhaps humorous pictures, so-called memes for instance – even many of the words in the (usually rather short) texts that people typically read and write online having been replaced with pictures, emoji. And of course, as Noë reminds us, this all coincides with digital technologies making it unprecedentedly easy for everybody to take and produce, reproduce and transmit massive quantities of pictures, including most notably selfies. This makes ours very much an “epoch of pictorial consciousness,” in which people feel they need to make and share pictures in order to even have experiences. It is as if, when one fails to make an image of it, nothing ever happened. Which could be problematic because, “If every moment is a Kodak moment, then, really, no moment is.” (Noë, 2015, p. 54.)

As explained, transactions with written texts do foster thinking capabilities, and for that reason the development whereby text is being replaced with pictures, words with emoji, is indeed a troubling one. Moreover, while the Internet certainly contains not just pictures but also countless writings, articles and books, it is no traditional library but a peculiarly stimuli-rich environment, a competitive attention economy constantly bombarding people with various attention demanding messages designed to lure clicks and visits, always suggesting new pages to jump to next: an environment where it is not unusual for concentration to be broken by digital interruptions. Nor are Internet platforms like traditional mass media outlets, although they can be equally popular channels for sharing information – and disinformation; crucially, unlike traditional outlets, Internet platforms have not been legally treated as “publishers” of information made available in the service by a third-party provider, and therefore have not needed an editor-in-chief to take legal responsibility for the published material (e.g., Napoli, 2019, p. 33). Recently, many countries have been taking measures to remedy the situation: laws have been or are on their way to be enacted in Australia, Britain, France, and Germany, as well as in the EU to regulate digital platforms. While many policymakers have themselves been lured by the temptations of populism in this new medium, on the whole legislators in many countries have been reacting, slowly but surely, to the problematic of unbridled social media platforms, and for good reasons; among other things, there are fears that the abundance of unedited information available for everyone is quickly undermining the very idea of expertise – people's trust in the specialists of a given field – and thus jeopardizing one of the core pillars of knowledge society, the intellectual division of labor (see Nichols, 2017).

## 10 | EVOLVING BEHAVIOR-MODIFICATION

Each major communication technology discussed here has been found useful by the members of some kind of community, and each has enabled novel ecological arrangements. Those have always involved both intentional and unintentional behavior modification. Proto-symbols were used by hunter-gatherer

bands to coordinate and organize their actions, and no doubt allowed hunting bigger game, for example; spoken language was pivotal to a whole range of sources of livelihood in larger communities with more elaborate division of labor; writing not only allowed early academic fields to emerge but was pivotal means for organizing entire states and their economies; printing press enabled the publishing business and journalism to emerge, and boosted modern science, capitalism, and the ideas of nation state and free individuals with inalienable rights; finally, electric communication devices were an intrinsic part of the second industrial revolution and allowed countless many new fields to arise, from telephony to TV commercials. And while the epoch of the World Wide Web is only a couple decades old, meaning that not too much can be said about it with confidence, it too seems to be giving rise to a new ecology and form of behavior modification.

The term “datafication” captures some remarkable features of platform economy and the behavior modification it involves. Datafication revolves around massive harvesting of digital data and attempted modification of human behavior by means of algorithms utilizing that data, oftentimes harnessed to the service of a peculiar new business model, which works especially well through social media platforms. The business model relies on algorithms' capability to produce probabilistic behavioral predictions from the data gathered, and on there being third-party clients willing to pay for the owner of the predictions to utilize them in attempts – through digital means oftentimes not well understood, perhaps not even noticed by the people targeted – to modify behavior in specific ways. The social media service, a medium for people to communicate their thoughts to others, to their so-called “friends” or “followers” for example, is provided free of charge, as the company makes money through harvesting and analyzing the users' data and selling the product of behavior-modification to third-party agents. Notably, while datafication holds great potential to benefit the human kind, the business model it typically involves has been thought to escalate some of the more problematic developments involved with digital ICT. (See Couldry & Mejias, 2019; Lanier, 2018; Zuboff, 2019). For one thing, the model largely relies on a company being able to addict users to its platform, and to this end utilize the users' social needs, manifested in their repeated feeling of “FOMO” (Fear of Missing Out), for example. Algorithms may also cluster platform users into internally homogenous groups, producing “echo chambers” or “filter bubbles” of likeminded people, which could strengthen people's biases. Many also think that this clustering tends to increase the nastiness of social media – public defamation campaigns, mob-like attacks on other people, harassing and threatening, even instigating violence.

It is not just companies that seek behavior modification through digital means. More or less authoritarian regimes such as China and Russia, as well as the United States, are known to utilize digital tools and data in many ways to surveillance and control their citizens, and to try and influence people both in their own country and abroad. The governments of many democratic countries are doing this too, although more discreetly. But the majority of datafied surveillance and control in democratic countries is exercised by corporate agents, and then the problems involved are perhaps aggravated by the monopolization or oligarchization of the field (e.g., Berners-Lee, 2018; Lanier, 2018; cf. Zuboff, 2019) – by there being but a handful of big tech companies head and shoulders above everyone else making use of datafication, and just one or two companies dominating any given subfield of digital business. In the field of social media, there are just two companies, Alphabet (Google, YouTube) and Meta Platforms (Facebook, Instagram), with net worth in the hundreds of billions. The term “digital feudalism” (Mazzucato, 2019) has been used to describe the situation: a small number of platform giants having a market position that forces others to do business with them – and pay them, either with money or with data.

It is a customary development in capitalist market economy that forms of capital and hence power pile up and accumulate into few hands. According to Tim Wu (2010), this has happened in all recent media industries – movie, radio, TV, telephone and cellphone: the markets, perhaps aided by the

nation state's government, lift up big corporations or cartels to gain monopoly. Although the first developers and the first users of a new communication technology may be hippie-like idealists, with great expectations about the new technology's emancipatory potential to help challenge power hierarchies and enhance horizontal, free communication, sharing of knowledge, new forms of expression and journalism, as soon as the technology goes from such idealistic inventors' hobby to a big business, the medium becomes controlled by a couple big companies, giving rise to their own power hierarchies. With the earlier, typically nation-wide media business fields, there were also arguments to be made for the upsides of this development from the society's point of view: a monopoly could help establish common standards and higher reliability of service, and allow the government to control the field better than if it instead consisted of a wild variety of equal-sized operators (Wu, 2010, pp. 6–10.). However, in the global scale human transactions in ecological niches have been changing rapidly over the past thirty years, in part because of the Internet and its platform economy, and today's social media and other Internet communications are not nation-wide fields like telephony and radio and television broadcasting used to be, but global ones. What this means is, monopolized or not, these are fields that nation states are very much struggling to have control over. To avoid governmental control was always a part of the ideology of many Internet developers, and to an extent that ideal was realized in democratic countries, where social media platforms remain much freer from governmental regulation than traditional mass media outlets (Napoli, 2019). Combined with monopolization and datafication, this freedom has handed tremendous power to the giant data-harvesting corporations of the Internet.

## 11 | DISCUSSION

Methodological relationalism leaning on a pragmatist theory of action of Deweyan origin, supplemented in particular with Noë's enactivism, has here been applied to analyze certain epoch-making changes in human communication, community, and cultural evolution. Communication technologies from this standpoint are pivotal tools that organize and improve the coordination of actions in a community and hence human transactions with the environment. The analysis revealed six epoch-making phases of cultural evolution: proto-symbolic or mimetic communication, which began ca. 2 million years ago; fully symbolic communication of spoken language and other symbol systems, starting gradually from around 100,000 years ago; writing, which has been used for some 5,000 years; the printing press, which became pivotal a little over 500 years ago; electric technologies of communication, used for less than 200 years; and digitalized communication and data gathering on the World Wide Web, which got started only a couple decades ago. Each of these in its turn was found useful in its socio-cultural, ecological niche.

Mimetic proto-symbols served small, nomadic hunter-gatherer bands, allowed their members to coordinate their actions more efficiently and to slowly accumulate rudimentary tools. Full spoken language gave rise to communities of more than ca. 150 heads, with more division of labor in and between groups (and hence, potentially, to more stationary dwellings), as well as to a symbolic, conscious mind capable of developing much more complicated and efficient tools. Written language played a pivotal role in organizing early, agriculture-based states, and allowed more established division of labor, including professions specialized in dealing with propositional knowledge, early knowledge workers and intelligentsia. Printing press technology was intimately interwoven with a broad variety of early-modern age innovations, spreading ideas like the nation state, democracy, and human rights, not to mention news of scientific discoveries and technological inventions that could further technological, industrial, and economic progress. Electricity made possible still faster communication over great distances, and gave rise to the phenomenon of news of the day – creating expectations for

people to hear about events from all across their country and from other countries, even from the other side of the world. This allowed for even large nations to grow tighter together, and started the development of globalization in earnest, a development which would later take a major step with the invention of World Wide Web.

All these communication technological developments gave rise to novel hubs of skillful human activity, indeed to novel organizations of community, to whole new livelihoods. These all involved some behavior modification, but it is perhaps worth pointing out that the latest form of behavior modification, in the service of datafication, can take place through peculiarly hidden and automatic, algorithmic means. Some novel problems could arise with this, although it is certainly too early to tell with much confidence now at this very incipient state of the current epoch. If new problems there are, though, in light of the earlier epochs it could be predicted that they involve organization of skillful human activities, perhaps more specifically people's social identity-building and sense of community. For example, today's social media companies are taking advantage of the human desire to feel oneself a valued member of community – even if an “imagined” (cf. Anderson, 1983) one. Their algorithms may also form something akin to groups, or at least clusters of interacting people, in the sense that they make people see lots of posts from others in certain ways similar to themselves, thereby creating so-called echo chambers or filter bubbles, feeding the “tribalism” of social media. Notably, this all emerges from and serves social media companies' profit-making, rather than any actual community's own purposes; and too often online tribalism involves mainly the negative side of tribes – us-against-them antagonism.

In this connection, it is good to keep in mind the Dunbarian point that, although people today can have very large formal networks in social media, they still invest most of their energy in, have by far the densest relations with, just the few people closest to them, and spend a minuscule amount of time with individuals outside their 150 closest people. However, as Granowetter (1973) argued almost half a century ago, people's “weak ties” – to those they do not know very well personally and do not spend much time with – serve important functions: while the intimate, strong ties are the emotionally more important, the majority of new information has long been going through weak ties. The Internet itself can be seen as a network of mostly quite weak ties. And what social media often adds to those weak ties is more emotional attachment – to a more or less imagined community. Platform algorithms are promoting such feelings, and FOMO, to addict people.

This is not to say that there are no positive, worthwhile online communities, and definitely not to deny that some such communities may emerge in the future. Remember that, according to Dunbar (1996), the evolution of spoken language was a key factor in allowing people to sustain communities bigger than ca. 150 heads; and that, as Anderson (1983) argues, the technology of printing press played a pivotal role in the creation of the imagined community of nation. Whether online networking platforms can create not just new kind of confrontations but also new and salutary kind of communities, is just too early to say: truly significant changes in community life take more time than the couple decades that social networking sites have been with us so far. What we can say, though, is that the latest major communication technology of social media platforms, ran by powerful algorithms serving the business model of datafication, has come with some novel problems. Given its societal significance, reforming social media so that it starts serving collective ends, is one of the defining challenges of our time (Mazzucato, 2019). And Napoli (2019, xi), for one, sees signs of governments and other institutions and actors, including social media corporations themselves (under increasing public pressure) already taking steps toward “a more public-interest-oriented [social] media governance framework.” If there is anything good about Brexit and Donald Trump's presidency and the related social-media-influenced events, it is that they have raised awareness and opened many eyes about the problems involved with social media. Even the UN Secretary-General Antonio Guterres

has voiced his worries about how much power a small number of social media companies now holds to influence people, and stresses that we should create new regulatory mechanisms to govern social media (Nichols, 2021). The inventor of the World Wide Web, Tim Berners-Lee (2018) agrees: according to him, even if we leave the main responsibility of curing social media to the companies themselves, nation states and the public sector will still need to form a more solid legal-regulatory framework to guide them in this work.

In any case, viewed in terms of our pragmatist theory of action, while there have been over the course of human evolutionary history a tremendous amount of cumulative and occasionally quite transformational technological developments and changes in human affordances and the respective hubs of organized skillful activity, it is good to understand that there are also certain basic elements or mechanisms to human life and evolution that have remained more or less the same throughout history. One thing that will hardly ever change is that human beings in their communities face a lot of uncertainty and potentially life-determining problem-situations without any ready-made solutions in their oftentimes rapidly changing environment, forcing people to continuously learn new habitual skills and organize them so as to use the available affordances to adapt to volatile circumstances. And the core mechanisms of human (social, apprentice-like) learning have not changed much since the Pleistocene (Kivinen & Piironen, 2018.). This makes the Deweyan theory of action highly pertinent in the globally networked information society of the epoch of the World Wide Web: the skills needed in this age, even the intellectual, knowledge-age skills like digital literacy, are still all about action in a changing environment. People need to have or acquire (learn by doing) the habits needed to utilize the affordances opening up in transactions with technology, to organize their skillful activities to meet the challenges and solve the problems posed by the environment.

## DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

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