Kohtala, Cindy; Boeva, Yana; Troxler, Peter

Alternative Histories in DIY Cultures and Maker Utopias

Published in:
Digital Culture & Society

DOI:
10.14361/dcs-2020-0102

Published: 04/03/2021

Document Version
Publisher's PDF, also known as Version of record

Please cite the original version:
Kohtala, C., Boeva, Y., & Troxler, P. (2021). Alternative Histories in DIY Cultures and Maker Utopias. *Digital Culture & Society*, *6*(1), 5-34. https://doi.org/10.14361/dcs-2020-0102

Vol. 6 | 2020, Issue 1

Digital Culture & Society

Cindy Kohtala, Yana Boeva, Peter Troxler

Alternative Histories in DIY Cultures and Maker Utopias

[transcript]

From:

Cindy Kohtala, Yana Boeva, Peter Troxler (eds.)
Digital Culture & Society (DCS)
Vol. 6, Issue 1/2020 – Alternative Histories in DIY Cultures and Maker Utopias

February 2021, 214 p., pb., 47 b&w ill.
29,99 € (DE), 978-3-8376-4955-0
E-Book:
PDF: 29,99 € (DE), ISBN 978-3-8394-4955-4

As DIY digital maker culture proliferates globally, research on these practices is also maturing. Still, particular terminologies dominate beyond their Western contexts, and techno-cultural histories of making are often rendered as over-simplified technomyths that render invisible diverse local practices. This special issue brings together contributions that highlight how historicising plays a role in mythmaking and the creation of social imaginaries. The peer-reviewed articles present cultural-historical perspectives, technology and design histories and historiographies, and alternative histories related to postcolonial resistance. The contributions illustrate the relevance of craft to making as a reparative practice after the Salvadoran Civil War and as a leisure activity to spark »innovation« in mid-century corporate culture; the political-economic background to the diffusion and differentiation of community workshops in contemporary Spain and post-war Germany; and the various aesthetics and politics of technology culture manifestos over the years.

The issue features an interview with Peter Harper of the Alternative Technology movement by Simon Sadler, as well as an interview with Felix Holm and Suné Stassen on the antecedents of making and design in South Africa. The special issue is rounded off with six short alternative (hi)stories of DIY making including multiple practices, geographies and temporalities.

Cindy Kohtala is a postdoctoral researcher in the department of design, Aalto University School of Arts, Design and Architecture, Espoo, Finland. Her research focuses on how peer-to-peer communities in fab labs and makerspaces organize themselves and address socio-environmental sustainability in their visions and practices. She also writes and lectures on urban activism and sustainable design.

Yana Boeva is a postdoctoral researcher in the cluster of excellence on Integrative Computational Design and Construction for Architecture at the University of Stuttgart. She has studied makerspaces and fab labs in Western Europe and Canada focusing on the sociopolitical and historical dimensions of digital fabrication in design. Her research explores the transformation of design, architectural practice, and different user perceptions with the inclusion of active matter and automation in contemporary fabrication models.

Peter Troxler is a research professor at Rotterdam University of Applied Sciences, the Netherlands. He studies the impact of readily available direct digital manufacturing technologies as well as of the makers' design and manufacturing practice on the creative and manufacturing industries; and the emergence of networked co-operation paradigms and business models based on lateral governance and on open source principles.

For further information: www.transcript-verlag.de/en/978-3-8376-4955-0

Introduction

Alternative Histories in DIY Cultures and Maker Utopias

Cindy Kohtala, Yana Boeva and Peter Troxler

Digital maker culture is increasingly studied for its impact on production and consumption patterns, technological innovation, educational potential and citizen engagement in design and technology. As making practices proliferate globally and begin to institutionalise, research on these practices is also maturing beyond mere conceptual speculation and propositional dogma. Nevertheless, particular terminologies tend to dominate beyond their Anglo-Saxon contexts (even the term "maker" itself), and technocultural histories of digital making are often rendered as over-simplified technomyths and hagiographies of selected gurus. Such story-making reinforces a specific represented history in the maker imaginary: typically, a white, male, well-educated (often engineering or computer science), middle-class, Western-situated narrative.

This special issue presents a targeted examination of DIY maker culture that profoundly acknowledges and investigates some of its diverse historical precedents, which play an important role in present practices and strategic visions even if unseen. Maker culture tends to refer to current communities, activities and projects in shared community workshops (fab labs and makerspaces), and/or electronics tinkering projects documented in online repositories and glossy magazines, but these endeavours are informed by more diverse practices than are always recognised (Richterich/Wenz 2017b). Activities considered "low-tech", the non-digital in DIY (Do-It-Yourself) cultures, are often pushed aside in the rush to promote the most photogenic high-tech tools, such as 3D printers, laser cutters and computer numeric-controlled (CNC) routers. Meanwhile, individual inventors are lauded as solitary heroes belying the collective efforts underpinning "DIT" (Do-It-Together) and "DIWO" (Do-It-With-Others). DIY stemming from former visions of self-sufficiency, handiwork and technical skill in the home has been reframed as an all-encompassing, all-embracing, universal, modernised and global "maker culture".

Much is being written about maker culture as a phenomenon, its meanings and possible future pathways, but discussion on its technocultural antecedents has been highly limited. Often referenced are the Homebrew Computer Club and its related garage tinkering cultures. Relevant counterculture movements that have fed its development are not always brought into the conversation, from hacking and community technology to DIY craft and building, media art and activist publishing and much more (e. g. Atkinson 2006; Medina/Marques/Holmes 2014; Krewani 2017). Moreover, the commonly espoused maker narrative frames Silicon

DOI 10.14361/dcs-2020-0102

Valley as a geographical and metaphorical locale, as the culture centre of DIY maker values, which radiate across the globe through commercial Maker Faires and the growing network of Fab Labs and makerspaces. Maker practices in other contexts – other continents than Europe and wealthy Anglo-Saxon nations, as well as the forgotten, neglected cities inside them – manifest differently, build on other local industrial and technological histories, and use other terminologies for their endeavours (Lindtner 2015; Usenyuk/Hyysalo/Whalen 2016; Braybrooke/Jordan 2017).

Such fragmenting of historical representations, even deliberate suppression, is cause for worry in these turbulent times, when makers' promises of empowerment, agency, inclusion, democratisation and openness of apparently everything too easily serve to render nothing as open or empowering (Powell 2012; Pomerantz/Peek 2016). The promises of making to ease the socio-economic ills of unfettered capitalism, not to mention environmental destruction, appear fragile and vulnerable to enclosure, commodification and colonisation (Fonseca 2015; Irani 2015; Lindtner/Lin 2017). Current dominant narratives, apparently stemming from the grassroots, are bloated with techno-optimism and techno-solutionism. They serve to shape a hegemonic sociotechnical imaginary (Jasanoff/Kim 2015; Stein 2017; Turner 2018) in ways that cause concern for researchers as to what is rendered invisible and voiceless: we need to re-examine and re-focus on who and what is left out. If DIY making is to be truly democratic and democratising, inclusive and equitable, accessible, empowering and capacity building, there is a role for research to unmask these alternative histories. We thus build on this journal's previous special issue on "Making and Hacking" (Richterich/Wenz 2017a) to place emphasis on legacies and foundations: thinking in terms of history places the emergent and fast-changing phenomena of DIY making practices into a broader and richer frame.

Our call for papers for this Special Issue "Alternative Histories in DIY Cultures and Maker Utopias" aimed to elicit contributions from cultural-historical perspectives, technology and design histories and historiographies, alternative histories related to postcolonial resistance, and studies that highlight how historical elements and historicising play a role in mythmaking and the creation of social imaginaries. In the following sections, we will review several key themes with regard to DIY, tinkering and inventing, community technology, user innovation, shared workshops and their histories and historiographies, as well as the benefits of learning through history and historicising. We then summarise the contributions that appear in this special issue before concluding briefly with some considerations as to why historical knowledge matters.

Historicising as a Tool

Over several decades, researchers in Science & Technology Studies (STS) and closely related approaches in feminist studies, indigenous and postcolonial studies, design, human-computer interaction (HCI) and so on have sought to overcome

the broader image of science and technology practised exclusively by "white elite groups" (e. g. Kline/Pinch 1996; Oudshoorn/Pinch 2003; Mavhunga 2017). Recent contributions have emphasised the hegemony of Western technology design and engineering cultures as not only driving the perception of who gets to define the "future", but also who from the past is to be revered. Anthropologist Arturo Escobar (2018) asks us to reconfigure these dominant, colonialising models of technology design by examining practices and movements among the indigenous and Afro-descended people in Latin America. Ron Eglash and Ellen Foster (2017) emphasise how fixer practices and *se débrouiller* (making do) in African maker cultures are as much about spiritual lineages, a collective ethos, creative play and subversive intelligence, as they are about economic necessity. Cindy Lin Kaiying, Silvia Lindtner and Stefanie Wuschitz (2019) demonstrate how Indonesian biohacker collectives provide an alternative narrative of DIY making and hacking, by positioning their practices in relation to distinctly Indonesian political, cultural and material antecedents. Daniela Rosner's volume (2018) challenges the dominant history of computing innovation as well as design practice as being void of traditional craftwork legacies. These examples and others make visible multifarious design and technology practices and repressed or forgotten histories.

DIY making and hacking has also often purposefully presented alternatives to the mainstream, which means individuals and groups are presenting counter-objects and "counter-contexts" where design, technology and engineering are wrested from hegemonies and given new meaning (Pfaffenberger 1992; Kohtala/Hyysalo/Whalen 2020). People's reasons for engaging in such making are political, whether that means explicitly rebelling against "the system" (Cuartielles/García 2020, in this issue; Foster 2020, in this issue); being compelled to invent to meet needs (Jungnickel 2020, in this issue; Latoufis/Tympas 2020, in this issue); taking on hobbies within a capitalist work ethic (Shorey 2020, in this issue; Stein 2020, in this issue); making do with what is to hand (Gibas/Nyklová 2020, in this issue; Usenyuk-Kravchuk 2020, in this issue; Sipos/Franzl 2020, in this issue); or finding solace and solidarity in handwork in conditions of adversity (Gowda 2020, in this issue; Velis et al. 2020, in this issue).

For historians of design, acknowledging politics and meanings entails examining not only consumption and production, but also mediation – the relations between designer, consumer, use and meaning-making (Lees-Maffei 2009), which, in DIY making "prosumption", shift fluidly. Moreover, scholars of STS and material culture have long argued that users are also innovators and have been more deeply involved in technology production, and for much longer, than many have been willing to give them credit for (Hyysalo/Jensen/Oudshoorn 2016). A history of innovation and technology bound only to what is considered "high-tech", is unmoored from what people themselves do, design, innovate and make – which includes also sewing and clothes, growing food, making furniture and even making and fixing cars.

As historians of consumer technology Ruth Schwarz Cowan (1987) and Joy Parr (1999) point out, we can benefit from shifting our focus from studying celebrated inventors and corporations to the practices of everyday life. Following their recommendation, several historians of technology and culture have explored the multiple paths and DIY practices of different user groups covering the development of transportation, household and computation technologies over the 20th century. These studies have captured the early automobile use and DIY tinkering by car owners (Franz 2005) and vehicle convergence to meet local energy supply needs and other farming necessities in the rural United States (Kline/Pinch 1996), through amateur ham radio hobby cultures in North America, Europe and Japan and their intricate relationship to professional identity-shaping (Takahashi 2000; Haring 2007), to more general treatments of maintenance work of electronics and electronic-based technology (Orr 1996).

DIY Material Practice Before Stabilisation: On Car Owners and Hams

For historian Kathleen Franz, car tinkering empowered users, particularly women, to minimise the imbalance between their desires and one standardised technology – the early Ford Model T. Drawing upon various examples in the contemporary popular literature, advice journals and travel logs, Franz reveals that women in this period were encouraged and very determined to tinker with their cars. Whether car owners had some previous mechanical know-how or not, they "were eager to tinker with the new machine" (Franz 2005: 1), and the combination of hands-on work on the vehicles, advice literature and exchange with others taught them to maintain and modify those. Women learned that in repair shops, through experimentation or by recalling their observations of technicians' work (ibid). Even the *Ladies Home Journal* published illustrated instructions on car maintenance. Such approaches to repair and maintenance vividly bring to mind how contemporary DIY making functions at times – by being messy, exploratory and to some degree sustainable (see Holm/Stassen/Kohtala/Boeva 2020, in this issue). Yet, the connection to these historical precedents within DIY maker cultures remains unaccounted. These ingenious DIY practices mostly disappeared in Western countries with their growing automotive industries, especially once vehicles were stabilised in terms of their design (ibid). Franz's study presents a limited perspective considering gender, race, class and geography, but her dedication to female car owners and their practices provides a glimpse of liberation and system opposition similarly experienced by women through DIY and craft practices in Kat Jungnickel's study of Victorian female cyclists (2018; 2020, in this issue).

Whereas necessity, sustainability, resourcefulness and also counteraction were associated with these previous examples, it was mostly hobbyism and pleasure that initially determined the tinkering with electronics. With the growing economic importance of electronic technology in the post-war period, it also gained significance for technical work. Both Haring and Takahashi describe tinkering with

ham radios as essential for the professional activity of technicians and in repair work. The difference between their studies, however, is that most Western tinkerers were doing it from a hobbyist perspective, while Japanese tinkerers were motivated by the economic conditions of occupation-era Japan. Western hams often turned to their amateur personas at work to sustain professional success (Haring 2007). Professional education and the industry during this period disconnected tinkering, DIY and material practice from (engineering) design, as Haring indicates, the "advocacy of tinkering as opposed to research and design allied the amateur and professional electronics communities with separate traditions of practice" (ibid: 90). These activities took place in individuals' private time and space and often remained uncelebrated outside that. Maker culture, the fab lab structure and contemporary STEM education, on the contrary, have been lauding DIY, tinkering and the entire ecosystem around it for increasing creativity and the potential of innovation. Moreover, this maker ecosystem has enforced a global, entrepreneurial Silicon Valley culture of worship (Irani 2019). The prevalence of entrepreneurial narratives around DIY making, however, fails to represent the wider cultural history related with hands-on practices, whether that includes electronics, computational technologies or remains non-digital.

DIY Making as "Critical Fabulations": On Gender, Race and Tech

The development of computer science as a discipline, computer engineering and its affiliated industry often portray their history by neglecting hands-on material user practices and the people involved in them, as many computer historians and HCI scholars have pointed out. There are multiple reasons for this. First and more comfortably aligning with computer/tech cultures, hands-on experimentation is difficult to structure and break down into discrete (binary) entities. Second, the restructuring and renaming of computer-related jobs in wartime and in the post-war period aimed at securing gender boundaries and ended up devaluing women's contribution to this field (Light 1999; Abbate 2012; Hicks 2017). The exclusion from historical memory, writes Jennifer Light (1999), further relates to implicit assumptions that the low status of women's occupations in computing are not deemed innovative. Many feminist scholars studying DIY, making and craft have noted a similar trend in Maker Media's disposal of Craft magazine and its relocation within a few pages of *Make:*, suggesting that "feminised" craft is less worthy of attention.

Early programming, before being labelled as "software engineering", resembled telephone switchboard operations which made it "more handicraft than science [and technology], more feminine than masculine" (Ensmenger 2010: 15). Programming then began deploying textile-based manufacturing practices such as in the core memory for NASA's Apollo 8 mission by line workers (Rosner et al. 2018) or the Fairchild semiconductor by Navajo women (Nakamura 2014), both executed by women mastering the craft of weaving. While line workers were hired for their particular textile craft skills required in the production of electronics, Navajo

women's mastery of weaving served to support a racialised labour rhetoric based "heavily on existing ideas of Indians as creative cultural handworkers" (ibid: 921). For many indigenous women, textile crafts are deeply entangled with cultural values, traditions as well as forms of subsistence (see Velis et al. 2020, in this issue). Their appropriation within tech culture narratives rarely serves to present an alternative, more nuanced but also problematic history of material and DIY-based shaping design and technology. Instead, as Nakamura argues, "[i]t posits that indigenous design informed electronic circuit design – a kind of colonialism in reverse – despite the lack of involvement of indigenous people in the company's research and development arm" (2014: 932). In other words, it becomes a white-washing of historical accounting.

Lately, research in the history of computing informed by approaches and epistemologies in the study of women, gender and sexuality, of race, ethnicity and post-coloniality as well as disability studies, has expanded the common trajectories of the white male or Western institutions and corporations as those who have shaped user practices and technological development. These projects combine digital DIY making with research methods to write alternatives, not just as a gesture of inclusiveness but as conceivably primary histories of technology and tech cultures. Some of them look at how historical tools, crafts and practices inform interaction design (Fernaeus/Jonsson/Tholander 2012); others take more exploratory and playful approaches to question the dominant paradigms of what counts as scientific and technical practice (Posch/Kurbak 2016; Boeva et al. 2017; Rosner/Bjørn 2019).

DIY Making's Visible Histories and Hagiographies

DIY maker culture's represented history within makers' own narratives has been limited to garage innovators such as the Homebrew Computer Club and oriented mainly to engineering and computer science technical cultures. In pursuing an imaginary that brings new forms and aesthetics to humanise – or even replace – mass production and consumption, makers' writings often also reference the Arts and Crafts movement of William Morris, lending their cause a tie to craftsmanship and artisan production. Such techno-utopianism tends to overlook the luxury of time and resources these objects and activities entail, and how the principles behind the Arts and Crafts movement later became forgotten as its products became commodified for wealthy, elite consumers (Sivek 2011; Cramer 2019). Moreover, offering a consumerist view of DIY making and hacking as the most valued – trajectories that end in best-selling products and multinational corporations – belies the very real traditions of many hacklabs and makerspaces in, for example, squatter, anarchist and social justice communities (Oldenziel/Hård 2013; Costanza-Chock 2020).

Several historians have noted how alternatives get "written out" of history until they are later rediscovered and become utopian – or re-utopianised. DIY maker culture has built upon garage tinkering, but also upon traditions of community

organising and alternative value creation, whose terminologies, ideologies and operating principles are easily "written out" (cf. Cuartielles/García 2020, in this issue). In the case of cooperatives, for instance, as neoclassical economics became the canon, discussion on cooperatives was dropped from economics textbooks; this in turn meant cooperatives were overlooked for their potential to address social problems (Kalmi 2007). Similar issues arise with documenting informal economies and gift economies in many regions, where DIY making clearly resides, not least with regard to repair, maintenance and material flow networks (Ahmed/Mim/Jackson 2015; Eglash/Foster 2017). In the same way, small craft production was written out of the history of mass production – often in itself presented as a linear trajectory – as if it never co-existed alongside globalising centralised production (Carson 2010). For historians such as Charles Sabel and Jonathan Zeitlin (1985), small firms and maker-craft production did not denote a traditional or subordinate form of economic activity. Their visionary figures, such as French philosopher Pierre-Joseph Proudhon, often inspired or even mobilised further cooperative production projects, using ideas and a political vocabulary unknown to the "well-schooled theoreticians of mass production" who thus rendered these alternative idioms obsolete through neglect or outright scorn (ibid: 142–143). Rediscovering technocultural phenomena may allow us to imagine new visions, recreate utopias and remake narratives of how to act in the world and how to be embedded in webs of life, in times of complexity and health, environmental and economic crises. This is particularly pressing now when it is unimaginable to see outside of capitalism and *homo oeconomicus*, and beyond ready-made solutions (Daily 2017).

Tool Domestication and Beyond: DIY and DIT

Numerous authors have summarised the histories of DIY as related to home maintenance and handicrafts, while others have included later music and self-publishing subcultures related to punk's explicit use of DIY terminology and a particular aesthetic. Florian Cramer (2019) assigns the roots of DIY culture to the romantic reaction to alienating industrial or institutional production – such as the Arts and Crafts movement, at least in Western cultures – which implies that Do-It-Yourself as a term lacks sense for eras or regions that are pre-industrial or less industrialised. DIY is thus both conservative and anti-conservative, depending on what is rejected or preserved (Cramer 2019). Paul Atkinson points to the "sometimes contradictory elements of need versus desire and creativity versus assemblage" when one attempts to categorise DIY activities (2006: 2). Linking DIY histories to "democracy" and people's agency in different eras, Atkinson suggests categories of "pro-active DIY", activities that are self-directed; "reactive DIY" which entails mediation through kits; "essential DIY", that is, home maintenance performed through economic necessity, and "lifestyle DIY", where the motivation for home renovation lies more in conspicuous consumption (ibid: 3). Historian of

technology Rachel Maines (2009) introduced the duo of utilitarian and hedonised DIY, the former referring to activities done out of necessity and the latter out of pleasure, to illustrate how under particular circumstances in Western countries utilitarian DIY became hedonised DIY. One and the same DIY activity, for example, needlework, could simultaneously be rendered utilitarian and hedonised depending on when it is performed and by whom.

In a similar quest to avoid technological determinism and chronological linearity when examining people's DIY practices over time, Knott (2013) proposes a taxonomy of prosumption that is not principally embedded in Western capitalism, as Toffler had conceptualised it (having coined the term prosumption in *The Third Wave*, 1980). Knott's categories for prosumers are those who "follow", that is, "the prosumer who follows the rules" when provided with kits, toolkits and instructions, such as paint-by-number kits; those who "reject" those provisions of capitalism and "pursue self-sufficiency", symbolised by the launch and subsequent influence of the *Whole Earth Catalog* (further discussed below); and those who "adapt" through hacking and ad hoc bricolage, such as "IKEA hacking" (2013: 45). For Ruth Oldenziel and Mikael Hård (2013), active users have been investing time, skills and resources as "consumers", forming user movements, "tinkerers" who appropriate technology and modify machines, and "rebels" who protest technology introduction such as surveillance software and hardware. Such DIY making and hacking includes computer tinkering, wind turbine and cargo-bike building, and children's engineering toy kits, which have shaped European infrastructures and technologies (Oldenziel/Hård 2013).

Domestic and Public DIY

Within the broader set of historical examples, some of the cultural antecedents of DIY making are squarely placed in the domestic sphere. The activities related to early car owners, farmers and amateur radio hobbyists often took place within the household confines, but they rarely addressed the needs of the home as a place and building and its individual caretakers. The aftermath of the Wars, especially in the United Kingdom, economic recessions but also the proliferation of hardware stores, manuals and instructions media, turned the house and home into a DIY site (see Gelber 1997; Hackney 2013). In activities like home renovations and repairs, homeowners engaged in utilitarian DIY activities out of financial necessity, household duty and an absence of qualified craftspeople; on other occasions, hedonised DIY provided an opportunity for artistic self-expression and pastime (see Edwards 2006). Similar to feminised care-work, repair and maintenance, however, utilitarian DIY gets limited attention from a historical and contemporary perspective. The home with its actors and activities is often treated as a marginalised space, placed out of the focus of collectively relevant attention and productive influence, but mostly as the site of gendered work and homemaking crafts that has little value to contribute (ibid). Besides, the ongoing hedonisation of

DIY practices and technologies connected to increase of wealth and resources in predominantly Western countries enables individual expression and exploration celebrated for its creative and libertarian attributes (see Gelber 1997; Powell 2012). These diverse studies suggest that a closer analysis of the histories of domestic and everyday DIY as a marginalised practice obscures present-day visions of DIY making as the locus of creative tech innovation.

Utilitarian DIY making in an improvement sense has recently taken a more political stance as cities and their residents feel pressure through ongoing gentrification, the ramifications of de-industrialisation and the absence of municipal support. In several cases, this has led to civic engagement through DIY actions such as urban gardening, neighbourhood exchange of goods and services as well as other forms of meaningful transformation of public space. Such examples have their own antecedents dating further back than most contemporary DIY-related activities, but tend to be overlooked once tech-based maker and hacker cultures are presented as the answer to communal issues.[1] Other renditions of these histories such as the DIY revitalisation practices for "gray spaces", that is, public spaces forgotten or abandoned by municipalities, carried out by local Detroiters from diverse cultural and ethnic backgrounds get little credit and public attention, as the study by geographer Kimberley Kinder (2016) illustrates. DIY revitalisation practices of public space and community, based on self-provisioning, however, lead to growth of local subcultures around common goals and methods (ibid).

Utilitarian DIY also characterised much DIY activity in regions such as the Soviet Bloc, where the scarcity and low quality of goods met authoritarian regimes' quashing of consumerism. A culture of craft, repair and bricolage developed, enacted in private homes, summer homes and gardens, and shared public spaces, and propagated through television programmes and DIY magazines (Gerasimova/Chuikina 2009; Oldenziel/Hård 2013; Gibas/Nyklová 2020, in this issue; Usenyuk-Kravchuk 2020, in this issue; Sipos/Franzl 2020, in this issue). At the same time, Soviet teens performed their own rebellion during the Cold War by appropriating blue jeans – a symbol of American capitalism – and making, customising and personalising them (Oldenziel/Hård 2013).

Punk Rebellion

DIY's lineage can further be traced in the punk subculture of the 1970s/1980s fostering the production of self-made media known as zines. Zines made with

1 One fitting example is the 2016 exhibition "Fix the City" curated by London's Machines Room makerspace as part of the London Design Festival. Though many of the projects created by the designers and makerspace members showed good intentions, only few embraced actual local craft and DIY traditions such as those required for houseboat living and maintenance and combined them with the means of digital fabrication (Foster/Boeva 2019).

cut-n-paste techniques, photocopying and collages, as well as hand and typewritten text not only created a particularly appealing subversive aesthetic that countered the commercial style of popular culture, but aligned (youth) interests and practices with direct action politics, feminism, anti-colonialism and more recently digital production (see McKay 1991; Triggs 2006; Foster 2020, in this issue). While the cultural histories of zine making and DIY print media with their idiosyncratic aesthetics often get credited in maker and hacker histories to emphasise their envisioned countercultural background, they have limitations in explaining the rather standardised design of mainstream online DIY instructions and media such as Instructables or GitHub. Instead, their current form puts these squarely in the style and logics of technical writing and tech culture (Cole/Perner-Wilson 2019), thus neglecting the diversity of DIY practices and their needs for representation.

Interestingly, the word "punk" stems from the late 1800s and meant "inferior" or "bad", and it was slang for a "worthless person" or young hoodlum in the early 1900s (Online Etymology Dictionary n. d.). The punk aesthetic and ethos from the hardcore music scene of the 1970s, with its imagery of hoodlums and rebellion against commercialism, has later informed the more political and protest-oriented subcultures in "craftivism" (Greer 2008). Craftivism entails handicraft performed individually or in groups, such as knitting circles, but directed to political activism, environmental advocacy, artistic protest and/or radical feminism (Minahan/Cox 2007). Particularly when connected to digital technologies, craftivism seeks to resist narratives of traditional gender roles and how they are associated with utilitarian craft, as well as the exclusion of women from innovation and technology imaginaries. Early craftivist communities were forerunners exploring novel networked possibilities to use "Web 2.0" as well as digital fabrication in creating new material cultures and alternative maker practices. As with the other DIY practices we have reviewed here, relationships of punk and protest-oriented DIY with mainstream mass production and consumption structures are never straightforward – subject as they are to sanctioned marginalising and invisibilising, or appropriation and commodification (Hebdige 1979). Today, despite the many espoused benefits, DIY maker practices and spaces have potential to contribute to neighbourhood gentrification and involuntarily to the more neoliberal sides of a "participation society" (Kelty 2017; Cardullo/Kitchin/Di Feliciantonio 2018; Cramer 2019); its punk, rebellious roots in protest and stimulating new politics are too easily ignored.

Collective Tools and DIWO

DIY making and hacking encompass individually oriented, often domestic or private, DIY, as well as socially oriented DIT – in public, private or third spaces, or in virtual spaces via online sharing. In 2006, the art collective Furtherfield coined DIWO, Do-It-With-Others, to denote art projects that were collaborative

and distributed (Garrett 2006) – arguably more explorative, expressive and open-ended than projects such as free/libre open-source software, which are typically associated with maker culture by business analysts. Handicrafts have always had their knitting circles and common workshops, while communities have long established alternative spaces for new materialist and peer-learning pedagogies or workshops for self-sufficiency and autonomy. Where motivations multiply, so does the variety of DIWO spaces, as Regina Sipos and Kerstin Franzl illustrate in their examination of Germany's Open Workshops (Sipos/Franzl 2020, in this issue).

While there is not space in this Introduction to elaborate on the histories of hacklabs and hackerspaces, they have clearly contributed to global maker culture evolution and diversity, particularly with regard to bringing media activism literacies, as well as surveillance and privacy issues into the realm of concerns and practices. Hacker cultures and their histories in Europe and the United States have been covered by Maxigas (2012), Jordan (2016), Autistici/Inventati (2017) and others, while Sasha Costanza-Chock (2020) summarise further examples of hacklabs in the Global South. Some technology collectives emerged from clearly anti-authoritarian social movements such as squatting; others were inspired by and worked in "participatory culture" (Jenkins 2006): alternative media and telecommunications, net art, fanzines, etc. Still others (and obviously these groups overlap) gelled around computer geek culture, such as the demoscene, which gave birth to several hacklabs especially in Europe, such as Bitraf in Oslo (Silvast/Reunanen 2014; Autistici/Inventati 2017).

Scholars have also noted that paying attention to histories of making activities and shared artisan workshops contribute more to our understanding of localised and low-tech innovation patterns that do not conform to the Silicon Valley corporate model. Shadreck Chirikure (2017), for instance, questions why scientific research and technological innovation are regarded as more legitimate when done in giant, high-tech laboratories funded by global capitalist regimes, as "mass production" for mass markets. (See Figure 1 for an example of a grassroots technology park in India.) Chirikure (2017) compares the Western notion of progress to the knowledge production accomplished through craft and making in fields and houses for small, local communities in the precolonial history of African technology – and their spiritual and cultural significance beyond their innovative capacities. For Chirikure, places for pottery and metallurgy were "sites of work and knowledge production", which were "often embedded in, and were eschewed for being in, the living space and the natural world" (2017: 73). Chirikure asks directly, should Western concepts always have African equivalents? (2017: 73). What is a fabrication laboratory for, and for whom?

Tool Citizenship: When "Sustainability" Arrived

One of the most popular references in DIY historiographies is Stewart Brand's *Whole Earth Catalog*, first issued in 1968, which took DIY out of the home and into the sheds, shacks, barns, fields and even domes of a counterculture, energy-conscious, self-sufficient utopia. The Catalog featured merchandise and plans for self-reliance, from building to agriculture – small-scale tools for an individualist, autonomous citizenship – targeted to the back-to-the-land commune movement of California in the late 1960s and early 1970s (Turner 2006; Sadler 2012; Turner 2018). Brand envisioned the Catalog also as a research tool, networking people and their stuff in a way that clearly brings to mind today's maker repositories: "nifty projects everywhere, earnest folk climbing around on new dome designs, solar generators" (cited in Turner 2006: 79). The network would be designed as a learning system steeped in the cybernetics movement that Brand both moved in and was instrumental in kindling, while the Catalog also inspired environmentalists worldwide (Boyle/Harper 1976; Turner 2006; Sadler 2012). (And domes persist in maker culture; see Figure 2.)

Emerging Cyberculture

The milieu in California's Bay Area in the 1960s, its movements and counterculture, evolved into the globally influential, individualist and libertarian capitalism we see today. Fred Turner, Simon Sadler, Richard Barbrook and Andy Cameron, among others, observe how a heady mix of McLuhan-inspired community media activism, hippie ecotopia and free market ideologues formed a "bizarre hybrid" only made possible "through a nearly universal belief in technological determinism" (Barbrook/Cameron 1996: 50; also Turner 2006; 2018; Sadler 2012). Pragmatic tool-making, prototyping and networked information sharing birthed mythical artefacts of California innovation and making such as the "virtual community" and WELL (Whole Earth 'Lectronic Link), and garage tinkering such as the Homebrew Computer Club (Wozniak 1984; Rheingold 1993; McGetrick 2017). Decades later, Chris Anderson, one of the editors of Wired magazine, published the capitalist maker bible *Makers* (Anderson 2012) and O'Reilly Media began publishing *Make:* magazine in 2005 – critiqued by some for representing and reproducing maker culture as hyperconsumerist technomyth (Sivek 2011; Shorey 2020, in this issue).

The *Whole Earth Catalog* connected to and had an influence on movements beyond California emphasising ecology, environmentalism and community technology. The (Anglo-Saxon) 1970s saw the rise of the appropriate technology and alternative technology movements, both of which sought to "devise technologies which offer genuine alternatives to the large-scale, complex, centralized, high-energy life forms which dominate the modern age" (Winner 1979: 80). The Appropriate Technology movement was conceptualised and popularised through E. F.

Schumacher's influential book *Small is Beautiful* (1973) – and is a framing that many makers and maker-researchers adopt today for their work, particularly in emerging economies reflecting its early focus on development (e. g. Pearce 2012; Guzmán/Reynolds-Cuellar 2018). Alternative Technology groupings conducted hands-on experiments with and provided information on renewable energy, eco-building, organic food production, water and sanitation, and cooperative ways to develop and use useful technologies by people and for people (Smith 2005; Harper/Sadler 2020, in this issue).

"Science and technology for the people" movements also unfolded in, for example, France, Latin America and India (Quet 2013; Smith et al. 2017). In India, People's Science Movements set the stage for the later incarnations of fab labs and hackerspaces to develop alternative technologies (Smith et al. 2017). Vigyan Ashram, for example, has been involved in education as well as the development of rural technologies since the early 1980s and established a Fab Lab in 2002 (Kulkarni 2016). (See Figure 1.)

Figure 1: Technology Demonstration Park, Vigyan Ashram, Pabal, India, 2017. Photographs: Cindy Kohtala.

Figure 2: Dome demonstrator (left), Vigyan Ashram, Pabal, India, 2017. Hacker dome (right), Koppelting maker festival, Amersfoort, the Netherlands, 2016. Photographs: Cindy Kohtala.

Anti-capitalism and Anti-design

DIY counterculture in the 1960s and 1970s presented pragmatic-utopian visions of shared machine shops, community technology workshops and "laboratory situations" that drew their inspiration from Ivan Illich, the Situationists and anarchist writers such as Murray Bookchin, Pyotr Kropotkin and Pierre-Joseph Proudhon (Boyle/Harper 1976; Hess 1979; Borgonuovo/Franceschini 2018) – distinguishable from current maker hagiographies that espouse the sole-genius-inventor narrative. Especially beloved are anarchist illustrator Clifford Harper's utopian "visions" in the Alternative Technology publication *Radical Technology* (Boyle/Harper 1976), of shared workshops for handicraft and small-technology production, community workshops for larger projects, and others (Figure 3).

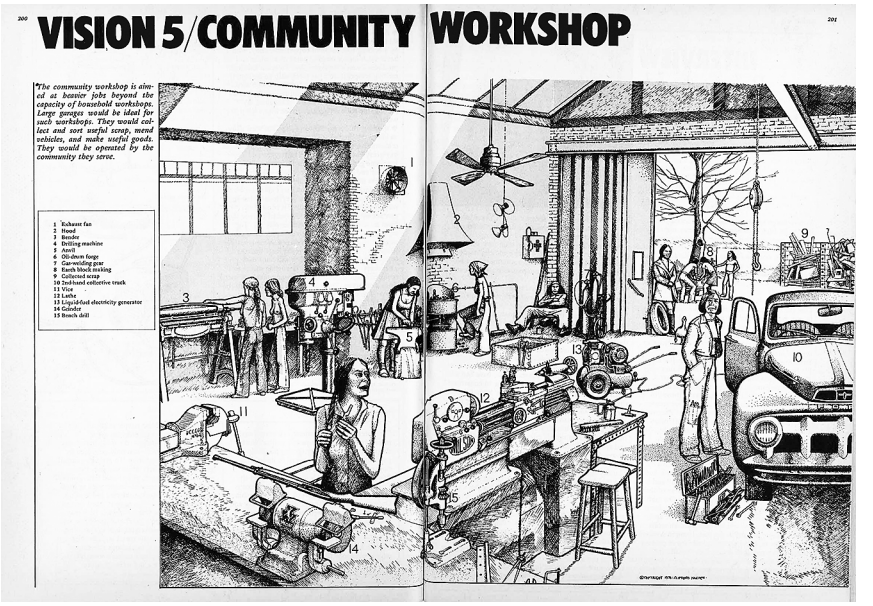
Some visions were actualised, such as the Centre for Alternative Technology (CAT) in Wales, now an educational centre on sustainability, and the Australian CERES Community Environment Park established in 1982, which was promoted as a "vision for Brunswick (called 'The People's Republic of Brunswick' in the press) as a decentralised/distributed DIY neighbourhood" featuring "local community sharing systems that included tool libraries, community gardens; fruit trees in streets, worm production, plant nurseries; and much more".[2] CERES had an impact on later formal design education in Australia. The early counterculture visions particularly heralded later initiatives that were informed by and more explicitly aligned with anarchism, feminism and ecosocialism as a reaction to neoliberal austerity politics, such as New Municipalism (Roth/Russell 2018; Thompson 2020). These translocal movements also call attention to compelling new practices for developing the digital tools for solidarity organising and participatory democracy, which become entangled with the material tools for making, living and working together in cities.

DIY countercultures also entailed the "adhocism" of self-built architecture, Drop City domes and projects built from waste materials (Jencks/Silver 2013 [1972]; see also Balkin/Harbison 1990). The radical technology groupings' focus on ecological solutions was labelled as anti-design and practitioners as "design outlaws" (Zelov/Cousineau 1997). North Italy too saw alternative Radical Architecture and Radical Design movements such as Global Tools that rebelled against the capitalist orientation of industrial design by promoting embodied peer learning about craft and materials, survival, the human body and philosophy in designated "laboratories" (Borgonuovo/Franceschini 2018). The collective sought to redress design's indifference to the political economy of the day, rife with the threat of nuclear war, racism, pollution and consumerism, by adopting an "anti-design", "anti-school" approach to design and pedagogy that – while avant-garde, provocative and speculative – contributed to later Environmental Design curricula in Italy

2 Chris Ryan, founder of CERES and professor of sustainable design, personal correspondence with Cindy Kohtala, 27 April 2020.

(Formia 2017). These rebellious acts from the periphery have thus had lasting impact on the field of sustainable design and how formal design education has incorporated elements of 1960s/1970s counterculture making.

Figure 3: Vision 5/Community Workshop illustration by Clifford Harper, pages 200–201 of Radical Technology *(Boyle/Harper 1976).*



Anti-militarism and Protest

Another characteristic marking DIY countercultures was protest: many groups were active in demonstrations denouncing the Vietnam War, for instance. Peter Harper from CAT collaborated with a Stockholm activist group called PowWow to organise the Exhibition of People's Technology in Stockholm, to take place during the 1972 United Nations Conference on the Human Environment (UNCHE) (see Simon Sadler's interview with Harper, Harper/Sadler 2020, in this issue). PowWow also organised protests against the Vietnam War during the spring and summer months of 1972 and aimed to challenge the governments attending UNCHE in what they saw as centralised environmental decision-making far from citizens and highly impactful techno-solutionism, what we would call ecomodernism today (Björk n. d.; Scott 2016). In fact, Stewart Brand shows up even here, bringing the activist group Hog Farm with him to stage an initiative called Life Forum – a performative act that many members of PowWow resented as American interference and an attempt by Brand to detract attention from the Vietnam protests (Björk n. d.; Scott 2016).

In 2015, two European initiatives (OuiShare and Open State) collaborated on a circularity- and open-source-oriented maker camp called POC21 (Proof of Concept), in anticipation of the UN Conference of the Parties assembly COP21 in France the same year. Inventors prototyped their solutions using a temporary fab lab, while eating, sleeping and working together in a commune-like environment (Conrad 2016). The materiality of the camp, commune and demonstrations of inventions respond to the aesthetics of the 1970s counterculture at the same time as bringing in Silicon Valley rhetorics and practices such as mentoring and pitching (Berglund/Kohtala 2020). Like PowWow and the Exhibition of People's Technology, POC21 aimed to draw attention to grassroots solutions by connecting to high-level summitry (Smith et al. 2017). Unlike PowWow, however, POC21 did not seek to protest elite environmental decision-making nor question the processes of how the UN defines sustainability for the people of the world. Indeed, in many maker subcultures, explicit protest and political critique are relatively rare. Beliefs that "science is neutral" and "technology is neutral" are remarkably tenacious, and pragmatic prototyping is clearly emphasised even in initiatives explicitly oriented to environmentalism and/or social good.

That said, critiques do arise regarding maker culture's apparent determination to remain depoliticised. Aligning with military partners and the petrochemical industry has been contested in maker and fab lab subcultures, even when the funding is earmarked for "good" educational initiatives (Altman 2012; Troxler 2014). The legacy of radical technology's alternative milieu – particularly its readiness for protest and critique – is thus most visible in today's most overtly political spaces, such as DIYbio and biohack labs; alternative spaces such as feminist hacklabs and Green Fab Labs; and Critical Making projects, some of which address privacy, anti-surveillance and sousveillance (Ratto 2011; Hertz 2012; Toupin 2014; Delgado/Callén 2016). Boston's South End Technology Center, for example, was initially established in the milieu of the civil rights struggle, as a technology training site for black Boston youth. Founder Mel King moved from protest and activism to political strategy, aligning with MIT, a predominantly white, elite institution, to connect a Fab Lab with the existing SETC, thus also enabling MIT to enact objectives aiming at diversity and inclusion (McIlwain 2020).

DIY Geographies: On Peripheries and Centres

One of our desired results has been to include geographical and spatial contexts of DIY maker practices beyond the well-represented ones in the Global North. However, the attempt to represent a "global" or in other terms world history of making within the limited scope of this special issue as well as from our own positionality (in northern/western Europe) further problematises this endeavour. As the growing scholarship on making, hacking, DIY, craft and its associated topics reveals, the prevalence of English as a lingua franca for exchange and in

publications reduces the opportunities to include voices and stories that remain unheard. This can already fail because of something deemed negligible such as understanding a call for papers or the absence of an accurate translation of concepts like *jugaad* in Hindi, *urawaza* in Japanese, *gambiarra* in Brazilian Portuguese and many more denoting something similar to DIY. In other words, the dominance of western DIY making and its histories begins with the language behind it. Other issues with expanding the geographic representation relate to the research methods required to uncover untold histories – DIY practices are not overtly represented in archives and scholars rely on oral histories, cues by research informants and interviewees, or even the actual reconstruction of artefacts (see Jungnickel 2020, this issue; Boeva et al. 2017).

Even so, a few ethnographic studies on contemporary maker culture have provided insights into other local industrial and technological histories as well as their manifestations that allow us to challenge the dominance of the Western and predominantly colonial perspective. The enduring link between education and DIY maker culture, often praised for its direct descent from Dewey, Piaget or Montessori's philosophy, is at the centre of several studies. Anita Say Chan's study (2014) of Peru's nationwide adoption of the One Laptop Per Child (OLPC), another MIT spin-off, in the early 2000s questions the long-lasting binary of centre and periphery. In capturing different events and strategies around OLPC's distribution in the country, she discovers how local indigenous educators and students from the Puno altiplano develop their own training programmes reflecting the culture of local Aymara and Quechua people, all leading up to the creation of Peru's first rural hack lab collective (ibid). Similar to Chan's work, Morgan Ames (2019) points out that not all DIY, constructivist educational models underlying projects like the OLPC translate well within the combination of Western "techno-utopian" schemes and metropolitan governmental enterprises of the Global South through her study of the OLPC programme in Paraguay.

Another strand on DIY making in less visible regions considers the connections to industry, manufacturing and innovation. Denisa Kera's comparative study (2012) of hackerspaces in Indonesia, Singapore and Japan demonstrates how such spaces mediate between high-tech/industrial and vernacular knowledge and traditions as much as between technology development and community building. Singapore's earliest hackerspace, for instance, is situated in a neighbourhood full of paradoxes – seafaring, colonial pasts, diverse religions reside next to IT innovation companies, commerce and entertainment areas – and it takes credit for that (ibid). Chinese DIY maker cultures and the growing DIY manufacturing businesses in Shenzhen are the focus of Silvia Lindtner's multi-year ethnography (2015; 2020). Studying how contemporary practices draw upon the culture of local Chinese manufacturing traditions, her work exemplifies how informal manufacturing systems, also known as *shanzhai*, that follow a DIY ethos were established in this region. Counted as prime examples of Chinese grassroots creativity and today the centre of governmental support, these places and activities have a marginal or

shadow existence in comparison to the Western (especially American) maker tech economy which paradoxically relies on the industrial infrastructures of production in Southeast Asia (Tanenbaum et al. 2013). The ignorance of local craft and make-do traditions as much as their co-optation into Western design, innovation and entrepreneurship paradigms builds the core of Lilly Irani's argument in her decade of fieldwork in a Delhi design studio (2019). She vividly illustrates how the process of casting designers, developers and non-governmental organisation workers as drivers of innovation in India conceals the contribution of local craftspeople, regular workers and activists to the country's development, which even gets framed as obstructive (ibid).

The review presented here is by no means expansive; it only captures the scholarly worlds closer to ours. Moreover, it is also afflicted by the same language issues described above. To expand the geographies of alternative DIY maker practices and their histories would likely require confronting research methods and practices (What counts as a history? When does it begin?), the research privileges of academia (Who gets to tell stories? And about whom?) and the deeply embedded colonial and marginalising structures of the technological and scientific worlds (Why is DIY making as the "economy of one" more valuable for society than making out of necessity and to fight poverty?).

In This Issue

Three full papers in the section *Field Research and Case Studies* present novel perspectives on alternative DIY maker histories. In "Craft and Artisan Initiatives of the Salvadoran Civil War (1980–1992)", Emilio Velis, Kate Samson, Isaac Robles and Daniel Rodríguez place Latin American craft strongly within a maker culture that elsewhere often devalues handicraft in favour of technology-oriented innovation practices and rhetoric. As digital makers do today, the artisans in the authors' study taught and practised craft making in workshops as an outlet for personal expression and even therapy, a way to develop technical skills for personal and collective empowerment, and as an opportunity for creative learning. The authors give voice to people not often heard in today's technology-addled maker circles – refugees, women, veterans and disabled people, all of them bonded as participants of artisan collectives during the strife of the Salvadoran Civil War in the 1980s.

In "Histories of Technology Culture Manifestos: Their Function in Shaping Technology Cultures and Practices", Ellen K. Foster examines the rhetoric, contexts, aesthetics and materialities of well-propagated feminist, maker and hacker, repair, and cyberfeminist and feminist hacker manifestos developed in different periods and geographies. Analysing these as historical artefacts, Foster makes a case for manifestos as tools for identity shaping as well as for laying the knowledge foundations of individual groups. Yet as the better-known examples of the maker, hacker and tech-related communities demonstrate, the values behind

them often result in the maintenance of a status quo instead of its uprooting. Instead, Foster proposes to expand the perspective towards radical feminist manifestos and their configurations which critically question power relations and account for diverse backgrounds around class, gender, race and geography.

The third full paper explores the recent history of Spanish DIY spaces. In "From Hacking to Making – The Commodification of Spanish DIY Spaces Since the 1990s", David Cuartielles Ruiz and César García Sáez survey the broader context of the country's different techno-social movements and spaces and the possible reasons why many of them underwent a double transformation through the commercialisation of DIY culture and a loss of its values associated with it. Capturing data from a broad range of sources including an online survey, social media and community channels, the authors present a compelling "Spanish DIY culture timeline" that includes the entry and exit points of some of these spaces, relevant media publications, public events, as well as policies and governmental reforms imposing changes on Spain's DIY spaces.

Two exploratory papers in the *Entering the Field* section open our perspectives on the diversity of DIY activities, communities and spaces. In "Tracing the History of DIY and Maker Culture in Germany's Open Workshops", Regina Sipos and Kerstin Franzl take the proliferation of contemporary makerspaces in Germany to trace their beginnings in the two formerly separated 20th-century countries. Combining oral histories and document analysis, their initial study illustrates how the different sociocultural and economic infrastructures of both countries constructed distinct DIY cultures – one being more countercultural and leisurely oriented, the other pursuing the education of future generations of young workers. Despite such differences, their commonality was an underlying idea of community-making.

The combination of hobbies/leisure time and workforce education through DIY is explored from a different perspective in "'What You Can Invent over the Weekend' and the Recurring History of Corporate DIY" by Samantha Shorey. The paper presents a comparative study of two sets of DIY texts – a collection of printed DIY booklets from the 1950s and 1960 provided by General Motors (GM) to their production employees, and the first issues of *Make:* magazine from the early 2000s. In studying the topics, projects, tools, materials and their intended audience turned makers in both printed sources, Shorey questions the argumentation for DIY as a practice and place for self-improvement and innovation, further noting that the techno-utopian celebration of making, craft and DIY within contemporary tech-cultures as unmapped sites of (workers') creativity deviates from GM's intentions for their workers' education and leisure time.

In the section *In Conversation With…*, we present two compelling interviews with practitioners and founding figures of alternative DIY movements. The first interview "Makers and Design in South Africa: Technology and Craft Cultures and their Antecedents" with Felix Holm, co-founder of the Maker Station in Cape Town, and Suné Stassen, founding director of Open Design Afrika, was

conducted over video conference with two of the guest editors days before the global pandemic shut down nearly everything. Here, Holm and Stassen reflect on how their engagement in making, design and creative practices has supported establishing infrastructures that reflect South Africa's diverse DIY traditions and empower local communities in a meaningful way. In "The Exhibition of People's Technology, 1972", Peter Harper, co-editor of the famous *Radical Technology* source, recapitulates in his conversation with design historian Simon Sadler the contents and topics of the 1972 Stockholm exhibition dedicated to it and its broader implications. Supplemented with a plethora of visual materials presenting some of the "alternative technologies" and instructions on how to rebuild them, the conversation reconnects contemporary tech DIY making with many of its initial promises around sustainability, democracy and diversity.

To illustrate an even richer landscape of DIY making's alternative histories, in the section *Moments in Alternative (Hi)stories*, we invited researchers and practitioners to contribute short vignettes that combine historical, ethnographic and practice-based research. Following from the Alternative Technology movement, Kostas Latoufis and Aristotle Tympas describe small wind turbine making and design in an isolated Scottish island community that has grown to a global group of supporters. In a similar way, extreme weather conditions and extremely remote locations engender ingenuity through DIY, as Svetlana Usenyuk-Kravchuk illustrates the wonderful bricolaged solutions for mobility crafted by inventors in the Russian Arctic. Socialism and the transition to a democracy created another locally contextual form of DIY in what is now the Czech Republic, merging necessity with leisure, as Petr Gibas and Blanka Nyklová's contribution reveals. Anupama Gowda looks at history from a different angle, that of using her fab lab to allow local children to explore the histories of their own urban neighbourhood of Halasuru in Bangalore, India. The experiences of educators are also at the heart of Jesse Adams Stein's vignette on the collective action of highly skilled engineering patternmakers teaching at a trade school in Melbourne during a stern period of de-industrialisation. The ultimate example, written by Kat Jungnickel, explores how historical clothing patents, in particular from the Victorian era, help uncover the unlauded inventiveness of women and marginalised people, created in a manner and with the motivation similar to other DIY cultures, but also how the actual DIY act of re-making these textile "technologies" creates seminal knowledge about the individuals and societal norms missing in the paper records.

Conclusions

The examination of DIY cultures and maker utopias confirms their importance paradoxically through their very marginality. By framing and reframing, appropriating and reappropriating, DIY making and hacking – understood through a wider set of people and practices – allows individuals and social groupings to

reassert control, choose how to spend their time in leisure or productivity, learn and bond, and have multiple orientations to "innovation". While the terminology of DIY is pegged to industrialisation and rendered irrelevant or colonising in less industrialised contexts, there is room for epistemological consideration as to how "maker culture" can be re-expanded to allow low-tech, handicraft and bricolage to inform. Historical examinations also serve to complicate problematic technology determinist views of innovation.

By remaining stalwart at the grassroots and the peripheries, alternative DIY maker cultures have created technocultural conditions by which technologies could be prototyped and eventually adopted more widely. The Alternative Technology movement, for instance, played a role in the mainstreaming of wind turbines in Denmark (Boyle/Harper 1976; Smith 2005). The antecedents to current maker culture are important with regard to how they contribute to making "enduring technologies" (such as bicycles or windmills), maintaining and resurrecting interest in repair and small-scale environmental technologies (Oldenziel/Trischler 2015: 5; see Latoufis/Tympas 2020, in this issue; Harper/Sadler 2020, in this issue). As such technologies become embedded in people's everyday lives, even at the fringes, they act as "pockets of persistence" which are rooted in routines, materiality and cultural reframings (Shove 2012: 372, cited in Oldenziel/Trischler 2015: 6). From the perspective of the history of technologies, then, it is less helpful to see innovations as having linear histories, moving in a trajectory towards stabilisation, than it is to observe how technologies and movements wane and revive in cycles and their relations to other technologies and practices (Shove 2012; Oldenziel/Trischler 2015). This appears particularly important with regard to how the contemporary maker culture takes up or disregards low-carbon technologies and to which technology narratives groups align.

Today's DIY maker communities and their spaces may take inspiration and even strategic guidance from the global commodified "maker movement", but they are geographically situated and actual practices and tactics are informed, explicitly or implicitly, by groups and norms that precede the makerspace and its community (Dunbar-Hester 2014; Costanza-Chock 2020). If articulated, currently invisible histories can tell us much about how such practices could be made more relevant, better answer local needs and gain staying power in their own localities (Soppelsa 2011). Historical knowledge can feed back into actual practice, strengthen the potential for positive socio-environmental impact, inform policy and more generally foster plurality of voice and agency.

Acknowledgements

We are grateful to the reviewers for their valuable contributions to this Special Issue. The work has been supported in part by the Nessling Foundation (Grant 201900394).

References

Abbate, J. (2012): Recoding Gender: Women's Changing Participation in Computing. Cambridge, MA: The MIT Press.

Ahmed, S. I./Mim, N. J./Jackson, S. J. (2015): "Residual Mobilities: Infrastructural Displacement and Post-colonial Computing in Bangladesh." Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems. New York, NY: ACM, pp. 437–446.

Altman, M. (2012): "Do Funding Sources Matter? Why I Chose to Stop Helping at Maker Faire After They Received Military Funding (For a Good Cause)." In: G. Hertz (ed.), Critical Making: Make. Hollywood, CA: Telharmonium Press. Retrieved from http://conceptlab.com/criticalmaking/PDFs/CriticalMaking2012Hertz-Make-pp01to10-Altman-DoFundingSourcesMatter.pdf.

Ames, M. G. (2019): The Charisma Machine: The Life, Death, and Legacy of One Laptop Per Child. Cambridge, MA: The MIT Press.

Anderson, C. (2012): Makers: The New Industrial Revolution. New York, NY: Random House Business Books.

Atkinson, P. (2006): "Do It Yourself: Democracy and Design." Journal of Design History 19(1), pp. 1–10.

Autistici/Inventati. (2017): +Kaos: Ten Years of Hacking and Media Activism (English edition). Amsterdam: Institute of Network Cultures.

Balkin, A./Harbison, J. (1990): Lackluster Bad-Ass Homes. Lackluster No. 2 [zine].

Barbrook, R./Cameron, A. (1996): "The Californian Ideology." Science as Culture 6(1), 44–72.

Berglund, E./Kohtala, C. (2020): "Collaborative Confusion among DIY Makers: Ethnography and Expertise in Creating Knowledge for Environmental Sustainability." Science & Technology Studies 33(2), pp. 102–119.

Björk, T. (n. d.): Challenging Western Environmentalism at the United Nations Conference on Human Environment in Stockholm 1972. Association Aktivism. Retrieved from http://www.aktivism.info/rapporter/ChallengingUN72.pdf.

Boeva, Y./Elliott, D./Jones-Imhotep, E./Muhammedi, S./Turkel, W. J. (2017): "Doing History by Reverse Engineering Electronic Devices." In: J. Sayers (ed.), Making Things and Drawing Boundaries: Experiments in the Digital Humanities. Minneapolis, MN: University of Minnesota Press, pp. 163–176.

Borgonuovo, V./Franceschini, S. (eds.). (2018): Global Tools 1973–1975: When Education Coincides with Life. Rome: Nero.

Boyle, G./Harper, P. (eds.). (1976): Radical Technology. London: Wildwood House.

Braybrooke, K./Jordan, T. (2017): "Genealogy, Culture and Technomyth: Decolonizing Western Information Technologies, from Open Source to the Maker Movement." Digital Culture & Society 3(1), pp. 25–45.

Cardullo, P./Kitchin, R./Di Feliciantonio, C. (2018): "Living Labs and Vacancy in the Neoliberal City." Cities 73, pp. 44–50.

Carson, K.A. (2010): The Homebrew Industrial Revolution: A Low-Overhead Manifesto. Charleston, SC: Booksurge.

Chan, A.S. (2014): "Beyond Technological Fundamentalism: Peruvian Hack Labs & 'Inter-technological' Education". Journal of Peer Production 5. Retrieved from http://peerproduction.net/issues/issue-5-shared-machine-shops/peer-reviewed-articles/beyond-technological-fundamentalism-peruvian-hack-labs-and-inter-technological-education/.

Chirikure, S. (2017): "The Metalworker, the Potter, and the Pre-European African 'Laboratory'." In: C.C. Mavhunga (ed.), What Do Science, Technology, and Innovation Mean from Africa? Cambridge, MA: The MIT Press, pp. 63–77.

Cole, D./Perner-Wilson, H. (2019): "Getting Lost and Unlearning Certainty: Material Encounters in an Electronic Craft Practice." In: L. Bogers/L. Chiapiani (eds.), The Critical Makers Reader: (Un)learning Technology. Amsterdam: Institute of Network Cultures, pp. 107–126.

Conrad, A. (ed.) (2016): We are All Crew: The POC21 Innovation Camp Report. Open State and OuiShare. Retrieved from http://www.poc21.cc/THE_POC21_REPORT.pdf.

Costanza-Chock, S. (2020): Design Justice: Community-Led Practices to Build the Worlds We Need. Cambridge, MA: The MIT Press.

Cowan, R.S. (1987): "The Consumption Junction: A Proposal for Research Strategies in the Sociology of Technology." In: W.E. Bijker/T.P. Hughes/T. Pinch (eds.), The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology. Cambridge, MA: The MIT Press.

Cramer, F. (2019): "Does DIY Mean Anything? – A DIY Attempt (= Essay)." Anrikningsverket Journal 1, pp. 54–72.

Daily, L. (2017): "'Change Your Underwear, Change the World': Entrepreneurial Activism and the Fate of Utopias in an Era of Ethical Capital." In: A. Day (ed.), DIY Utopia: Cultural Imagination and the Remaking of the Possible. Lanham, MD: Lexington Books, pp. 227–252.

Delgado, A./Callén, B. (2016): "Do-it-Yourself Biology and Electronic Waste Hacking: A Politics of Demonstration in Precarious Times." Public Understanding of Science 26(2), pp. 179–194.

Dunbar-Hester, C. (2014): "Radical Inclusion? Locating Accountability in Technical DIY." In: M. Ratto/M. Boler (eds.), DIY Citizenship: Critical Making and Social Media. Cambridge, MA: The MIT Press, pp. 75–88.

Edwards, C. (2006): "'Home is Where the Art is': Women, Handicrafts and Home Improvements 1750–1900." Journal of Design History 19(1), pp. 11–21.

Eglash, R./Foster, E.K. (2017): "On the Politics of Generative Justice: African Traditions and Maker Communities." In: C.C. Mavhunga (ed.), What Do Science, Technology, and Innovation Mean from Africa? Cambridge, MA: The MIT Press, pp. 117–135.

Ensmenger, N.L. (2010): The Computer Boys Take Over: Computers, Programmers, and the Politics of Technical Expertise. Cambridge, MA: The MIT Press.

Escobar, A. (2018): Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds. Durham, NC: Duke University Press.

Fernaeus, Y./Jonsson, M./Tholander, J. (2012): "Revisiting the Jacquard Loom: Threads of History and Current Patterns in HCI." CHI '12: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. San Diego, CA; New York, NY: ACM, pp. 1593–1602.

Fonseca, F. (2015): Repair Culture. Retrieved from http://efeefe.no-ip.org/livro/repair-culture.

Formia, E. (2017): "Mediating an Ecological Awareness in Italy: Shared Visions of Sustainability Between the Environmental Movement and Radical Design Cultures (1970–1976)." Journal of Design History 30(2), pp. 192–211.

Foster, E. K./Boeva, Y. (2019): "Making Sense of Place: Research Reflections from Two Multi-sited Ethnographies." Making Futures: Crafting a Sustainable Modernity – Towards a Maker Aesthetics of Production and Consumption Vol. 5. Retrieved from https://drive.google.com/open?id=1hb-vXJTJRd3lVKklxLYYT4IgYGj2r3me.

Franz, K. (2005): Tinkering: Consumers Reinvent the Early Automobile. Philadelphia, PA: University of Pennsylvania Press.

Garrett, M. (2006): "D.I.W.O." [blog entry]. Furtherfield. Retrieved from http://www.furtherfield.org/lexicon/diwo.

Gelber, S. M. (1997): "Do-It-Yourself: Constructing, Repairing and Maintaining Domestic Masculinity." American Quarterly 49(1), pp. 66–112.

Gerasimova, E./Chuikina, S. (2009): "The Repair Society." Russian Studies in History 48(1), pp. 58–74.

Greer, B. (2008): Knitting for Good!: A Guide to Creating Personal, Social, and Political Change Stitch by Stitch. Boston, MA: Trumpeter.

Guzmán, S. B./Reynolds-Cuellar, P. (2018): "Achieving Grassroots Innovation Through Multi-lateral Collaborations: Evidence from the Field." Journal of Peer Production 12. Retrieved from http://peerproduction.net/issues/issue-12-makerspaces-and-institutions/peer-reviewed-papers/achieving-grassroots-innovation-through-multi-lateral-collaborations/.

Hackney, F. (2013): "Quiet Activism and the New Amateur: The Power of Home and Hobby Crafts." Design and Culture 5(2), pp. 169–194.

Haring, K. (2007): Ham Radio's Technical Culture. Cambridge, MA: The MIT Press.

Hebdige, D. (1979): Subculture: The Meaning of Style. London: Routledge.

Hertz, G. (2012): Critical Making: Projects. Hollywood, CA: Telharmonium Press.

Hess, K. (1979): Community Technology. New York, NY: Harper & Row.

Hicks, M. (2017): Programmed Inequality: How Britain Discarded Women Technologists and Lost Its Edge in Computing. Cambridge, MA: The MIT Press.

Hyysalo, S./Jensen, T. E./Oudshoorn, N. (eds.). (2016): The New Production of Users: Changing Innovation Collectives and Involvement Strategies. New York, NY: Routledge.

Irani, L. (2015): "Hackathons and the Making of Entrepreneurial Citizenship". Science, Technology, & Human Values 40(5), pp. 799–824.

Irani, L. (2019): Chasing Innovation: Making Entrepreneurial Citizens in Modern India. Princeton, NJ: Princeton University Press.

Jasanoff, S./Kim, S.-H. (eds.) (2015): Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power. Chicago: The University of Chicago Press.

Jencks, C./Silver, N. (2013): Adhocism: The Case for Improvisation (Expanded and updated edition). Cambridge, MA: The MIT Press.

Jenkins, H. (2006). Convergence Culture: Where Old and New Media Collide. New York, NY: New York University Press.

Jordan, T. (2016): "A Genealogy of Hacking". Convergence 23(5), pp. 528–544.

Jungnickel, K. (2018): Bikes & Bloomers: Victorian Women Inventors & their Extraordinary Cycle Wear. London: Goldsmiths Press.

Kalmi, P. (2007): "The Disappearance of Cooperatives from Economics Textbooks." Cambridge Journal of Economics 31(4), pp. 625–647.

Kaiying, C. L./Lindtner, S./Wuschitz, S. (2019): "Hacking Difference in Indonesia: The Ambivalences of Designing for Alternative Futures." Proceedings of DIS'19 the Designing Interactive Systems Conference. New York, NY: ACM, pp. 1571–1582.

Kelty, C. M. (2017): "Too Much Democracy in All the Wrong Places: Toward a Grammar of Participation." Current Anthropology 58(S15), pp. S77–S90.

Kera, D. (2012): "Hackerspaces and DIYbio in Asia: Connecting Science and Community with Open Data, Kits and Protocols." Journal of Peer Production 2. Retrieved from http://peerproduction.net/issues/issue-2/peer-reviewed-papers/diybio-in-asia/.

Kinder, K. (2016): DIY Detroit: Making Do in a City without Services. Minneapolis, MN: University of Minnesota Press.

Kline, R./Pinch, T. (1996): "Users as Agents of Technological Change: The Social Construction of the Automobile in the Rural United States." Technology and Culture 37(4), pp. 763–795.

Knott, S. (2013): "Design in the Age of Prosumption: The Craft of Design after the Object." Design and Culture 5(1), pp. 45–67.

Kohtala, C./Hyysalo, S./Whalen, J. (2020): "A Taxonomy of Users' Active Design Engagement in the 21st Century." Design Studies 67, pp. 27–54.

Krewani, A. (2017): "Urban Hacking and Its 'Media Origins'." Digital Culture & Society 3(1), pp. 139–146.

Kulkarni, Y. (2016): "Fab Lab 0 to Fab Lab 0.4: Learnings from Running a Lab in an Indian Village." Proceedings of the Fab 12 Research Stream, FAB12: Fabricating the Future, 8–14 August, Shenzhen, China. Retrieved from https://archive.org/details/Fab12Kulkarni.

Lees-Maffei, G. (2009): "The Production-Consumption-Mediation Paradigm." Journal of Design History 22(4), pp. 351–376.

Light, J. (1999): "When Computers were Women." Technology & Culture 40(30), pp. 455–483.

Lindtner, S. (2015): "Hacking with Chinese Characteristics: The Promises of the Maker Movement against China's Manufacturing Culture." Science, Technology, & Human Values 40(5), pp. 854–879.

Lindtner, S. (2020): Prototype Nation: China and the Contested Promise of Innovation. Princeton, NJ: Princeton University Press.

Lindtner, S./Lin, C. (2017): "Making and its Promises". CoDesign 13(2), pp. 70–82.

Maines, R. (2009): Hedonizing Technologies: Paths to Pleasure in Hobbies and Leisure. Baltimore, MD: John Hopkins University Press.

Mavhunga, C.C. (2017): "Introduction: What Do Science, Technology, and Innovation Mean from Africa?" In: C.C. Mavhunga (ed.), What Do Science, Technology, and Innovation Mean from Africa? Cambridge, MA: The MIT Press, pp. 1–44.

Maxigas. (2012): "Hacklabs and Hackerspaces: Tracing Two Genealogies." Journal of Peer Production 2. Retrieved from http://peerproduction.net/issues/issue-2/peer-reviewed-papers/hacklabs-and-hackerspaces/.

McGetrick, B. (2017): "More is Better: Making Makers in California." In: J. McGuirk/B. McGetrick (eds.), California: Designing Freedom. London: Phaidon Press, the Design Museum, pp. 116–153.

McIlwain, C.D. (2020): Black Software: The Internet and Racial Justice, from the AfroNet to Black Lives Matter. New York, NY: Oxford University Press.

McKay, G. (ed.) (1991): DIY Culture: Party & Protest in Nineties Britain. London: Verso Books.

Medina, E./Marques, I.C./Holmes, C. (eds.). (2014): Beyond Imported Magic: Essays on Science, Technology, and Society in Latin America. Cambridge, MA: The MIT Press.

Minahan, S./Cox, J.W. (2007): "Stitch'nBitch: Cyberfeminism, a Third Place and the New Materiality." Journal of Material Culture 12(1), pp. 5–21.

Nakamura, L. (2014): "Indigenous Circuits: Navajo Women and the Racialization of Early Electronic Manufacture." American Quarterly 66(4), pp. 919–941.

Oldenziel, R./Hård, M. (2013): Consumers, Tinkerers, Rebels: The People Who Shaped Europe. London: Palgrave Macmillan.

Oldenziel, R./Trischler, H. (2015): "How Old Technologies Became Sustainable: An Introduction." In: R. Oldenziel/H. Trischler (eds.), Cycling and Recycling: Histories of Sustainable Practices. New York, NY: Berghahn, pp. 1–12.

Online Etymology Dictionary (n.d.): "punk" [entry]. Retrieved from https://www.etymonline.com/word/punk.

Orr, J. (1996): Talking about Machines. Ithaca, NY: Cornell University Press.

Oudshoorn, N./Pinch, T. (2003): How Users Matter: The Co-construction of Users and Technologies. Cambridge, M: The MIT Press.

Parr, J. (1999): Domestic Goods: The Material, the Moral, and the Economics in the Postwar Years. Toronto: University of Toronto Press.

Pearce, J. M. (2012): "The case for Open Source Appropriate Technology." Environment, Development and Sustainability 14(3), pp. 425–431.

Pfaffenberger, B. (1992): "Technological Dramas." Science, Technology, & Human Values 17(3), pp. 282–312.

Pomerantz, J./Peek, R. (2016): "Fifty Shades of Open". First Monday 21(5). Retrieved from https://journals.uic.edu/ojs/index.php/fm/article/view/6360/5460.

Posch, I./Kurbak, E. (2016): "Crafted Logic Towards Hand-Crafting a Computer." Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA '16). New York, NY: ACM, pp. 3881–3884.

Powell, A. B. (2012): "Democratizing Production Through Open Source Knowledge: From Open Software to Open Hardware." Media, Culture & Society 34(6), pp. 691–708.

Quet, M. (2013): "Science to the People! (and Experimental Politics): Searching for the Roots of Participatory Discourse in Science and Technology in the 1970s in France." Public Understanding of Science 23(6), pp. 628–645.

Ratto, M. (2011): "Critical Making: Conceptual and Material Studies in Technology and Social Life." The Information Society 27(4), pp. 252–260.

Rheingold, H. (1993): The Virtual Community: Homesteading on the Electronic Frontier. Cambridge, MA: The MIT Press.

Richterich, A./Wenz, K. (eds.) (2017a): Making and Hacking [Special Issue]. Digital Culture & Society 3(1).

Richterich, A./Wenz, K. (2017b): "Introduction: Making and Hacking." Digital Culture & Society 3(1), pp. 5–21.

Rosner, D. K. (2018): Critical Fabulations: Reworking the Methods and Margins of Design. Cambridge, MA: The MIT Press.

Rosner, D. K./Bjørn, P. (2019): "Fabulating Historical Data by Hand: AtariWomen and Historical Re-Telling." Conference paper presented at the Annual Meeting of the Society for the History of Technology (24–27 October 2019). Milan, Italy.

Rosner, D. K./Shorey, S./Craft, B. R./Remick, H. (2018): "Making Core Memory: Design Inquiry into Gendered Legacies of Engineering and Craftwork" (Paper 531). Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems. New York, NY: ACM.

Roth, L./Russell, B. (2018): "Translocal Solidarity and the New Municipalism." ROAR 8, 26 September, p. 7.

Sabel, C./Zeitlin, J. (1985): "Historical Alternatives to Mass Production: Politics, Markets and Technology in Nineteenth-Century Industrialization." Past & Present 108, pp. 133–176.

Sadler, S. (2012): "The Dome and the Shack: The Dialectics of Hippie Enlightenment." In: I. Boal/J. Stone/M. Watts/C. Winslow (eds.), West of Eden: Communes and Utopia in Northern California. Oakland, CA: PM Press, pp. 72–80.

Schumacher, E. F. (1973): Small is Beautiful: A Study of Economics as if People Mattered. London: Blond & Briggs.

Scott, F. D. (2016): Outlaw Territories: Environments of Insecurity/Architectures of Counterinsurgency. Cambridge, MA: The MIT Press.

Shove, E. (2012): "The Shadowy Side of Innovation: Unmaking and Sustainability." Technology Analysis & Strategic Management 24(4), pp. 363–375.

Silvast, A./Reunanen, M. (2014): "Multiple Users, Diverse Users: Appropriation of Personal Computers by Demoscene Hackers." In: G. Alberts/R. Oldenziel (eds.), Hacking Europe: From Computer Cultures to Demoscenes. London: Springer, pp. 151–163.

Sivek, S. C. (2011): "'We Need a Showing of All Hands': Technological Utopianism in MAKE Magazine." Journal of Communication Inquiry 35(3), pp. 187–209.

Smith, A. (2005): "Environmental Movements and Innovation: From Alternative Technology to Hollow Technology." Human Ecology Review 12(2), pp. 106–119.

Smith, A./Fressoli, M./Abrol, D./Arond, E./Ely, A. (2017): Grassroots Innovation Movements. Abingdon, UK: Routledge.

Soppelsa, P. (2011): "Intersections: Technology, Mobility, and Geography". Technology and Culture 52(4), pp. 673–677.

Stein, J. A. (2017): "The Political Imaginaries of 3D Printing: Prompting Mainstream Awareness of Design and Making". Design and Culture 9(1), pp. 3–27.

Takahashi, Y. (2000): "A Network of Tinkerers: The Advent of the Radio and Television Receiver Industry in Japan." Technology and Culture 41(3), pp. 460–484.

Tanenbaum, J. G./Williams, A. M./Desjardins, A./Tanenbaum, K. (2013): "Democratizing Technology: Pleasure, Utility and Expressiveness in DIY and Maker Practice." Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. New York, NY: ACM, pp. 2603–2612.

Thompson, M. (2020) "What's so new about New Municipalism?" Progress in Human Geography, in press, 1–26.

Toffler, A. (1980): The Third Wave. New York, NY: Morrow.

Toupin, S. (2014): "Feminist Hackerspaces: The Synthesis of Feminist and Hacker Cultures." Journal of Peer Production 5. Retrieved from http://peerproduction.net/issues/issue-5-shared-machine-shops/peer-reviewed-articles/feminist-hackerspaces-the-synthesis-of-feminist-and-hacker-cultures/.

Triggs, T. (2006): "Scissors and Glue: Punk Fanzines and the Creation of a DIY Aesthetic." Journal of Design History 19(1), pp. 69–83.

Troxler, P. (2014): "Fab Labs Forked: A Grassroots Insurgency Inside the Next Industrial Revolution." Journal of Peer Production 5. Retrieved from http://peerproduction.net/issues/issue-5-shared-machine-shops/editorial-section/fab-labs-forked-a-grassroots-insurgency-inside-the-next-industrial-revolution/.

Turner, F. (2006): From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism. Chicago, IL: University of Chicago Press.

Turner, F. (2018): "Millenarian Tinkering: The Puritan Roots of the Maker Movement." Technology and Culture 59, pp. S160–S182.

Usenyuk, S./Hyysalo, S./Whalen, J. (2016): "Proximal Design: Users as Designers of Mobility in the Russian North." Technology and Culture 57(4), pp. 866–908.

Winner, L. (1979): "The Political Philosophy of Alternative Technology: Historical Roots and Present Prospects." Technology in Society 1(1), 75–86.

Wozniak, S. (1984): "Homebrew and How the Apple Came to be." In: S. Ditlea (ed.), Digital Deli: The Comprehensive, User-Lovable Menu of Computer Lore, Culture, Lifestyles, and Fancy. New York, NY: Workman Pub.

Zelov, C./Cousineau, P. (eds.). (1997): Design Outlaws on the Ecological Frontier. Easton, PA: Knossus.