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Technology and the Promise of Decentralization

Origins, Development, Patterns of Arguments

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Abstract

Digitalization has long been associated with the promise of a technology-enabled decentralization of social conditions. Although such expectations have regularly fallen short, their underlying generic vision has proven to be astonishingly stable. This paper strives to trace the origin of the notion of decentralizing socio-economic forms of coordination through technological means—from the do-it-yourself scene of the late 1960s, the computer counterculture of the 1970s and the 1980s, and the debates on cyberspace and Web 2.0 in the 1990s and 2000s to present day ideas of decentralized and distributed forms of production and economic systems. An elaboration of the basic patterns of arguments behind technology-based promises of decentralization and their communicative functions then follows.

Zusammenfassung

Mit der Digitalisierung geht seit jeher das Versprechen einer technikinduzierten Dezentralisierung gesellschaftlicher Verhältnisse einher. Obgleich die daran geknüpften konkreten Erwartungen bislang von den empirischen Entwicklungen regelmäßig enttäuscht worden sind, erweist sich das dahinterliegende allgemeine Zukunftsbild als erstaunlich stabil. Vor diesem Hintergrund verfolgt dieses Papier zum ersten das Ziel, die Entstehungsgeschichte der Vorstellung einer Dezentralisierung sozioökonomischer Koordinationsweisen durch technische Strukturen zu rekonstruieren – von der Do-it-yourself-Szene der späten 1960er-Jahre über die Computer-Gegenkultur der 1970er- und 1980er-Jahre, die Diskussionen um das Web (2.0) in den 1990er- und 2000er-Jahren bis hin zu gegenwärtigen Ideen distribuierter Wirtschaftsweisen. Daran anknüpfend werden zum zweiten die argumentativen Grundmuster und kommunikativen Funktionen technikorientierter Dezentralisierungsthesen herausgearbeitet.

Contents

1 Introduction[1]

From the very beginning, the social appropriation of the Internet has been accompanied by the promise of technology-driven decentralization: Already in its earliest embodiment, the World Wide Web was meant to foster decentralized and thus more democratic social and economic structures (Negroponte 1995); Web 2.0 was to trigger a replacement of traditional mass media and one-to-many distribution by user-centric exchange processes and many-to-many communication—ultimately leading to an unprecedented ubiquitous form of *prosumer capitalism* (Ritzer and Jurgenson 2010); with the advent of the Internet of things, 3D printing, and cyber-physical systems, the promise of new forms of collaboration in the production of material goods sufficient to effectively counteract existing asymmetries of economic power again has carried on for a number of years now (e.g., Rifkin 2014; Mason 2015).

Although none of these expectations, in all of their radicality, has yet to empirically redeem itself, their underlying premise for the future has proven to be astonishingly stable. The belief that the Internet and digital technologies will someday lead to a decentralization of fundamental societal communication and coordination processes, along with hopes for equality, transparency, and far-reaching democratization, has significantly shaped the various discourses in their respective areas of development. Most recently, this includes discussions of blockchain technologies and systems for distributed accounting in computer networks that may render classic financial and contractual intermediaries obsolete: "Using cryptography, some clever code and collaboration, blockchain creates a decentralised network with trust built into the system." (Tapscott 2018: 3; cf. Tapscott and Tapscott 2017; Davidson et al. 2018)

Drawing on empirical material (e.g., web content, text and video documents, press reports, contemporary sources) and available literature, this paper begins with a concise and problem-driven reconstruction (see, e.g., Héritier 2008; Mayntz 2004: 238f.; Scharpf 1997: 29ff.) of the origin and development of the notion of decentralizing socio-economic forms of coordination through technological means—from the Californian do-it-yourself (DIY) scene of the late 1960s, the computer counterculture of the 1970s and 1980s, and debates on cyberspace and Web 2.0 in the 1990s and 2000s to present day ideas of decentralized and distributed economic systems. Subsequently, the core assumptions, basic patterns of arguments and communicative functions of such technology-based promises of decentralization are elaborated.

[1] The research for this text was funded by the Hans-Böckler-Stiftung.

2 The Whole Earth Catalogue and the DIY culture

The *Whole Earth Catalog* represents a fundamental point of origin for the notion of a decentralized do-it-yourself (DIY) culture. Regularly published from 1968 to 1971, it is considered one of the primary organs of the California counterculture movement of the late 1960s (Kirk 2007; Roszak 1986). The catalog defined itself as an "evaluation and access device" for tools and technological aids and propagated, as a counter-reaction to the increasing division of labor as well as political and economic centralization, a return to the practices of individual, distributed production:

> "So far, remotely done power and glory—as via government, big business, formal education, church—has succeeded to the point where gross defects obscure actual gains. In response to this dilemma and to these gains a realm of intimate, personal power is developing—power of the individual to conduct his own education, find his own inspiration, shape his own environment, and share his adventure with whoever is interested. Tools that aid this process are sought and promoted by the WHOLE EARTH CATALOG." (Brand 1968: 2)

Stewart Brand, the founder of the *Whole Earth Catalog* (WEC) and its successor, the popular science magazine *CoEvolution Quarterly,* was an entrepreneurial activist in the North American hippie subculture with parental financial reserves and had previously organized music festivals; in 1985, he went on to launch The WELL ("The Whole Earth 'Lectronic Link"), one of the first virtual communities accessible via dial-up modem. Contrary to many of his contemporaries (e.g., Mumford 1967, 1970), Brand (1974: 23) viewed technological progress, social balance, and the conservation of nature as not being fundamentally in conflict with one another; the proper application of the appropriate technology, he argued, held the promise of a better future in each of these areas: "Man has still within him sufficient resources to alter the direction of modern civilization, for we then need no longer regard man as the passive victim of his own irreversible technological development."

In this respect, Brand identified *information*—specifically practice-oriented knowledge of production and technological applications, which had often not been open and freely accessible in the past—as a key resource:

> "On the one hand […] information sort of wants to be expensive, because it's so valuable. The right information in the right place just changes your life. On the other hand, information almost wants to be free, because the cost of getting it out in many respects is getting lower and lower all the time […]. So you have […] these two things fighting against each other." (Brand in Getty Images 1984: 0:38–1:09)

Accordingly, the basic idea of the WEC was to make technical know-how accessible to as many people as possible in order to empower them to a decentralized production of material goods and to overcome capitalist structures: "At a time when the New Left was calling for grass-roots political (i.e., referred) power, Whole Earth eschewed politics and pushed grassroots direct power—tools and skills." (Brand 1998:

3) Thus, already in the early years of the modern DIY movement, the screwdriver-in-hand amateur was cast as a social figure standing in sharp contrast to the world of centralized production and private enterprise, one who, aided by the power of how-to knowledge and relying on distributed means of self-organization, would prepare the way for a better era of human existence to come.

Brand clearly touched the nerve of the times—while the first WEC initially was distributed in small numbers, by the time of the so-called *Last Whole Earth Catalog,* published in 1971, the catalog had a print run of more than one million copies and was being distributed by a major publisher. Hugh Kenner (1971: 34) described the WEC and related publications at this time as "metaphors disguised as how-to-do-it and where-to-find-it manuals. The deepest need they satisfy is the need for such metaphors: a need that's propelling across bookstore counters, by the hundred thousand, what only two years ago was the information exchange of a nearly invisible subgroup." In addition to its unwavering belief in the primacy of technology as a solution to social problems, the early WEC stands out, aside from its more or less single-handed leadership, for the initial development of a business model that is today omnipresent: "essentially encouraging customers to create the product, and then selling the customers and their work to each other […]." (Worden 2012: 212; cf. Turner 2006) In Stewart Brand's subsequent publications (*CoEvolution Quarterly,* 1974–1984; *Whole Earth Review,* 1984–2003), ecological issues accordingly moved further into the background as increasing attention was given to technological innovations and options for entrepreneurial decentralization (the published issues of both magazines are accessible on http://www.wholeearth.com).

In Europe, where self-sufficiency previously has been a matter more of necessity due to the constraints of the post-war period, politically motivated DIY practices gained prominence with the rise of the environmental movements of the 1970s. In addition to the then omnipresent nature and wildlife documentaries on television by filmmakers such as Horst Stern and Bernhard Grzimek, with their increasingly explicit warnings about environmental sins, the 1972 report "The Limits to Growth," by the *Club of Rome*, questioned the widely held blind belief in the benefits of progress and imparted a fundamental awareness of the significance of ecological imbalances (Engels et al. 2005: 153ff.; Brand et al. 1997). One response to the ensuing unease, in the alternative subcultures subsequent to the student-centric political movements of the late 1960s, was a change in personal lifestyle, with the desire to free oneself from the influence of market forces leading to a rediscovery of local artisanry and small trade.

The conceptual basis behind the shift to decentralized production and consumption patterns could be found in numerous large-scale works critical of big industry, i.e., Robert Jungk (1973), Otto Ullrich (1977), and Ernst F. Schumacher (1973). Schu-

macher, in particular, with his notion of an "economics of permanence," which had a major impact on the international environmental movement, anticipated some essential ideas for a decentralized post-growth society and, like Brand, saw the key to human survival in changing the way we approach existing and emerging technologies:

> "[…] a technology with a human face, is in fact possible […]. It serves production by the masses instead of mass production. […] I have no doubt that it is possible to give a new direction to technological development, a direction that shall lead it back to the real needs of man, and that also means: to the actual size of man. Man is small, and, therefore, small is beautiful. To go for gigantism is to go for self-destruction." (Schumacher 1973: 117f.)

Similarly, Scott Burns (1977: 14) foresaw an "inevitable […] decline of the market economy" and Willis Harman (1974) signed for a social transformation, that—as Michael Marien (1977: 422) summarized—would lead to "frugal technology […], a redefinition of growth […], and more emphasis on social innovation."

3 The computer counterculture and the Free Software Movement

Admittedly, by the early 1970s, the activist networks associated with the WEC were already turning into another direction—away from the idea of an all-encompassing anti-capitalistic lifestyle and toward the emergence of a computer hacking scene as a subcultural complement to the material world (Kirk 2001; Turner 2006): First of all, the small portion of its readership seeking to really implement the WEC's proposals quickly realized that decoupling from centralized economic structures required a degree of individual technical competence that could not be achieved overnight. Second, Brand and the activists around him recognized that a subsistence lifestyle went hand in hand with "mind-numbing labor and loneliness" (Baldwin and Brand 1978: 5) and thus was out of the question for most people. Third, through his observations on the student-programmed video game *Spacewar!* for the minicomputer PDP-1, Brand had developed an early fascination for the computer counterculture:

> "In those days of batch processing and passive consumerism (data was something you sent to the manufacturer, like color film), Spacewar was heresy, uninvited and unwelcome. The hackers made Spacewar, not the planners. When computers become available to everybody, the hackers take over. We are all Computer Bums, all more empowered as individuals and as co-operators. That might enhance things … like the richness and rigor of spontaneous creation and of human interaction … of sentient interaction." (Brand 1972: 50)

Although a closer inspection suggests that *Spacewar!*, given its development from 1961 onwards on university computing equipment donated mainly by major corporations and its later adoption by the video arcade industry (Lowood 2009), can hardly

be considered a typical example of a product developed in a hacker scene fully detached from the commercial market, by 1972 Brand already had recognized the potential for shifting WEC concepts of socio-economic decentralization and individual empowerment through access to technological knowledge to the world of intangible information networks, which in the 1990s came to be referred to as "cyberspace."

The relatively free and open circulation of technological knowledge and information was in fact formative for many computer-centered project groups being established at universities in North America from the 1960s onward, whose work served as the breeding ground for the broader amateur computer scene arising in the 1970s, which has been described as "an avid, eager-beaver breed, anxious to share technological insights and applications with other chip fanatics" (Time 2/1978: 49). As this niche gradually expanded in the 1980s into a full-fledged microcomputer industry serving the mass market, the sharing of product knowledge became increasingly hampered by technical hurdles such as the distribution of software in closed binary format and changes to copyright law (Menell 2002). In response, MIT employee Richard Stallman (1983) announced the development of a freely usable, open-sourced operating system (GNU) as an alternative to proprietary software distributions. With Stallman's "Free Unix!" manifesto, the Free Software Movement was born, since then promoting open, self-organized and decentralized software development. With its establishment of legally recognized licensing models for open-source software, the movement eventually became the basis for today industry-fundamental open-source projects such as the Linux kernel and the Apache HTTP Server (Schrape 2018).

Stewart Brand was associated with the Free Software Movement from its beginning; in 1983 he was given an advance of 1.3 million US-$ to create a *Whole Earth Software Catalog* "[that] would do for computing what the original had done for the counterculture" (Turner 2006: 129; cf. Lehmann-Haupt 1984). The catalog came out in 1984, but was a commercial disappointment. The subversive impetus behind the original *Whole Earth Catalog*, however, could clearly be felt:

> "Computers and their programs are tools. They empower. They estrange. Their power was first generated and employed by institutions originally in the various conceptual theaters of World War II (decrypting, weapon-aiming, command and control, bomb-blast modeling). Their power grew with governmental and commercial institutions after the war; they became a tool of institutional science and a major industrial product […]. With the coming of personal computers came a shift in the power balance. It may be that more accumulated code is stirring in the interests of individuals now than in the interests of institutions. It may be that more significant invention is coming from the hands of individuals." (Brand 1984: 2)

Brand, together with Kevin Kelly (who later became the editor of the digital technologies periodical *Wired* and went on to play an influential role in shaping the Web 2.0 discourse), organized the first Hackers Conference in the vicinity of San Francisco in 1984, bringing together the protagonists of the Californian hacker scene as well

as the burgeoning IT industry. The event saw the further development of the early hacker ethic (Levy 1984) as well as the emergence of new business models—and it was at this conference, too, that Brand's later oft-repeated but frequently misquoted statement first arose: "Information *almost* wants to be free" (see above).

Kelly, along with Brand, was furthermore involved in the launch of the online community The WELL ("The Whole Earth 'Lectronic Link") in 1985, which unlike social-networking sites of today was funded by membership fees, with no advertising:

> "By contrast to ponderous commercial systems like Prodigy and Compuserve, the WELL offers little beyond what its users bring to the system. […] Despite its state-of-the-art veneer, WELL habitués argue that the medium is as much a step backward to the 19th-century literary salon as a step into the future. […] Now run by a staff of five and recently outfitted with a more powerful computer, the WELL has been consistently profitable and may reach annual revenue of half a million dollars by the end of the year." (The New York Times 1989: A14)

With the *Whole Earth Software Catalog*, the Hackers Conference and The WELL, the transformation in California "from counterculture to cyberculture" (Turner 2006) was thus visibly accomplished: No longer was the focus on the decentralized production of material goods, but rather on the appropriation of the nonmaterial world of digital information. On the one hand, the belief in the decentralizing power of the network—resulting not least in a dissolution of the established distribution of social roles between producers and consumers and a loss of relevance of formal organizations—was certainly a defining influence on the subsequent discourse on cyberspace and Web 2.0. On the other hand, the WEC and The WELL, with their early implementation of intermediary platforms for the distribution of user-generated content, put to the test a basic concept that was influential for the development of the later Internet economy (see already Rochet and Tirole 2003).

4 Cyberspace, Web 2.0 and digital prosumerism

Beginning in the early 1970s, but widely unrelated to the Californian countercultural movement, a number of hopes for decentralization began to circulate, particularly in the German-speaking countries, where, given the influence of Bertolt Brecht's (1967 [1932]) radio theory and Hans-Magnus Enzensberger's "Constituents of a Theory of the Media" (1970), they were linked to the then new media: The videocassette system was seen as the antithesis of the "hierarchically constituted […] society" (Baumgart 1970: 212); videotext systems (in West Germany: BTX, in France: Minitel, in the UK: Prestel) heralded the end of the classic mass media and the advent of novel options for the public "to participate directly in essential decisions" (Haefner 1984:

290); cable television, with its richness of information and the intended provision of "open channels," was expected to offer once passive media recipients new opportunities of choice and forms of expression (Modick and Fischer 1984).

With the development of the World Wide Web as a user-friendly interface to the Internet by Tim Berners-Lee (1989), these two lines of discourse converged: the Web quickly becoming known as an essentially "free and open" medium, one that would promote greater public democracy (Bollmann and Heibach 1996) and "[eliminate] the separation of roles between communicator and recipient" (Höflich 1996: 13). Nicholas Negroponte (1995: 239f.; cf. Shapiro 1999) attested to the Internet's capability—at the time often termed as "cyberspace" (Barlow 1996)—to advance the shift of intelligence from sender to receiver: "It has four very powerful qualities that will result in its ultimate triumph: decentralizing, globalizing, harmonizing, and empowering. […] The traditional centralist view of life will become a thing of the past." In a very similar sense, Steven McGeady (1996: 147) diagnosed a "shift back towards decentralized management models and decentralized work models." More moderate voices, such as Neil Postman (1999), who noted that it is no longer the dissemination of information that is the pivotal problem, but rather how to use it to generate knowledge and insight, were paid little attention at this time.

After a brief period of disillusionment as a result of the implosion of the dot-com bubble in the spring of 2000, discussions about the reformative power of online technologies picked up again in 2002 in the social sciences: Drawing on the open-source movement's own narratives (e.g., Raymond 1999), Yochai Benkler (2002) pointed to the increasing relevance of open-source software development projects as evidence of the emergence of a new, technologically more effective production model that, being based on equitable, decentralized forms of collaboration, would eventually gain advantage over the classic forms of socio-economic coordination:

> "Commons-based peer production is […] emerging in the digitally networked environment. Facilitated by the technical infrastructure of the Internet, the hallmark of this socio-technical system is collaboration among large groups of individuals, […] who cooperate effectively to provide information, knowledge or cultural goods without relying on either market pricing or managerial hierarchies […]." (Benkler and Nissenbaum 2006: 394)

Another influential concept, for which Henry Chesbrough (2003) in turn drew on the initial success of open-source projects, is the paradigm of *open innovation*, which he characterizes as the opening up of previously closed and intra-organizational research and development (R&D) processes, thus decentralizing the dynamics of innovation and presumably improving cost-effectiveness. At the same time, the paradigm promises a potential answer to the question of how companies are able to secure their competitiveness in a sector such as the international IT industry characterized by extremely short innovation cycles (Herstatt and Nedon 2014; Bogers and West 2012).

In 2005, the Internet once more moved to the forefront of public discourse with the publication of Tim O'Reilly's widely noticed essay "What is Web 2.0." At its core, O'Reilly's text addressed the unprecedented bundling of data in the business world and questions about who would control it:

> "Database management is a core competency of Web 2.0 companies [...]. This fact leads to a key question: Who owns the data? In the internet era, one can already see a number of cases where control over the database has led to market control and outsized financial returns. While we've argued that business advantage via controlling software APIs is much more difficult […], control of key data sources is not, especially if those data sources are expensive to create or amenable to increasing returns via network effects." (O'Reilly 2005)

This aspect of digitalization, however, quickly faded into the background during this phase of public discussion, as Web 2.0 quickly became a new synonym for an overall spirit of optimism about the enabling possibilities of the Internet. In this context, three expectations can be distinguished that together amount to a technology-induced decentralization and dismantling of established role distributions (Schrape 2012):

- *End of the mass media:* Dan Gillmor (2006) referred to Web 2.0 as the first "many-to-many" medium and first step in the loss of relevance for the classic, "one-to-many" mass media: "Grassroots journalists are dismantling Big Media's monopoly on the news, transforming it from a lecture to a conversation."
- *Dissolution of producer and consumer roles:* Howard Rheingold (2003) resumed the discussion on the expansion of collective intelligence through the Internet and James Surowiecki (2004) coined the idea of the "wisdom of the crowds," followed by Kevin Kelly (2005), who postulated that by 2015 "everyone alive will (on average) write a song, author a book, make a video, craft a weblog, and code a program. This idea is less outrageous than the notion 150 years ago that some day everyone would write a letter or take a photograph."
- *Democratization of societal decision-making processes:* The assumption that all onliners would become prosumers also led to the idea of a general decentralization and democratization of decision-making processes throughout society (e.g., Castells 2009; Shirky 2008), since "all are now capable of asserting their influence, regardless of background, account balance, or connections" (Grob 2009).

In the initial Web 2.0 debates, as well, critical voices were rarely to be heard—this is certainly true of the comments of Jürgen Habermas (2006), who noted the ambivalent political consequences of a fragmented public sphere, as well as for Jaron Lanier (2006), who warned of the unpredictable consequences of self-governing collectives: "History has shown us again and again that a hive mind is a cruel idiot when it runs on autopilot. Nasty hive mind outbursts have been flavored Maoist, Fascist, and religious, and these are only a small sampling. I don't see why there couldn't be future social disasters that appear suddenly under the cover of technological utopianism."

Although it soon became apparent that the sheer technological possibility would not immediately lead to shifts in social roles and that the dynamics of the information age are shaped to a much lesser extent than expected by the users than by a small number of multinational IT corporations (Dolata and Schrape 2018), the listed affirmative theses became sententious points of reference in the ongoing discourse, eventually culminating in the proclamation of an entirely new age—"the age of the prosumer" (Ritzer et al. 2012: 380). This "prosumer society" (Ritzer and Jurgenson 2010: 17) would be characterized, on the one hand, by the newfound power of the consumer and niche products in economic realms (Anderson 2006). On the other hand, it would involve the decentralization not only of the processes of media production and dissemination, but also of socio-political organizing processes. In this context, the well-received concept of *connective action* was worked out by W. Lance Bennett and Alexandra Segerberg (2012) under the influence of the so-called Arab Spring: they characterized online technologies as "organizing agents" that would enable novel decentralized forms of "peer organization in the crowd" (Bennett et al. 2014: 239) and assume the coordination tasks of traditional core organizations.

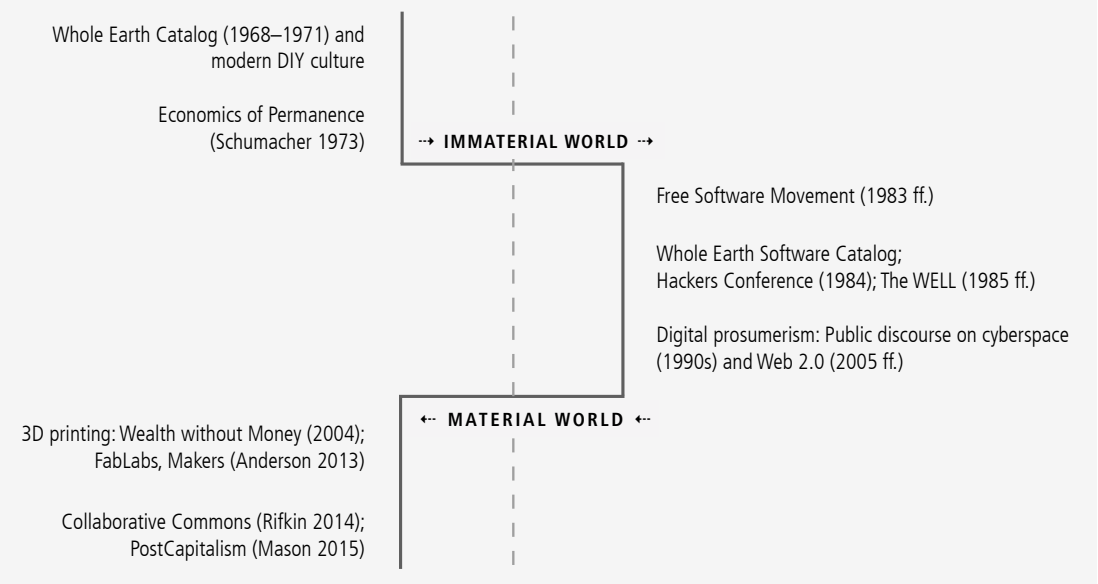
5 The notion of a post-capitalistic maker economy

With the popularization of 3D printing technology, from the mid-2000s onwards, technological utopianism again took a "material turn" away from the world of immaterial information and communication and toward the distributed production of material goods. Drawing on additive manufacturing technologies already in use industrially since the 1980s (Freedman 2012), Adrian Boyer initiated the project *Replicating Rapid-Prototyper* with the aim of producing a 3D printer assembled entirely from 3D-printer-produced parts using freely available design data sets. In his manifesto "Wealth without Money" (2004), he characterized 3D printing as the next step in socio-technological development, one that would decentralize economic processes and return control over the means of production to the people (cf. Randerson 2006).

A similar impetus lays behind MIT employee Neil Gershenfeld's so-called *FabLabs* (2005)—open workshops equipped with modern machinery offering all comers the opportunity to manufacture their own material goods. Technology visionary Chris Anderson (2013: 51), already present in the Web 2.0 discourse, thus described 3D printing as the harbinger of a "new industrial revolution" that would lead to the emergence of a "maker economy" in which product ideas could be realized anywhere: "Once again, new technology is giving individuals the power over the means of production, allowing for bottom-up entrepreneurship and distributed innovation."

The basic idea set forth in the Californian counterculture of the 1960s that "grassroots direct power" could be achieved by making available technical tools and technical knowledge, thereby enabling the decentralized production of material goods, has thus undergone a comprehensive update since the mid-2000s (*Fig. 1*): New technologies are now expected to tackle the inherent problems in the DIY scene, as many of the needed tools and resources could now be manufactured by amateurs themselves; in this manner, central dilemmas of many open-source projects (e.g., exploitation by market-dominant corporations) should be resolved through a fundamental decoupling of traditional capitalist market structures; modern means of communication should help to ensure that self-sufficiency no longer needs to be accompanied by social deprivation (Rifkin 2014; Anderson 2013; Gershenfeld 2012).

Figure 1: Material and immaterial orientations in the discourse on decentralization



Source: Own considerations

Taken altogether, so the narrative, 3D printers, online technologies, cyber-physical systems and the Internet of things could now tap into all of the opportunities for social transformation that previously could not be realized:

> "The Makers Movement […] has been driven by four principles: the open-source sharing of new inventions, the promotion of a collaborative learning culture, a belief in community self-sufficiency, and a commitment to sustainable production practices. But underneath the surface, an even more radical agenda is beginning to unfold, albeit undeveloped and still largely unconscious. If we were to put all the disparate pieces of the 3D printing culture together, what we begin to see is a powerful new narrative arising that could change the way civilization is organized in the twenty-first century. Think about it. The DIY culture is growing around the world, empowered by the idea of using bits to arrange atoms." (Rifkin 2014: 99)

In other words, these visions are no longer solely about commons-based peer production or an adhocracy among equals in a real-world enhancing cyberspace, but moreover—as it is discussed, among others, under the umbrella term "collaborative commons" (Rifkin 2014)—a desire to overcome real-world socio-economic imbalances through a distributed and decentralized production of material goods (Douglas 2018; Kostakis et al. 2018; Stalder 2018; Powell 2012). Drawing in turn on such narratives are propositions positing a socially and ecologically balanced post-capitalism, offering the prospect of an upturn for the individual and a loss of relevance for classic economic authorities due to "the rise of non-market production, of unownable information, of peer networks and unmanaged enterprises" (Mason 2015: 244).

Thanks to new forms of technologically mediated communication and coordination, distributed production communities such as FabLabs or Makerspaces can now exchange data and knowledge at all stages of development regardless of time or location; such distributed communities, it is suggested, will pave the way for a sustainable economic order, as decentralized production not only reduces the need for the transport of goods, but also promotes a more environmentally friendly and humane form of existence (Hankammer and Kleer 2018; see, for a critical review, Blühdorn 2017). Much like their forerunners, "resilient communities, the degrowth movement and peer production" are described as complementary components of a comprehensive paradigm shift—"away from an economic system based on the irrational exploitation […], towards one characterized by a radically different definition of the content of human well-being" (Kostakis et al. 2015: 133). In that sense, Blockchain technology, i.e. the principle of decentralized accounting on the basis of cryptographically secured chains of distributed data ledgers managed by peer-to-peer networks, is likewise considered by some evangelists to be the stepping stone to an emerging period of post-capitalism, as intermediary organizations and platforms allegedly become increasingly obsolete (Tapscott and Tapscott 2016; Waters 2018):

> "It is possible that Bitcoin may end up being just another form of market-based capitalism. What is perhaps more intriguing about Bitcoin and its role in facilitating a shift towards post capitalism, is its underlying technology known as blockchain. […] Industry experts, such as Goldman Sachs suggest that blockchain tech could eventually be worth tens of billions of dollars in finance, insurance and related industries. […]. However, beyond its impact on mainstream industries operating with market-based capitalistic models, blockchain, and similar derivatives like ethereum, pose significant opportunities for radically new forms of post-capitalist organizing." (Cohen 2016: 743, cf. Cohen 2017; Muñoz and Cohen 2018)

In this respect, from the countercultural message of the *Whole Earth Catalog*, to the early computer hacking scene and the debates about the World Wide Web and Web 2.0, but also in the discourse on an emerging maker economy, new technologies have been and continue to be characterized as the stimulus for fundamental processes of social transformation. By enabling comprehensive processes of decentralization, they are seen to open up the possibility to surmount current socio-political conditions.

That technological innovation per se, however, is not capable of pushing society in a particular direction, but gradually unfolds in accordance with multi-layered dynamics of socio-economic appropriation, is something that already the well-studied history of the Gutenberg printing press clearly shows us. From a socio-economic as well as a socio-cultural point of view, the technology of the modern letterpress was only able to achieve its transformative potential in a complex interplay with numerous major societal developments, including the European Reformation and the Industrial Revolution (e.g., Beck 2005; Stöber 2004; Faulstich 2002; Hall 1986).

6 Basic patterns and functions of technology-based decentralization promises

The outlined visions and expectations of a technology-driven decentralization of socio-economic conditions are characterized by three fundamental assumptions:

- New technological solutions or the repurposing of existing technology will enable the replacement of hitherto centrally coordinated communication and transaction procedures by distributed processes in peer-to-peer networks.
- As a result, intermediary organizations, established market structures, and classic forms of hierarchical coordination and decision-making (e.g., in business corporations) will decline in influence and significance.
- Together, these dynamics will lead to a significant reduction of socio-economic resource and power asymmetries, the disintermediation of social roles, and to a general democratization of the society as a whole.

However, although the Internet, at a purely technical level, is still based on the principle of decentralization, the empirical developments in the addressed areas point in a direction that is opposed to these notions: The DIY counterculture that arose with the WEC did not lead to an erosion of centralized forms of production; instead, by exploring intermediary structures of aggregation for user-based content, it contributed to the genesis of a fundamental business model for the Internet economy. The present-day relationship between open-source software development communities and the commercial IT sector is not characterized by competition but by complementariness, as these projects serve as important incubators for industry-fundamental infrastructures and standards (Schrape 2018). Although the Web (2.0) makes communication more flexible and has contributed to the emergence of new hybrid forms of private and public spheres (e.g., "personal publics," Schmidt 2014), this has not eroded the significance of big media providers, nor has it led to a general dissolution of pro-

ducer-consumer role distinctions in economic processes. Instead, the Internet economy is characterized by the worldwide hegemony of a few technology companies and, along with that, a historically unique bundling of private sector power over infrastructures and data (Dolata and Schrape 2018). Nor will further technically mediated forms of co-production and co-consumption alone presumably lead to an end of mass production or a loss of relevance for intermediary organizations.

One reason for the popularity of technology-driven promises of decentralization in spite of repeated empirical disappointments—other than their general compatibility with elementary utopian ideals (cf. Sargent 2010; Naisbitt 1982)—can be found in their basic patterns of factual, social, and temporal complexity reduction (*Tab. 1*):

Table 1: Simplification patterns of technology-based decentralization promises

Factual Dimension	**Social Dimension**	**Temporal Dimension**
Decontextualization	*Overgeneralization*	*Detachment*
Decoupling from socio-economic contexts; bridging social problems through technology	Transference of technological practices from specific user milieus to the population at large	Dissociation from past empirical disappointments; marginalization of professionalization dynamics

Source: Dickel and Schrape 2017; Schrape 2012; further considerations

In the *factual dimension*, technological infrastructures are conventionalized as a means of overcoming or bypassing long-term solidified social problems. As a part of this, the respective processes of technology appropriation and adaption are decoupled from their overarching socio-economic contexts and characterized as universal alternatives. In the Web 2.0 discourse as well as in discussions of an emerging post-capitalistic maker economy, context-dependent application possibilities of new technology sets such as 3D printing or social media have been depicted as a catalyst for the genesis of comprehensive decentralized substitution structures for fully-fledged functional contexts of society (such as the mass media or industrial sectors).

From a *social viewpoint*, the practices of early adopters of new technologies are often projected onto a future population without any consideration being given to their milieu-specific sociocultural backgrounds. The activists in the early DIY movement, for example, were forced to realize early on that the ideal of a distributed subsistence economy was not an option for the majority of the population; likewise, the prefer-

ences of the young, educated, and tech-savvy early adopters of Web 2.0 were not easily transferred to later users (seminal: Rogers 2003); the users of open workshops such as FabLabs and Makerspaces are conspicuous for their specific motivations and socio-economic backgrounds (Lange and Bürkner 2018; Schmidt and Brinks 2017).

From a *temporal perspective*, current theses of decentralization are readily dissociated from previous developmental stages, failed expectations, and professionalization dynamics. In the often missing consideration of empirical qualifications or caveats regarding former expectations for the reformative power of the Internet in today's discussions of a post-capitalist maker economy, we see a reflection of the same ignorance of the failed visions of decentralized production from the 1970s found in the Web 2.0 discourse. The gradual appropriation of such niche developments by established economic actors in earlier periods (see, e.g., Geels and Schot 2007) is likewise more or less overlooked in the current debates or else regarded as the consequence of afore insufficiently defined technological infrastructures (Mason 2015; Rifkin 2014).

Table 2: Communicative functions of technology-centered visions of decentralization

Channelization	Alignment due to the necessity of either consent or disagreement; semantic coordination of collective and corporate activities
Motivation	Motivation of volunteers in civil society, of freelancers and employees in economic contexts, or of early adopters in innovation processes
Distinction	Supporting the construction of a collective identity, simplifying differentiation from other social domains or groups in early user milieus
Legitimization	Plausible basis for validation and legitimization in entrepreneurial or organizational, political, and personal decision-making processes
Attention	Public awareness of potential new socio-technological development paths; marketing of commercial products and content; individual self-marketing
Criticism	Critical assessment of given social conditions through the construction of utopian alternatives alongside new technological possibilities

Source: Own compilation

On the basis of such patterns of simplification and arising out of diverse economic and political interests, novel and far-reaching promises of technologically-enabled

decentralization are regularly reformulated[2]—not least as they are easily integrated in a variety of ongoing political, cultural as well as economic discourses and fulfill elementary communicative functions in the areas being addressed (*Tab. 2*; cf. Tutton 2017; Beckert 2016; Borup et al. 2006; Konrad 2006; Brown et al. 2000).

With their explicitness and thus insistence on either agreement or repudiation (akin to a religious doctrine), such propositions of technological decentralization considerably contribute to the *alignment* and channeling of socio-political communication processes, the semantic coordination of corresponding collective or corporate activities, and the *motivation* of employees, freelancers, consumers, users, and volunteers. Moreover, they facilitate the construction of a collective identity as well as processes of *distinction* from other social domains in early-adopter milieus and civil society.

In light of a fundamentally unpredictable future, the outlined visions and expectations also offer a plausible basis for *validation and legitimization* in organizational, political, and personal decision-making processes as they substantially contribute to the coping with contingencies and uncertainties (Dickel and Schrape 2017: 54): "In these utopias (or dystopias), business corporations may see a confirmation of their current course or derive from them an urgent need for reorganization; early adopters can align their preferences on them […]; science can claim the need for further research; politicians can call for societal reorientation […] and mass media providers, […] can mount a series of successive coverage."

Furthermore, as can be seen in the history of the discourse since the 1960s and, more recently, in the example of blockchain technologies, radical visions and expectations of technology-driven decentralization serve to create *public awareness* of potential socio-technological development paths that private-sector organizations or science and politics at some point will also have to confront. And finally, utopian expectations and visions of the future associated with new technological lines of development make it possible to depict the societal status quo as both conditional, or contingent, and therefore changeable and open to *criticism* (Dickel 2011). Thus, the recourse to technology-based promises of decentralization can serve as an instrument for reducing situational complexity in a number of communication contexts.

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[2] Visions of technological decentralization often derive from professional "visioneers"—" developing a broad and comprehensive vision for how the future might be radically changed by technology, doing research and engineering to advance this vision, and promoting one's ideas to the public and policy makers in the hopes of generating attention and perhaps even realization." (McCray 2013: 13; see also Sand 2018).

7 Conclusion

Notions and visions espousing technology-driven decentralization and the accompanying democratization of socio-economical structures continue to circulate with increasing ubiquity—from the Californian counterculture of the 1960s, the computer hacking scenes of the 1970s and 1980s, and the numerous debates on the disruptive potential of the World Wide Web and Web 2.0 in the 1990s and 2000s to current visions of a post-capitalist economy. The specific expectations range from references to the material (e.g., decentralized production of goods) to the intangible (e.g., user-centered information distribution); however, they all share in common the prospect to overcome existing social power configurations and the belief that (new) technological solutions will enable the transfer of hitherto centrally coordinated socio-economic activities to distributed and decentralized peer-to-peer networks.

Their definite and unambiguous formulation allows them to function as easily recognizable landmarks in the respective discourses, contributing to the channelization of communication, public awareness, and a basis for legitimacy in individual, collective and corporate decision-making processes. Most visionary publications, however, inherently give little consideration to the possibility of an expansion, conversion or layering of existing socio-economic structures—instead of their displacement: Even though new technologies from the 1960s onward have led to considerably greater flexibility in our forms of communication, coordination, and production, as well as they have contributed to substantial shifts and changes in the actor figurations in many economic fields, this has by no means led to a radical erosion of fundamental socio-political power asymmetries and societal role distributions, or to a general replacement of established forms of socio-economic coordination. Open-source projects, for example, are now an integral part of the research and development activities of major IT companies; Web 2.0 has led to the emergence of highly profitable multi-sided market structures and platforms for user-generated content.

Promises of decentralization of socio-economic structures solely through technology thus remain a discursively well-honed delusion, one that in the worst case obscures contradictory empirical developments (such as oligopolistic configurations and dynamics of recentralization in the digital economy). At their best, technological infrastructures can serve to enhance existing trends in social or economic areas, which already show a tendency toward decentralization; however, these potentials will not be realized automatically, nor within a short period of time, but will be developed gradually, through complex processes of deliberate adaption and negotiation.

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