

Making Sense of Place: Research Reflections from Two Multi-sited Ethnographies

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Abstract

Proponents of making, particularly those in the West (Anderson 2012; Gershenfeld 2005), have been promoting a generalized idea of maker practice and education across the globe. Examples include international standards in the form of the Fab Charter and the exclusion of local maker presenters during the first editions of the Maker Faire Shenzhen in China. Such strategies work to highlight the dominant narrative of making within the cultural localities of the Silicon Valley and the East Coast of North America. But what happens, when the social, economic, and cultural conditions of the West do not apply to the making practices of other places, even in what is widely understood as the West? How are locally-based practices, traditions, and pedagogies shaping the adoption of this maker model? In this paper, we draw on observations and analyses from our distinct ethnographic research on maker practices, makerspaces, and their communities across North America and Europe. Spanning five years and conducted in nine countries, our methods were primarily qualitative including data gathered through observation, interviews, and attendance of maker-related events. One of us has been examining the presumably disruptive qualities of “alternative” maker practices. This has resulted in explorations of makerspaces in US public libraries, feminist hacker groups, and repair collectives and their potentially emancipatory impact on marginalized communities. The other author has been charting the influence of maker practices and technologies on professional design work. This research has led to questioning the ideas of de-professionalization and deconstruction of boundaries between lay and professional practice. Our mutual point of entry into our distinct but intersecting studies, which we share with other research on maker practices and cultures (Lindtner et al. 2016; Lindtner & Li 2017), is a disapproval of the Western technosolutionism programmed into maker narratives. While some of the observed making manifests Western ideas on the surface, we have also encountered how different—even Western—makerspaces and fab labs have reintroduced culturally contingent local features to discern themselves from innovation-driven technological objectives. Examples include, for instance, slöjd traditions in the work approaches of Danish designer-makers and pedagogical techniques such as the Montessori approach in DIY care projects in Italy. This position paper shares several instances of making and makerspaces framed by local attributes and histories—and while it does not cover postcolonial sites, it still reveals that a general trope of the West is also imprecise. Thereby we hope to contribute to an ongoing rearticulation and intervention into the dominant presence of the Silicon Valley-model of maker practice (Lindtner & Lin 2017). References: - Anderson, Chris. 2013. *Makers: the New Industrial Revolution*. New York: Crown Business. - Gershenfeld, Neil. 2005. *Fab: The Coming Revolution on Your Desktop—From Personal Computers to Personal Fabrication*. New York: Basic Books. - Lindtner, Silvia, Shaowen Bardzell, and Jeffrey Bardzell. 2016. “Reconstituting the Utopian Vision of Making: HCI After Technosolutionism.” In: *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI ‘16)*, 1390-1402. - Lindtner, Silvia, and Cindy Lin. 2017. “Making and Its Promises.” *CoDesign*, 13(2), 70-82.

Introduction

The claim that ‘one size fits all’ could be considered a possible catalyst for the rise of making and maker culture. While rebutting this idea is what making and digital fabrication claim to achieve, the ongoing development seems to enable exactly the opposite. Western-born maker culture and the associated makerspaces, fab labs, shared machine shops proliferate the idea of a global, decentralised industrial revolution that will reconstruct practices and identities (Anderson, 2012; Gershenfeld, 2005). However, both the decentralised model and ‘maker’ identity pertain to the values of specific cultural localities—the Silicon Valley and the East Coast of North America. This ‘one size fits all’ mentality is haunted by the homogenisation inscribed into standardised norms such as the Maker Media franchise or the Fab Charter with the growing Fab Cities network.¹ Besides that, such a mindset could also be interpreted as modern-day censorship.

Such strategies work to highlight the dominant narrative of making as housed within the cultural localities of the Silicon Valley and the East Coast of North America. But what happens, when the social, economic, and cultural conditions of the West do not apply to the making practices of other places, even in what is widely understood as the West? How are locally-based practices, traditions, and pedagogies shaping and confronting the adoption of this decentralised, yet somewhat central, maker model? While our own main research questions have focused on other features at play within maker cultures, these overarching inquiries are key for understanding how our field sites fit into a greater narrative and speak to our own findings that trouble a totalising, ‘Western-centric’ influence or viewpoint.

In order to address these concerns, we draw on observations and analyses from our distinct ethnographic research on maker practices, makerspaces, and their communities across North America, Europe, and Africa. Spanning five years and conducted in nine countries, our methods were primarily qualitative. This includes data gathered through observation, interviews, and attendance of maker-related events. One of us has been examining the presumably disruptive qualities of ‘alternative’ maker practices. This has resulted in explorations of makerspaces in US public libraries, feminist hacker groups, and repair collectives with an analytical eye toward how they establish diverse maker practices, and how to further cultivate and recognise such heterogeneity in relation to Science, Technology, Engineering and Mathematics (STEM) education (Foster 2017). The other author has been charting the influence of maker practices and technologies on professional design work. This research has led to questioning the ideas of de-professionalisation and deconstruction of boundaries between lay and professional practice. Our mutual standpoint, which we share with other research on maker practices and cultures (Lindtner and Lin, 2017), is a disapproval of the Western technosolutionism programmed into maker narratives.

While some of the making we observed manifests common Western ideas on the surface, we have also encountered how distinct makerspaces and fab labs have reintroduced culturally contingent local features to discern themselves from innovation-driven technological objectives. Although the paper does not cover postcolonial sites, it still reveals that a general trope of the West is also imprecise. In our analysis, we seek to highlight scenarios where this is not the case. The four examples included here describe variations of making and maker cultures that expand and counter the common tropes of novelty, scaling-up, and innovation. They include the encounter of care facets through repair collectives in the United States (US) and Austria, of attending to diverse forms of knowledge in feminist hackerspaces, of embodied sloyd traditions in the work of Danish designer-makers, and of remixes of old and new techniques in the art and conservation in boat building and pottery in the United Kingdom (UK).

For the remainder of this article, we will give a background of literatures and theory that pertain to our research, leading into a description of our four case studies. We will then discuss themes, findings, and

connections across these four examples, ending with concluding remarks that summarise major findings and provocations for further examination.

Background

Making has been researched widely around communities, practices, and identities in the fields of human-computer interaction and science and technology studies. Definitions of maker cultures, shared spaces of fabrication, and the communities of practice are ever evolving. As a common working definition, the makerspace is touted as an exciting and often liberatory venue in which interested individuals can tinker, explore, appropriate, manipulate, and innovate technology (Davies, 2017). Makerspaces and maker culture are often geared toward social entrepreneurship, prototyping, and material production. Yet the delineation of such spaces is complex and messy, with many maker groups focusing on community-building activities and social justice practices alongside more tech innovation endeavours. While makerspaces and cultures have further entrenched technological manipulation into the material world via digital fabrication and electronic prototyping, there are other diverse maker cultures. This includes communities that practice repair, craft, and civic science actions simultaneously supplementing and combining them with technical practices. Such groups often focus on local needs, traditions, and resources rather than having the greatest and best 'maker' technologies at their disposal. In general, the maker cultures we have been studying also establish a 'community of practice' (Lave and Wenger, 1991) that is specific to each locale and space. For our research, agendas in particular, we are invested in highlighting the diversity, as opposed to a homogenised monoculture, among such groups.

The idea of a systematic homogenisation and co-optation of countercultures and do-it-yourself (DIY) and creative practices by larger technological movements has been studied closely in the fields of communication studies (Turner, 2006). A similar trend surrounding maker cultures and digital fabrication, considered a 'clash between ... cultures' (maxigas, 2014), has been observed and explored by other social scientists (Nascimento, 2014). In addition, a growing body of research has turned its focus to issues of diversity and plurality within maker identities, traditions, and practices (Lindtner and Li, 2012; Eglash and Foster, 2017). This move responds to growing debates on postcolonial issues, the need to give prominence to developments in the Global South, and, more specifically, it works to counterbalance the strong presence of Western, Silicon Valley-framed innovation perspectives. For instance, in their longitudinal ethnographic work on Shenzhen's hackers and makers, Silvia Lindtner and David Li exemplify how the Western model of making distributes an authoritative notion of expertise, innovation, and design, which local Chinese collectives' aim to challenge (Lindtner and Li, 2012). They emphasise that the idea of making as returning manufacturing, back to (its Western), centres is less the appeal of Chinese cultures. Rather, it works to reveal that they are the enablers of Western technology design and production (Lindtner and Lin, 2017). Contrasting the proclamations of the Maker Movement as 'technomyths,' Kat Braybrooke and Tim Jordan argue that oftentimes powerful narratives about specific local origins, practices, and socio-technical interactions work to mute and neglect other ones (2017). As they note, 'the "West" [is] being formed not by a concrete conception of others but by a relation to absence. The non-Western is simply erased and ignored' (ibid.: 41).

The systematic co-optation into a uniform model of funding and governing makerspaces can be discerned even amongst those counters to the prevalent commercial ones. Drawing upon her empirical study of several European fab labs and specifically the Fab Lab Amersfoort in the Netherlands—a fab lab aiming to be entirely open-source and sustainable—Sabine Hielscher notes that despite the strong open-source objective of this space, 'practices in the lab and attached values have steadily become more formalised' (2017: 59). While this space's financial necessity to build their own open-source machines and to develop open-source software counters most MIT Fab model-based spaces with a high initial start-up capital, formalisation, in this case

through the implementation of fees, workflow rules, instruction guides, and similar, pushes them back in this direction. Hence, there exists not only a hybridity of practices, but also a multiplicity of spaces that insinuate this sense of co-optation.

As such, it is important to establish a narrative of spaces and practices that complicate a dominant frame. Exploration of diverse cultures within the Western narrative and their plurality has been established by work on feminist spaces (Toupin, 2014; Fox, Ulgado, and Rosner, 2015), repair collectives (Graziano and Trogal, 2017; Jackson 2014; Houston 2013; Rosner and Turner, 2015), and citizen science or community-responsive science initiatives (Dosemagen et al. 2012; Liboiron et al. 2016). In their study of feminist hacker and makerspaces, Sarah Fox, Rachel Rose Ulgado, and Daniela Rosner note that the work of these spaces lies as much in the realms of material production and manipulation, as in their push to transform, hack, and remake dominant cultures regarding technological practice (2015). Specifically, they found that

... by tracing the often-explicit interweaving of hacking things with hacking the self, ... feminist hackerspaces reorient our concern for women in technology from ideas of access to an ongoing working through of definitions, acknowledging the breadth of technical work that women already do. Hacking thus becomes a technological imaginary, a set of deeply held ideas and norms subject to failures and partial readings that shape the work of technology cultures. (Fox, Ulgado, Rosner, 2015: 56)

Calling for recognition of marginalised or erased readings of technology and technical practice contributes to the acknowledgment of diversity within making practices, and how they are rooted in histories of technology and local traditions that are often neglected. This is also the case in relation to repair traditions and their increasing popular interest.

Steven Jackson relates how repair cultures, which are often on the margins of maker cultures, are based on values that do not fit into the typically innovation-centric Maker Movement. In his work on epistemologies of repair, he illustrates how the basis of repair cultures in care and attention to relationships with the material world enable a different understanding of innovation (Jackson, 2014). Lara Houston (2013) corroborates his theory via her research on repair in Uganda and the effects of local practices on innovative techniques when repairing proprietary, or warranty-protected devices. Meanwhile, Daniela Rosner and Fred Turner have researched and written about repair cultures specifically on the West coast of the US, and how they are influenced by, yet different from Silicon Valley cultures and values (2015). Their work connects to that of Hielscher in that they see the dominant influence within non-dominant contexts. Yet, it is not all encompassing and gives room for hybrid approaches. Working with repair groups from Italy and the UK, Valeria Graziano and Kim Trogal argue that small-scale repair communities run the risk of co-optation by and capitulation to a neoliberalist agenda that 'promotes self-reliance and resilience as a form of self-sufficiency that embraces the ongoing impoverishment of society' (2017: 19). However, they describe mechanisms that counter such tendencies as repair groups use their social capital to advocate legislative policies for changing industry standards. Thus their work has the possibility to traverse beyond small repair gatherings toward changing the culture of how things are produced, putting the onus on industry instead.

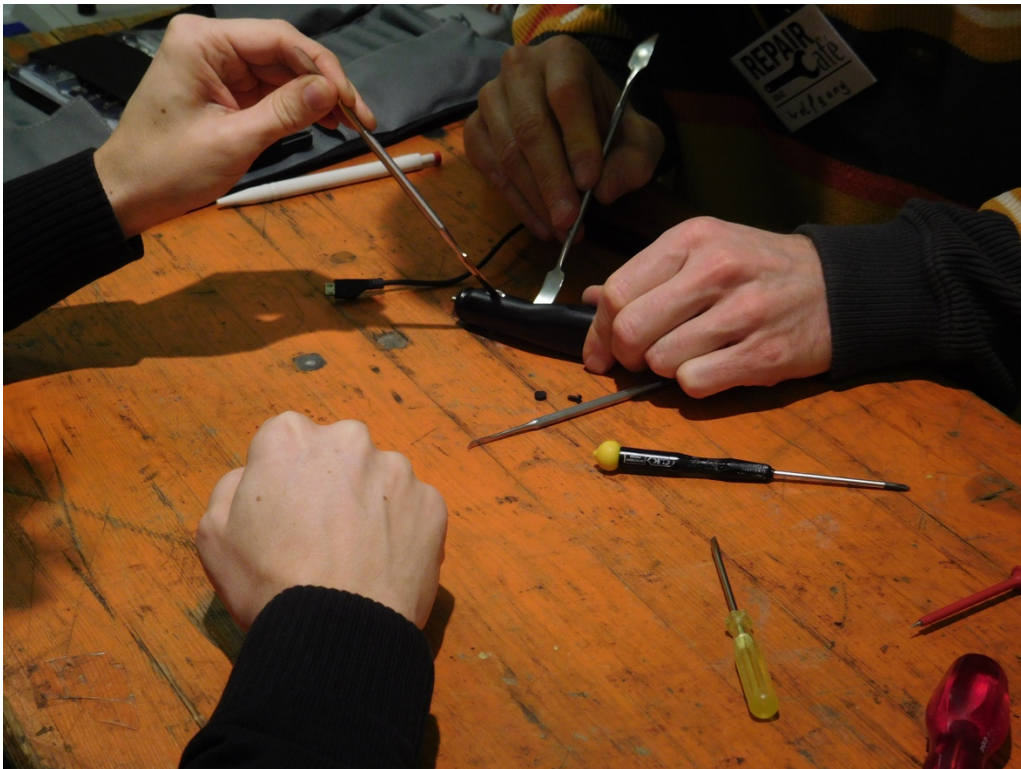
Drawing from this previous scholarship in regard to maker cultures, we further argue that acknowledging diverse and hybrid practices in a Western context is imperative for breaking down hegemonic characterisations of making. Even within the so-called 'West,' there exist obscured voices, communities, and practices that demonstrate a plurality. These are often based on local traditions that precede globalising and essentialising tendencies associated with Silicon Valley cultures, or on situated contexts in conversation with diverse skills and interests in a community. We would like to extend this work to demonstrate how attention to values like care, slow-ness, and non-productivity in a Western context are possible. At the same time, we do not want to contend that this is an 'either, or' situation. Often local traditions are in conversation with, or take on

characteristics of dominant trends, resulting in a hybrid approach. Yet, we argue against broad generalisations and demonstrate how each of our cases exemplify the possibility for scaling out instead of scaling up, showing how context changes the ways in which technology and making practice is shared, manipulated, used, and resourced. In what follows, we will explore how attention to localities in a Western context might complicate essentialising narratives and give further visibility to practices we see as often obscured by a focus on critiquing the dominant.

Accounts of Non-Fabrication Productivity

Fixing and Repair Collectives

For this case study, Dr Foster observed, interviewed, and worked with participants from the NYC Fixers Collective located in New York City, New York and a Repair Café in Graz, Austria. Instead of fabrication and a classic sense of 'making,' fixing and repair groups focus on resuscitating broken objects. They often fix them in evocative and surprising ways, such as replacing an automatic paper shredder with a hand-crank for operation. Hearing interlocutors speak about the sharing of best practices, and the observed indoctrination of new fixers or participants, these repair groups have built communities of practice, through which to connect and share with one another in socially dynamic forms. Expertise as well as tools are shared and not seen as housed in one individual – they also involve the attendee and their experience or knowledge of their object.



A Graz Repair Cafe attendee (on the left) acts as a third hand for the fixer (on the right) helping to carefully open a phone charger for further inspection. Photo credit: Ellen Foster.

Similarly aligned, in his theorisation of ‘broken world thinking’ through the lens of repair cultures, Steven Jackson describes the practice of Bangladeshi ship dismantling and recycling as ‘the site of a remarkable and distributed expertise’ (2014: 336). It may seem that broken ships are disconnected from fixing appliances, but when something is broken or inoperable, there is often a collective expertise associated with breaking it down, scrapping it, or making it into new things. As Jackson observed, the knowledges, and the tools used to do so, are aggregate – an observed and consistent aspect of both the NYC Fixers Collective and Repair Café in Graz. Shedding light on the intricacies, timescales, social worlds, and non-continuous functioning of technologies, fixer and repair groups demonstrate a new way of theorizing and engaging technology – as well as its wastes, by-products, and maintenance routines. They foreground a different position to technology and innovation – that of an ethics of care. The care which fixers exemplify is that of maintaining and caring for objects, which in turn functions as caring for self, community, and environment

As part of the Fixers Collective mission statement reads, which is similarly aligned to Repair Café endeavours: ‘The goal of the Fixers Collective is to increase material literacy in our community by fostering an ethic of creative caring toward the objects in our lives.’ⁱⁱ This sentiment is quite different from that of the totalising Silicon Valley, makery ideology, which typically focuses on shiny, new, and flashy technologies, on efficiency and how to make things smaller, ubiquitous, stream-lined and seamlessly incorporated into our daily routines. In contrast, fixer and repair collectives are invested in revealing the brokenness, inconsistencies, and clunkiness of technology – for us to take time, breath, observe, and acknowledge the intricacies and inner-workings of the stuff that fills our everyday routines. In the brokenness there is learning, community, care, mindfulness, and an unveiling of the politics embedded into our built environs.

The NYC Fixers Collective and the Repair Café’s are also committed to scaling out as opposed to scaling up. They acknowledge that there are different needs, types of expertise available, and social dynamics across different cultures and locations. Thus, they do not see their practices as homogenising, or something that should be replicated exactly across all locations and peoples. Instead, they have created flexible infrastructures and frameworks within which other groups can take up different standards and practices according to local needs and values. This is observed in the different objects repaired within NYC versus Graz, the differences in numbers and population, the diverse values at play within the spaces, and a variety of practices including mending clothes, cleaning electronics, cleaning and oiling analogue mechanisms, intricate electrical repairs, and gluing shoes back together.

Feminist Hacker Collectives

As already mentioned in the overview of literature, feminist hacker collectives were formed to galvanise feminist and female-identifying hackers, technologists, and makers who were feeling unheard or out of place in other hackerspaces. Many factors were involved including the way other spaces cultivated a narrow definition of technology, practices, and knowledges of import, as well as sexist comments or micro-aggressions.

Feminist hacker groups on the west coast of the United States formed to counter the Silicon Valley tech monoculture, which they experienced as toxically masculinist. However, alternative narratives in the European and South American context exist, some as precursors to the US west coast. These alternate trajectories trace back to the early 2000s and late 1990s in the organising and running of many day gatherings such as Eclectic Tech Carnival (ETC) and the TransHackFeminist! (THF!) Convergence. They also entail experimentations in what it might mean to create queer and/or feminist technologies, such as DIY gynaecological practices and feminist servers, for instance the Anarcha Server, that are maintained by primarily female-identifying system administrators, which is typically a male-dominated position. As autonomous infrastructures, these feminist servers are set apart from other server farms, thus creating a safe space for data storage and establishing an

intra-net of information for privacy purposes, often to support feminist activist organizations. This poses the possibility for them to be precarious in other ways including storage space, speed, or consistency.

These practices and their outcomes are not based on typical standards of efficiency, tech-innovation, or technophilia (Turner, 2006). Instead, they are situated in a partial reading and feminist standpoint that aims to explore the politics of care in technology practices, how technology is defined to preference some knowledge-sets over others, and hacking the very cultures of technological practice. This includes reflecting on the self, relationships, and one's own positionality in techno-social landscapes.

One mechanism through which feminist hacker collectives explore the politics of care in tech practices is in relation to exploring exclusion via 'safe space' that is intended to establish inclusion of marginalized communities. Many employ exclusionary tactics to set themselves apart from the implicit dominant discourse within making and hacking communities that claim an open and inclusive culture. In this sense they are more interested in cultivating, as well as revealing already well-established, alternatives to dominant tech cultures and conceptions of what technology development, expertise, craft, and making might mean. Through collective action such as through the feminist 'hacking with care' group, a different way of interfacing with our technologies is explored. This is done via careful interactions and a focus on slow-tech, embodied knowledge, the various senses, and mind-body connections. Safe space and hacking with care create a structural frame for dealing with previous exclusions or discomforts in relation to technology, so the focus is on building shared values and intentional culture before bringing in digital tools, coding, and fabrication.

As with the repair groups, feminist hacker collectives are not interested in every space being exactly the same, or having an overarching frame through which to work. The previous examples of technologies and organising frames are just some among many, and are not true for all such groups. The safe space mechanism is also flexible and looks different for diverse configurations, interests, and needs. Although various groups often share stories and advice with one another, due to their basis in being "feminist" such groups have strong convictions that there is not one 'right' way to do things, and that practices as well as values need to be iterated according to who takes part in the group. As my own research and that of Rosner, Fox, and Forlano demonstrates (Rosner and Fox, 2016; Forlano, 2016), different forms of 'feminisms' and their intersections with race, socioeconomic class, (dis)ability, local interests, or needs play a big part in how various practices and each collective manifests. Due to diverse and divergent interests among feminist hacker collectives themselves, they are against essentialising narratives, and interested in establishing heterogeneity outside of the dominant discourse.

Accounts of Local Context in Fabrication

Sloyd Legacy

The notion of craft and craftsmanship has circulated in various accounts of making. Make magazine's early partner publication Craft reckoned craft as a feminine pastime. For sociologist Richard Sennett, craft is expressed as the basic human desire to carry out a job for its own sake (2008). Beyond those, the maker culture, with its digital fabrication technologies, has been credited for invoking craft and craftsmanship through post-industrial means and mindset. Yet craft lacks the equivalent attention compared to the threads on innovation and reindustrialisation. This should not mean that craft is non-existent, but that it requires a reading through a subtle cultural embeddedness. For instance, for more than a century craft training has been part of school pedagogy for a variety of reasons and with local variations across several Western countries. This reformed craft-based pedagogy, also known as sloyd or slöjd, was developed in Finland in the mid-nineteenth century and distributed across Scandinavia, Germany, England, and the United States. It was conceived for a

general rather than a vocational education. Nowadays it remains part of compulsory education in the four Scandinavian countries.

Sloyd's cultural embeddedness with its much longer tradition than that of contemporary maker cultures or digital fabrication indicates that it might influence the practices of contemporary makers, at least within the above-specified geographical region. During practice observation at UNDERBROEN, one of Copenhagen's makerspaces, the second author identified a rather implicit influence of sloyd tradition upon the work and approach of the members and staff of the makerspace. The space describes itself as a laboratory for local and urban production. While most of the makerspaces and fab labs across some European countries and Canada included in her study have their idiosyncratic and culturally local differences, oftentimes their membership consists of a larger number of tech- and design-educated members with a homogenous skillset looking to build a prototype for the consumer market. Often their pedagogical influence comes from the theoretical methods of higher education combined with a professional practice in the creative service industry. Less obvious in the identity of many makers is an ingrained school education of hands-on working and craftsmanship. Therefore, reckoning this delicate aspect at UNDERBROEN—that several of their members and staff are either traditionally trained craftspeople or have all taken sloyd in school—was not an aspect that the interlocutors found exceptional. After all, Denmark has a long-standing tradition in bespoke product design. Moreover, UNDERBROEN portrays itself on the website as 'tomorrow's manufacturing workshop where traditional craftsmanship is combined with modern digital production technologies.'ⁱⁱⁱ

In other words, their objective aligns not only with a Western, but what now has become a global idea of returning manufacturing and production back to urban centres often mandated by financial partners on communal and corporate level. However, by doing so UNDERBROEN manages to embrace its local tradition of craft-based education, regardless whether it is a general type of sloyd or a vocational one without questioning their actuality. Rather, the local tradition of sloyd and other craft training frame an inexplicable part of a collective tacit knowledge much like riding a bike. On the question of their entry point into maker culture and digital fabrication, one of UNDERBROEN's staff members noted that it was through woodworking. For them, the experience of traditional woodworking such as carpentry or carving and the use of the appropriate tools for that defines craftsmanship. In this sense, having learned and experienced that through sloyd makes the next step of learning computer-aided design (CAD) modelling for computer-aided manufacturing (CAM) and the use of the respective computer numerical control (CNC) machines such as CNC mills or laser cutters a fairly implicit undertaking. Besides, this comes without surprise considering that woodworking still makes up a larger portion of the sloyd curriculum.

Remixing the Past

The emergence of maker cultures and the growing accessibility to digital fabrication technologies and practices has stimulated a resurgence of past, even obsolete, objects and techniques in arts and crafts. At the same time, academic research in the field of digital humanities has expanded its major scope on the intersection between the textual and computing towards the material reconstruction of objects as data. Meanwhile, the recent maker practices and technologies have encouraged many artists and craftspeople to rethink anew the possibilities of analogue making through the incorporation of digitally enhanced manufacturing. The academic approaches involving maker technologies and practices perhaps appear as novel, regardless of their application in the humanities and social sciences, or in the STEM disciplines, but in their essence they follow a much longer tradition of experimentation in arts, crafts, and science. However, as experimentation in science and arts are rather forward-looking, the careful reconnection of the past with the present is less expected to be found amongst maker collectives. The following example of a boat reconstruction with digital fabrication technologies conveys how its making challenges not only the common orientation of experimentation as

aiming at the future, but also challenges the wider objectives of maker cultures for their co-optation into high-tech innovation.

Punts are small wooden boats traditionally associated with the River Thames in England. In 2016, the second author met Ross Andrews, a makers-in-residence at the East London-based makerspace Machines Room. His work on the punt had been included in Machines Room's exhibition 'Fix the City, curated for the 2016 London Design Festival. Being involved in the local boat community, he was interested in finding ways to connect the traditional craftsmanship and attitude of the local boat community with the perceived novelty of digital manufacturing technologies and practices. The punt project he worked on was a suitable fit, as it involved constructing the whole boat from scratch instead of using digital fabrication technologies for the conservation and repair of an old one. The starting point was a blueprint of a punt designed by a friend's grandfather in the 1940s. The plan required a translation into a digital format appropriate for a machine to execute it. Embracing the DIY/do-it-together (DIT)-ethos of the makerspace, he first learned by himself how to create a 3D-CAD model with SketchUp from the blueprint. This was then followed by learning the steps of the CAD/CAM-pipeline to produce the punt parts with the help of the maker community.



*The assembled punt manufactured with digital fabrication technologies at Machines Room, London.
Photo credit: Yana Boeva.*

Like the repair collectives, this semi-historical approach is perhaps unsuitable for the innovation-driven mainstream of making, which continually finds itself on the verge of scaling up and expansion. However, it captures the idea that the application of a computer-based technology might not immediately lead to a co-optation into a decentralised, data-driven future, but could be subverted into the preservation of the local. In the context of East London with its steady demise of craftsmanship and small-scale repair workshops, Andrews was using the punt project as a way of introducing the traditionally bound, somewhat technology-skeptical, boat community to what he recognises as a viable alternative for such purposes in the long-run. In full awareness of the time and financial effort involved in training and executing a project like this one for a novice,

an idea of scaling up production appears as cumbersome. Rather, the project shows that the post-industrial means and principles of digital fabrication should equally acknowledge the localities and traditions to prevent their complete demise in favour of a homogenisation by way of globalisation and digitalisation.

Discussion: Scaling Out, Not Up

Within the current dominant discourse on maker cultures, there is an increasing tendency to take new models of collaboration and peer production and convert them into the established model predicated on capitalism. This co-optation becomes more problematic as the subtleties of inclusion, democratisation, local practice and respect disappear in favour of a homogenised culture. In addition, the conversion of maker cultures, practices, and technologies into a Western innovation paradigm prompts the economic trope of scaling up as the admired objective. However, this does not need to be the case. Instead, the authors suggest that the concept of scaling out as opposed to scaling up is taken evenly into consideration. Across all four case studies, the authors identified how locally contingent knowledge and best practices shift according to culture, tradition, craft communities, morals, and values, resulting in a heterogeneous narrative even within a Western context, which is often overlooked in claims of monoculture within maker discourse.

Both repair communities and feminist hacker collectives demonstrate how engaging technology can be about changing mindsets and focusing on valuations of care, specifically paying attention to the politics in relation to care practices, the actors involved, and what it might mean to care across difference and for diverse actants, such as non-humans. They are also dedicated to cultivating heterogeneous cultures of making and building up their own organizing entities outside of more established maker and hackerspaces, meaning they do not want to take over and shift dominant discourses, per se, but they want to garner resources and create room for new technology cultures to co-exist. In shifting cultural ideals of technological practice, they are interested in slowing down with technology and creating practices for diverse technology experiences. This has meant not focusing on the 'next new thing,' but instead on how to repair what they saw as broken systems that had previously resulted in marginalised others, unevenly affected publics, and unsustainable futures. They also work to redefine technology practices of interest, focusing on neglected skills such as maintenance, cleaning, organizing, archiving, and mending. Like the other two case studies, both repair communities and feminist hacker collectives demonstrate the mixing of old and new traditions through a reflexive mindset that acknowledges predecessors including consciousness-raising groups and older tinkerer hobbyist traditions.

The other two cases disclose how fabrication can embody traditions of local craft education and manufacturing without contravening the novelty of maker cultures and digital fabrication technologies. Instead these two examples counter the deterministic belief that new approaches launch with the introduction of a new instrument, technology, or practice. As Carolyn Marvin argues, new media, in her case the late nineteenth century developments in communication technologies, is shaped by permanent negotiations 'with whatever resources are available' (1988: 5). For Marvin,

[old] habits of transacting between groups are projected onto new technologies that alter, or seem to alter, critical social distances. ... New practices do not so much flow directly from technologies that inspire them as they are improvised out of old practices that no longer work in new settings. (ibid.)

Indeed, traditional sloyd education based on woodworking barely works in the newer technological manufacturing ecologies regardless whether they are small or large scale. However, sloyd training reduces the distance between analogue woodwork with a chisel and lathe to the digital CNC mill and CAD application. It appoints to the primacy of embodied craft practice by informing or stimulating contemporary digital fabrication.

What resembles an appropriation or co-optation into the previously described homogeneity is within the reflective practice of the sloyd-trained makers or boat builders an act of responsible and local diversification.

Conclusion

This paper began with the articulation of how contemporary developments in making and digital fabrication are recreating a homogenous, Western, and, in particular, Silicon Valley tech-based culture. This homogeneous culture is built upon innovation-driven scenarios, newness, standardisation, and efficiency. While, on one side, it co-opts and appropriates the countercultural practices underlying the different maker cultures and communities of practice, on the other, it neglects the local needs, interests, and expertise that prompt those. By demonstrating four empirical cases from our distinct fieldwork in Western makerspaces and fab labs, this paper has discussed the necessity to take account of the past and to previous narratives, as well as to alternative narratives, while staying focused and response-able to local situations and resources. Moreover, the paper conveyed that a general trope of the West is further imprecise. These spaces, their actors and projects have reintroduced culturally contingent local features to discern themselves from, but also to expand the common tropes of novelty, scaling-up, and innovation.

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ⁱ The Fab Charter by the Fab Foundation outlines a common set of norms, rules, and definitions for new fab labs to pass if they wish to acquire the model's certification. The Fab City Global Initiative represents a network of cities, which envision an urban model of local production through global digital connection with other network hubs.

ⁱⁱ This text is taken from the Fixers Collective website, which can be found at:
<http://www.fixerscollective.org/about/>.

ⁱⁱⁱ UNDERBROEN Homepage: <http://underbroen.com/>.