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Makerspaces, makers, and maker movement
Introduction

Welcome to this special issue of Nordisk Tidsskrift for Informationsvidenskab og Kulturformidling. This time we want to present papers on makerspaces, makers, and maker movement. The word makerspace articulates a site for creative production promoting physical as well as digital activities, information sharing, and engagement with materials, processes, and ideas. Therefore, makerspaces are of interest for design processes in local communities, cultural institutions, NGOs, private companies, etc.

In these years, there is an interest in developing research in this field. A central theme could be how makerspaces give opportunities for exploring boundaries between the physical and digital, between theoretical and practical knowledge, and between construction and mediation. Another theme might concern how to establish co-creation understood as a process where digital technologies, materials, and the interests and knowledge of the participants mutually re-configure each other. The theme of this special issue goes in quite another direction. The focus of the papers will be on the driving forces existing behind the co-construction of makerspaces, makers and maker movement. One paper analyses a practice of curating the maker movement, and it discusses how such practices, among others, might have provided an identity of being a maker. Another paper investigates strengthening and weakening factors for establishing makerspaces in different countries, and it examines what the motivations of the particular makerspace operators were for developing these labs. The third paper analyses and develops a model representing different kinds of motivations for being a maker, and that model is applied when recommendations are giving regarding how to support maker engagement in distributed problem-solving projects. Finally, we have an essay describing a concrete makerspace in a Danish public library. In this way, this issue contributes to a specific theme in the field of research on makerspaces. The papers will be summarized:

The *first* paper, "What makes a maker? Curating a pioneer community through franchising" is written by Andreas Hepp, media researcher from University of Bremen, Germany. In the paper, a makerspace is defined as "a site providing access to the latest creative tools including 3D printing and laser cutting, a place where knowledge sharing and advice are the standard currency". Hepp writes about not only makers and makerspaces but also the maker movement. This movement is defined as a pioneer community taking its first steps around 2005 when among others the magazine *Make:* was launched. He describes the maker movement as a hybrid of social

movements and think tanks, where the first are "engaged in societal transformation from below" and the second are "open to new forms of entrepreneurship". However, it is also important to say that it is a movement oriented towards media-related change. The paper explores the involvement and contribution of Maker Media, the publishing company of the magazine mentioned, the magazine itself and its online platform to the maker movement. Defining the role of Maker Media as a curator, Hepp translates this practice of curating by using the words of a franchise model. Based on a media-ethnographic approach, the analysis shows how this model became a stabilizing element in the co-construction of the movement by providing professionalization, narration and a framing of the community´s practices.

The *second* paper, "Cui bono? Nodes of participation in the Maker Movement. A case analysis of FabLabs and makerspaces in German- and Arabic-speaking countries", is written by Sissy-Ve Basmer-Birkenfeld et al., a group of researchers from Helmut Schmidt University, Germany. The authors define FabLabs and makerspaces as representing "first pioneers of bottom-up-economics", offering "3dprinters, laser cutters, milling machines", and enabling "anyone to participate in value (co-)creation if one wants to prototype an idea or just tinker around". By asking ´cui bono?´, the authors pose the question ´what is the potential of FabLabs and makerspaces?´ To get closer to the answer, the paper examines the driving forces and obstacles of developing FabLabs in German- and Arabic-speaking countries from the viewpoint of FabLab representatives. The authors conducted interviews with FabLab representative and collected a data material about each FabLab visited in 2017. The FabLab representatives told the authors about the conditions in developing the particular FabLab and about their motivation and visions regarding their work. As an example, it is mentioned in the paper that the motivation was not only to offer access to technologies for their communities, "they want to deliver *low-level* access to new technologies, *connect* competencies, and use *Open Source* technology". This kind of motivation is found in FabLabs in both German- and Arabic speaking countries. As part of the conclusion, the paper presents a number of recommendations for how to promote new FabLabs including how to support participation in design and production processes.

Bruno Asdourian, communication and media researcher from Fribourg University, and Jimena Lazarte, digital marketing specialist, Switzerland, has written the *third* paper: "Making for humanity. Why makers participate in distributed problem-solving humanitarian projects". The paper defines makerspaces as "collaborative workspaces for information and communications technology-powered design and production". The authors explain how the humanitarian sector is in a need of a new business model and technological tools. Maker communities have a lot to offer the sector. Therefore, the purpose of the paper is to support maker engagement in humanitarian projects by understanding the motivations of the makers. The aim is to examine why makers participate in distributed problem-solving humanitarian projects where there seldom are substantial material rewards. Based on both a literature review and investigations involving interview as well as questionnaire the paper develops a model identifying the most significant motives for maker participation. It is found that the most significant motives are interest and enjoyment followed by relatedness, symbolic affinity and competence. This is relevant information not only for humanitarian projects but also project organizers in general.

As shown, the definitions of makerspace across the three papers have many similarities. However, their approaches differ from one another. It is different kind of cases, different contexts and different theories. Still, they all highlight the same question: how can we describe the agenda, incentives, and motivations that shape makerspaces, makers, and maker movement.

After the three papers, an essay follows. Under the heading "Ballerup Bibliotekernes Makerspace", Michael Anker and Thomas Sture Rasmussen from Ballerup public library describe a particular makerspace in Denmark, a makerspace in the library in Ballerup Municipality. The contribution gives us a concrete understanding of what a makerspace might be today.

I wish you a pleasant reading.

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What Makes a Maker?

- Curating a pioneer community through franchising

Abstract

Academic research typically portrays the Maker Movement as a bottom-up emancipatory movement that emerged out of localised, grassroots initiatives. On the basis of a broad media ethnography that gathered data in Germany, Great Britain, and the USA, this article demonstrates the myopia of this assessment. Rather than being a bottom-up movement, the Maker Movement is in fact a pioneer community with intimate connections to the corporate world and the political class maintained by a globally spread organisational elite. The increasingly global sweep of the Maker Movement is a complex act of co-construction involving an abundance of different actors. With its curatorial centre firmly embedded within the offices of the Maker Media company—guiding the discourse on the movement's identity through its periodical Make: and its experiential experiences through international Maker Faires—the Maker Movement has its organisational basis in a franchise model that leaves it open to the flexible influence of an organisational elite who secures the intellectual and physical space for individual practitioners and local groups.

Keywords: Maker Movement, pioneer community, maker spaces, franchising, curating, deep mediatization

1. Introduction

The terms "maker" and "maker space" have become fairly recognizable over the past few years. Across Europe and North America one would be hard-pressed to find a major city that does not house at least one maker space, a site providing access to the latest creative tools including 3D printers and laser cutters, a place where knowledge sharing and advice are the standard currency. In previous research, this spread of maker spaces and the related Maker Movement is presented as a bottom-up process. Makers appear as a kind of movement emanating *from below* embodying amateurs trying to establish a new culture of manufacturing. A great emancipative force is assumed and this is exemplified no more clearly than in David Gauntlett's book, *Making is Connecting* (2018) with its pointedly expressive subtitle: "the social power of creativity".

In contrast to Gauntlett's position, this article aims to make tangible my argument that the spread of the "idea" of the makers was a highly curated process of co-construction. A central position in this co-construction was occupied by the Maker Media company, who publish the *Make: Magazine* periodical and holds the rights to the Maker Faires. Maker Media's curatorial practices were based on a certain financial and organisational model,

namely, an adaptation of the franchising model. Contrary to their own discourse, the Maker Movement is *not* a social movement that has emerged "from below", but, rather, it constitutes another form of social figuration that I refer to here as a *pioneer community*.

Pioneer communities represent an enduring phenomenon in the development of digital media and their infrastructural formations. We can see a prime example in Fred Turner's work on the Whole Earth Network (2006) who published the catalogue of the same name and curated the discourse on a large number of the technological developments that emerged out of the Bay Area. Media-related pioneer communities like to refer to themselves as "movements" but are not social movements in the narrow sense of the word due to their intimate relationship to private companies and the political world. We could say that they actually share more characteristics with think tanks (Hepp, 2016) and it is the 'organisational elites' (Hitzler & Niederbacher 2010: 22) within pioneer communities who embody most of their curatorial activity. From this point of perspective, we can understand Maker Media as one important facet of the Maker Movement's organisational elite.

Based these considerations, this article deals with the following research question: *How does the organisational elite of the Maker Movement curate the co-construction of this pioneer community?* To these ends, I will briefly outline the Maker Movement as a pioneer community. I will then explain the methodologies utilised for my analysis followed by an account of the empirical results we gathered. These data describe, firstly, how Maker Media was able to curate the identity discourse around the Maker Movement by outwardly franchising *Make: Magazine* and its online platform, and secondly, how the same franchise model was applied to Maker Faires. My conclusion will reflect more generally on Maker Media's franchise model as a way of curating pioneer communities in times of deep mediatization.

2. The Maker Movement as a pioneer community

Tracing the origins of the Maker Movement is no simple task. When we consider hacker spaces (community-operated work spaces for people with an interest in computers, technology, and hacking) and FabLabs (small-scale, but very well equipped workshops for digital fabrication) as similar locations to maker spaces where their respective communities come together, 'hacker culture' (Coleman, 2013; Hunsinger & Schrock, 2016; Levy, 1984; Lange, 2015) can be identified as a significant precursor to the Maker Movement and there remains a connection between the Maker Movement and the hacking and open-source communities to this day (Krebs, 2014: 20). Furthermore, the Do It Yourself (DIY) movement (Atkinson, 2006), which has a long tradition in Europe and the US, has significantly influenced the Maker Movement (Hemphill & Leskowitz, 2012).

The Makers emerged around 2005 when Neil Gershenfeld's (2005) book on FabLabs and 3D printing was published, *Make: Magazine* was launched by O'Reilly, and the first Maker Faire was held in the San Francisco Bay Area. The introduction of the Arduino board in 2005 was another important step in the development of the movement, as was the introduction of the RepRap Open Source 3D printer[i] in 2007, the first MakerBot 3D printer[ii] in 2009, and the Raspberry Pi microcomputer[iii] in 2012, technologies that support practices of self-determined manufacturing. The publication of *Makers: The new industrial revolution*, a book by former Wired editor Chris Anderson (2012), offered a condensed ideology compatible with the maker community's vision of collectivity and change. Simply put, they were represented as a 'community of equally obsessed people from around the world' (Anderson, 2012: 15; 73-77; 92-95; see also Hatch, 2014), a community that believes that the 'internet of things' (Greengard, 2015) would herald a 'new industrial revolution' (Anderson, 2012) bringing together DIY, handcraft, and self-made technological innovations.

As already mentioned, we can understand the Maker Movement in its present form as a pioneer community. Communities of this kind are not only figurations connected to new media technologies, their members also share a common "we" and have built enduring structures to maintain shared practice. Pioneer communities tend to have a sense of purpose: a sense that they are at the forefront of the media-related transformation society is going through. Individual members publicly present themselves in these terms and they are often the subject of ongoing reportage, whether this is in media run by the pioneer community itself or in more traditional outlets (Hepp et al. 2018).

Pioneer communities are neither social movements nor are they think tanks; they behave much more like a hybrid of the two that finds its specific nature in an orientation towards media-related change. Much like social movements (Porta, 2013), pioneer communities are engaged in societal transformation from below while being open to new forms of entrepreneurship and policy-making akin to traditional think tanks (McGann & Sabatini, 2011).

Maker Media was founded as a subsidiary of O'Reilly Media in 2012 by Dale Dougherty to publish the magazine, *Make:,* and organise the early Maker Faires. Despite going through a financial and organisational crisis in 2015/16, resulting in several layoffs and a restructuring of the firm, Maker Media persists as the pillar of the pioneer communities' organisational elite. Recent initiatives— for example, the "Maker Net", developed by Nathan Parker to connect makers around the world,—are put into motion with Maker Media's knowledge and support.[iv] The company's principal partner in German speaking countries is the Heise Group based in Hanover.

It is typical that the organisational elite of pioneer communities are unable to "control" them by virtue of their complexity. Nevertheless, they have enormous influence over them through their curatorial activities. In general, 'curation' refers to a process of 'defining', 'selecting', 'arranging' and 'presenting' (Traue, 2013: 286; Thorson & Wells, 2016). With this definition in mind, since 2004 O'Reilly and later Maker Media as a company began curating pre-existing tinkerers and hobbyists of a technological bent to create a shared identity under which they could come together as so-called makers. But how did this organisational elite curate the co-construction of the Maker's pioneer community in detail?

3. Methods

My analysis is based on a media-ethnographic approach to participant observation, interviews and discourse analysis. While an 'ethnography proper' aims at a 'thick description' (Geertz, 1994) of entire cultures, the objective of a media ethnography is far more limited and can best be described as 'an ethnography about humans who use, distribute or produce media' (Bachmann & Wittel, 2006: 183). As these media-related practices take place in various locations, media ethnography can often take the form of a 'multi-sited ethnography' (Marcus, 1995; Falzon, 2009). Its typical instrument, therefore, consists of a bundle of 'accumulated ethnographic miniatures' (Bachmann & Wittel, 2006: 191).

For the purposes of this study, we interviewed and followed members of the Maker Movement, in particular, those who are considered to make up the community's organisational elite (*person-based access*). As they form the principal site for the integration of the globally scattered pioneer communities that make up the Maker Movement worldwide, it was essential that we focused a large portion of our observation at Maker Faires (*event-based access*) so that we could develop a clear understanding of the community's transnational and transcultural qualities. As one might expect, pioneer communities bring with them specific locales and in the case of the Maker Movement these generally consist of so-called "maker spaces". To complement the participant observation conducted at the Maker Faires and our interviews with the organisational elite from the community, we spent a substantial amount of time observing and interviewing members of two local maker spaces (*location-based access*). Combined, these three "ethnographic miniatures" allowed us to form a comprehensive picture of the Maker Movement in its current form. While a media-ethnography can also address online media practice, our research neither takes the form of a 'virtual ethnography' (Hine, 2015) nor does it constitute a 'netnography' (Kozinets, 2015) which address practices taking place online. Rather, the ethnographic study we conducted is more concerned with locally situated media-related practices and the communicative figurations they form as they occur across a variety of contemporary media.

Table. I. Data basis

organisational elite (person-based access)	• Interview with Dale Dougherty (Maker Media, Executive Chairman and CEO)
	• Interview with Daniel Bachfeld (Heise Group, Editor in Chief, Make: Magazine, Germany)
	• Interview with Daniel Rohlfing (Heise Group, Senior Product Manager, Maker Faire, Germany)
	• Interview with Peter König (Deputy Chief Editor, Make: Magazine Germany)
Maker Faires: Berlin and Hanover (event-based access)	• Participant observation at both events in 2016 and 2018
	• 8 interviews with professional exhibitors
	• 18 interviews with amateur exhibitors
	• 27 (partly group) interviews with participants
Local maker spaces (location-based access)	• Participant observation at two local maker spaces / FabLabs in 2016 and 2018
	• 4 group interviews with local organisational elite
	• 14 interviews with members and visitors

Within the overall framework of a media ethnography, that was in fact part of a larger comparative research project on pioneer communities in Germany and the UK,[v] this article is based on selected data (see Table 1). To develop an understanding of the movement's organisational elite, in February 2017 we interviewed O'Reilly Media co-founder, Dale Dougherty and performed a discourse analysis of his book, co-written with Ariane Conrad, *Free to Make* (2016) and the content of Maker Media's website. This was followed by interviews with three of the principal actors at Heise Media, the German publisher of *Make: Magazine* and licensee of the Maker Faire in Germany. Editor-in-Chief, Daniel Bachfield, Deputy Chief Editor, Peter König, and Senior Product Manager, Daniel Rohlfing each provided valuable insight into the franchisee's experience within the Maker Movement. The second stage of data collection was accomplished through a round of participant observation carried out at the two largest German-speaking Maker Faires in Berlin and Hanover in 2016 and 2018. In addition, we interviewed each of the twenty-three exhibitors and a selection of visitors at the Hanover Faire in 2016 as well as a selection of professional and amateur interviewees and participants in 2018. Finally, I present data from participant observation and interviews carried out at two maker spaces in North Germany. All of our data was analysed—supported by MaxQDA coding software—by applying standard grounded theory procedures, that is, a step-by-step process originating from an open coding exercise that is then transferred to more focused methods of axial and selective coding to help establish theoretical foundations that are, in effect, 'grounded' in empirical data (Glaser & Strauss, 1999; Corbin & Strauss, 2015).

This approach allows us to triangulate our detailed interviews with prominent members of the Maker Movement's organisational elite with our discourse analyses and observations of and interviews with exhibitors and participants with the end goal of "reconstructing" Maker Media's franchise model. It is important at this point to distinguish the two separate branches of Maker Media's franchise model: on the one hand, we have the *Make: Magazine* franchise, the principal objective of which is to curate the movement's identity discourse, while on the other, we have the Maker Faire franchise that seeks to curate extraordinary experiences for the pioneer community.

4. Franchising *Make: Magazine*: Curating a discourse

As outlined above, Maker Media is integral to our understanding of the co-construction of the contemporary Maker Movement. However, this does not mean that the movement's growth was a result of Maker Media's work alone. But if we are to approach a figuration of this pioneer community with adequate rigour, it is necessary to consider Maker Media as a crucial part of its organisational elite while understanding that the entire figuration is made up of multiple actors. Our data shows that Maker Media's engagement in the curation of the Maker Movement is built around a 'franchise model', which differs, however, from a standard understanding of franchising as it is implied in economics and management.

If we follow the debate around franchising in the fields of economics and management,[vi] it is best understood as a system for the sale of commodities, services or the application of technology. Franchising centres on close and continuing cooperation between juridically and financially autonomous companies. The core idea is that the 'franchisor grants his franchisees the right and he puts them under the obligation to exploit a business in accordance with the business concept' (Verbieren et al., 2008: 398).

While having some similarities with this general definition, Maker Media's franchising exploits are realised somewhat differently. Their model is harnessed to curate a pioneer community while at the same time cultivating a certain openness that aligns with their values all with limited resources. In Maker Media's model, *Make: Magazine* serves to curate an identity discourse, which in turn generates more localised opportunities for the community to experience the movement through Maker Faires. Of course, Maker Media, much like any other commercial endeavour, has commercial interests. However, the goal of value creation is limited by the fact that its central actors are concerned with measurable action in the pioneer community; profit interests are manoeuvred towards the goal of creating an 'imagined community' (Anderson, 1983) based on sharing and mutual support.

Maker Media's character as that of *curator* becomes more tangible if we cast a glance at the magazine's origins and the decisions involved in its naming. According to their website, Maker Media claim to be 'leading the Maker Movement'.[vii] During his interview, however, Dale Dougherty took a much less self-congratulatory tone but was still at pains to emphasise the role his company played in defining what makers are and what they have done to bring together a collectivity of tinkerers under that name. Interestingly, his starting point was the broader hacking community: While preparing the first issue of what became *Make: Magazine*, working together with O'Reilly Media in 2005, his initial instinct was 'to call it hacks magazine' (Interview Dale Dougherty, 02/2017; see also Dougherty & Conrad, 2016: 14-16) to address hacking in a broad sense, encompassing not only computer hacking but also ways in which it was possible to 'hack your health or hack finance or things like that […] not enough, especially younger people, understood that' (Interview Dale Dougherty, 02/2017).

This wider understanding of what was possible through hacking led Dougherty to start thinking about another, broader and more accessible term that would connect with the tinkerers he was targeting with the magazine. In the end, he settled on *Make:*. He told us that the 'name is a bit of an inside joke' based on a UNIX utility application that 'compiles a list of programs, using a file that starts off with "Make:"' (Dougherty & Conrad, 2016: 278). Private jokes aside, the term was purposefully chosen to address the loose network of tinkerers and hobbyists that had no overarching platform for sharing their experiences in building and finishing their projects but had hitherto not formed a coherent community. As Dougherty put it, 'there were small communities out there, but they didn't connect to each other very well: there wasn't any framing for that' (Interview Dale Dougherty, 02/2017).

When the team around Dougherty—specifically Mark Frauenfelder as editor-in-chief and David Albertson as designer—began putting together *Make: Magazine*, they realised that they were giving an explicit name to a latent collectivity of people. Dougherty reflects that 'using the word Maker and stuff was sort of like giving away something' (Interview Dale Dougherty, 02/2017). In his view, this would create a 'decentralised network […] anybody can join it, just by saying they're part of it' (Interview Dale Dougherty, 02/2017). This openness is also

reflected on the Maker Media website, which describes makers as a movement that 'embraces innovation, creativity, and learning to improve our communities and create a better future'[viii].

Their *self-perception as curators* is clear: Maker Media's main players emphasise their central role in the organisational elite of the Maker Movement, even claiming to have coined its nomenclature while at the same time assuming the openness of the Maker Movement; in their refusal to determine who is and who is not a member, affiliation is ultimately defined by the members themselves.

To what extent a discourse on identity is influenced by Maker Media becomes evident when one considers the *practice of curating* itself. First, there is the act of defining the movement's core identity. Even though Dougherty emphasises that 'the magazine did not have any ideological leanings', we can see processes of identification emerging through the magazine's claim that they are aiming to construct a 'mindset [of] the practice of making', or when they urge the reader to 'do something to learn something new, try something out' (Interview Dale Dougherty, 02/2017). This very clear position is laid out in early editorials where the question of what constitutes a maker is explicitly discussed.

Second, the Maker Media team engage in *selecting* and *presenting* Maker projects. Dougherty defines this as a form of "community journalism" where the goal of the magazine was not to produce traditional "tech journalism" as such but 'to follow what individuals were doing' (Interview Dale Dougherty, 02/2017). Accordingly, the magazine centres around particular stories on certain maker projects, some of which resemble how-to guides for similar projects. Ideally, from the point of view of *Make: Magazine*'s editorial team, those who regard themselves as makers would be recruited to write for the magazine. However, this presents Maker Media with a challenge; not all hobbyists are necessarily good writers. This rings true to the extent that even if contributors can be persuaded to write about their projects, they often require extensive journalistic support.

While Dougherty presents the magazine as having a hands-off approach to the figuration of a specific pioneer community, the extent to which their so-called community journalism is in fact an exercise in curation is very clear. Maker Media *selects* the projects and authors that they deem most compatible with their point of view while the *presentation* of those projects seeks to promote the (assumed) values of the pioneer community to not only attract an audience but to encourage readers to become active makers as well. Through these curational practices, each contribution to the magazine, even those that do not explicitly deal with the Maker Movement, is concerned with a discourse on identity by implicitly discussing Dougherty's 'mindset […] of making'.

Maker Media's self-perception as curator combined their curational activities has extended to the nuts and bolts of franchising *Make: Magazine*. Of note is that the emergence of this franchising process was already an act of co-construction, that is, it was not Maker Media's idea alone to adopt the franchise model, but it came about as a consequence of their interactions with the German Heise Group.

Active in the field of tech journalism since 1977, the Heise Group launched a publication in 2012 whose name was comparable to *Make: Magazine*. The name *c't Hardware Hacks* derives from its sister publication and Heise's flagship title, a computer magazine simply called *c't* (for "computer technology"). *C't hardware hacks* (later truncated to *c't hacks*) was a successful special issue published four times a year that included articles from the monthly *c't* that dealt with hacking and data security more broadly.

As a publishing house active in the field of technology journalism, Heise Group's management had *Make: Magazine* in its sights since its launch in 2005.[ix] They were already considering the feasibility of 'translating the magazine in license', but as Daniel Bachfeld, the founding editor-in-chief of today's German *Make: Magazine* says, there were:

> simply issues of making it German enough, […] certain things were incompatible, on the one hand resulting
> from cultural differences: if they [...] discuss anything about a quadrocopter aircraft on the west coast I'm not

interested as a German in Germany—and the other thing was that certain crafting-related topics simply do not work in Germany (Interview Daniel Bachfeld, 11/2016).

Bachfeld's last comment stems from the simple fact that there are different standards of compliance in place for electronic components in Germany. This kind of disparity let to the licensing project being abandoned. However, driven by the desire to realise their own craft fair, members of the Heise Group attended a Maker Faire in New York, after which they organised a similar event in Germany. The first German Maker Faire organised under license took place in Hanover in 2014 (see Section 5). This led to plans for the rebranding of *c't hacks*:

> At some point [we said]: okay, now we have the Maker Faire. [...] But we called [our magazine] *c't hacks* or *hardware hacks*, that somehow does not match. Then we asked the Americans, we would like to license the name and rename ourselves in Germany, what do we need to do to make that happen? And then, we went into business with them, so we're going to produce the magazine and organise the faire consistent with the look and feel of the American *Make: Magazine*, and the Maker Faires (Interview Daniel Bachfeld, 11/2016).

As a result, the license agreement for the magazine came bundled with one for the Maker Faire, demonstrating how intertwined the event and the periodical were at the time.

How then was Maker Media's approach to curating translated to German-speaking countries through their franchise model? At the core of the contract is the stipulation that the design and the *Make:* brand are incorporated into the German edition and that the German publisher has the right to use articles from the American edition and vice versa. Likewise, the online appearance of the two magazines are coordinated and refer to each other. As well as a constant online exchange regarding operational issues, the franchiser and franchisee holds an annual joint meeting to coordinate and plan future strategies and publications. In a German context, then, Maker Media GmbH was founded in 2014 as part of this license agreement as a subsidiary of Heise Group and is responsible for the German-language *Make:* and Maker Faires (Interview Daniel Rohlfing, 10/2016).[x]

The German-language *Make:* team's *self-perception as a curator* was ultimately akin to Maker Media's. By adapting their understanding of what a "maker" is, as a publisher they were able to curate the pioneer community's identity discourse and widen its network at the time. Editor-in-chief, Daniel Bachfeld puts it well when he says:

> In the meantime [a] movement emerged, that now stands for the term maker, which also works interdisciplinary. I think that's the thing compared to the past, to the Hobbythek[xi] days, etcetera. [...] today it is more interdisciplinary: People can handle a laser cutter, 3D printer, a milling machine, and they network. Of course, the open source [movement] had an immense influence on the Maker Movement: "we exchange our projects" it is what characterises it today (Interview Daniel Bachfeld, 11/2016).

Bachfeld's statement is doubly important. Even though, it demonstrates how the Heise Group's understanding of what a "maker" is was similar to Maker Media's, it still conveys a sense that the German team distanced themselves somewhat from the founders' original vision. Although the term "maker" is considered an apt one, overall, and in the absence of another suitable idea, it is regarded much more as a *"*trendy" conceptualisation of something that was in other forms already there.

There are other differences we can see between the two teams' *curational practices*. With the German version of *Make:* there also exists processes of *selection* and *presentation*. Typically, *Make:* editors take advantage of their presence at the Maker Faires to gather story ideas from their readers. Makers, however, are not necessarily trained journalists, so instead of contributing directly to the magazine, they are often used as a source of ideas for articles that are then written up by professional writers. There are, however, external contributors to the German version of *Make: Magazine* and some of them even contribute on a regular basis. In addition, what seems to distinguish the German version of *Make:* from its sister publication is that they publish a wide range of tutorials aimed at the non-beginner. Here, *Make:* journalists are assumed to be operating in contradiction to

Dougherty's vision of "community journalism" as a curational practice. Daniel Bachfeld puts this down to localised attitudes towards journalism. He believes that German readers prioritise in-depth information more highly than their English-speaking counterparts, he explains:

> German readers tick a little differently when it comes to what they expect from an article. While the original *Make:* is about "build this now and then it works", the German edition decided to include a lot of information about how thing work, […] which is what holds this project together at its the core. (Interview Daniel Bachfeld, 11/2016).

Differences like these became an issue for the transnational and transcultural processes of co-constructing a definitive identity for the movement as the Germans' heightened emphasis on background information began to appeal to readers of the English-language edition of the magazine. Subsequently, the English magazine had to adapt and began incorporating articles from the German edition.

> Because it [the maker scene] is so heterogenous you can never expect to be able to address the entire audience adequately, which is why we reverted to addressing the technically well-versed and interested […] to some extent I think we are already at the point where we are the suppliers of technical know-how, so to speak, and how they apply it afterwards is up to the readers themselves. (Interview Peter König, 05/2018)

My analysis so far has revealed that the original iterations of *Make:* was a communicative offering that sought to curate an identity discourse and act as a catalyst for the burgeoning Maker Movement that came in their wake. Through Maker Media's franchise model—in itself an act of co-construction—their identity as a curator and its corresponding practices were passed on to German-speaking countries. However, these practices were performed by the German organisational elite in different ways and, through a process of dynamic co-construction, the founders of Maker Media in the US adopted the German way of doing things.

5. Franchising Maker Faires: Curating an Experience

As mentioned above, Maker Media's franchise model extends to the Maker Faires. The aim of the faires is to curate an experience for the Maker community in the form of a public event, whether they be large in scale or smaller "Mini Faires". Regardless of size, these events are important to the Maker community for two reasons: first, they allow a locally dispersed pioneer community to meet; second, they generate a degree of visibility that allows the community to be appreciated by a wider audience.

This double character is reflected in the choice made to name the events "faires" and not "conferences", for example, which is a term more often reserved for the business-to-business realm, as seen in the 2018 MakerCon in Heidelberg Germany in April of 2018 which was particularly aimed towards the tech industry.[xii] The term "faire" not only connotes an exhibition of goods or a marketplace, it suggests the atmosphere of a "fête" or "carnival", that is, an event where extraordinary experiences can be had. When Dale Dougherty, Louise Glasgow, and Sherry Huss came up with the concept for the first Maker Faire (held in 2006 in San Mateo, Bay Area), deciding to call the events "faires" was a conscious decision. The idea was to hark back to traditional country faires, which 'were a mix of exhibits, lectures, and marketplace' (Dougherty & Conrad, 2016: 33) and create a "hybrid" science, crafts, and arts event.

The concept of the Maker Faire was developed in early 2005, 'not too long after the magazine was established' according to Dougherty (Interview Dale Dougherty, 02/2017). The initial motivation for organising the events was 'to talk to these people, to meet them, […] just to have a conversation with Makers about what they made' (Interview Dale Dougherty, 02/2017). From this initial impulse the concept for a prominent event was developed through local meetings curated by Maker Media. As far as Dougherty is concerned, the 'Maker Faire is the most interesting thing they have developed' and was maintained by a 'commercial ecosystem' that they had to set up independently, as there were no 'gambling funds' or 'cultural funds' (Interview Dale Dougherty, 02/2017) available. Because there were no genuine financial foundations for the endeavour, the Maker Faire was

organised from its inception in close cooperation with private enterprise. Dougherty describes the Maker Faire's objectives as follows:

> We didn't want to be a trade show, we didn't want to [be] like [a] vendor booth, we wanted makers that were there to talk to you about their project. And we felt, like, you have to make that personal connection, you know, Makers who came one year came the next year and […] So, there was kind of a way, like, we didn't mind sales happening but that was a background rather than a foreground thing […]. (Interview Dale Dougherty, 02/2017)

The first Maker Faire was a great success inspiring the Maker Media team to realise the faire in new locations at home and abroad. Since resources were lacking, the licensing model came up early on in their discussions on how to make this plan a reality. The central idea of their licensing model was to provide an 'interesting framework where someone applies for it, we try to vet them, and we trust them to do a good job' (Interview Dale Dougherty, 02/2017). Licensing of the Maker Faires went well, especially in contrast to their efforts to franchise *Make:* and the Maker Faire began its global spread much more rapidly. In 2016, Maker Media licensed and supported 191 Maker Faires in thirty-eight countries, in both large and small communities (for 2018 see Figure 1).

Fig. 1. Maker Faires in 2018

Flagship Maker Faires	Featured Maker Faires	Mini Maker Faires	School Maker Faires
Faires curated and produced by the Maker Media team	Larger-scale regional events	Community events	K-12 Faires (closed to general public)

https://makerfaire.com/map [accessed: 16.11.2018]

To all intents and purposes, Maker Media licenses the Maker Faire brand, its basic structural elements, and provides support through technical documents and annual meetings. A close network was built around this licensing model in the years following 2006. Prominent members of this network are: Eric Pan (funder of Seeed Studio and organiser of the Maker Faire in Shenzhen), Massimo Banzi (co-founder of the Arduino Project in Italy, and organiser of the Maker Faire in Rome), and the team at the Heise Group who organise the Maker Faires in German-speaking countries. This global network is coordinated by Sabrina Merlo, Managing Director of Maker Faire at Maker Media and Dougherty himself regularly attends larger faires as a keynote speaker and visitor to support the global networking of the movement and the brand.

The Heise Group's initial foray into the Maker franchise was a competition they held in *c't* magazine called *Mach flott den Schrott* ("repair the scrap"). Readers were asked to think about what they could do with their discarded hardware and what followed was a steady flow of remarkable submissions including a laser plotter made from discarded DVD drives, a smart home thermostat made from an old mobile phone, and a toilet paper printer. The *c't* editorial team were so excited about the entries they received, they decided to exhibit them at Cebit, one of

Germany's largest technology and innovation conferences in Hanover. Seeing the amount of interest in DIY, tinkering, and hacking generated by their exhibit, The Heise Group team decided to launch *c't hacks*.

Following the excitement of the Cebit exhibit and general enthusiasm for *c't hacks*, Heise Group's managing director, Alfons Schräder thought it might be a good idea to try and organise a Maker Faire in Germany. In 2014, the first German one-day Maker Faire was held in Hanover. The organisers forecast for 1,000 visitors, however, 4,000 came and based on this enthusiasm the Heise Group licensed the Maker Faire for a second, two-day event in 2015 that attracted 9,000 visitors.

The success of the first two faires saw Heise Group and Maker Media sign a long-term franchise agreement. Heise Group was to pay Maker Media a fee to use the Maker Faire logo and all other corporate branding for promotion across all platforms. The basic structure of the event—which is part of the franchised model—combined elements of 'show-and-tell' (the presentation of projects by Makers themselves), traditional exhibition stands (by professionals and amateurs) and artistic performances (typically as main acts to attract a wider audience). German events were advertised on the US website, operating in the co-constructive realm once again as localised experiences were brought together with Maker Media's curational self-understanding. Maker Media, however, remained the dominant partner in this exchange. As Daniel Rohlfing says:

> Up to a certain point, contacts [are] controlled by the Americans. First, they have set up an online platform that we can use to exchange views, where items of interest and news are sent on a regular basis, and when someone has a question [he or she can] send it to everyone else, wherever they are in the world [...]. That's one possibility. [...] [In addition to this,] the Americans [...] also offer producer workshops during [the] San Francisco and New York [Maker Faires], [...] for exchange, networking, and for development. (Interview Daniel Rohlfing, 10/2016)

Beyond the general model designed into the licensing agreement, Heise Group were able to refine Maker Media's approach to curating the Maker Faire. According to our German interviewees, the point of the faires is to act as an anchor for the Maker Movement in German-speaking countries. Essential to this process is the interplay between the Maker Faires and the more low-key Mini-maker Faires. The Maker Faires proper are keynote events for a wide audience held in Berlin and Hanover and organised solely by the Heise Group. Mini-maker Faires are much smaller events, typically organised by a local FabLab, maker space, hacker space or educational institution. Here, the Heise Group provides the brand and a level of know-how but the events are organised by local groups. Together, both events serve to curate the experience of the Maker Movement's imagined community. The core curational team comprises Daniel Rohlfing acting as senior product manager and Philipp Stefan who works as community manager.

Today, the large Maker Faires in Berlin and Hanover are organised one year in advance and last three days, including one weekday (in 2016, 100 teachers and 1,500 school pupils attended on the Friday). The faires include a number of high-profile attractions, typically artists with large interactive contraptions and performances centred around "self-made" artefacts - attracting over 21.000 attendees at the 2018 Hanover faire alone.

These attractions are the main generator of media coverage, either online, on social media, or by the press and radio and television broadcasters. The main *practices of curating* here are *selecting* and *arranging* presenters and exhibitors: The first step in the organisation process is a 'call for makers', an open call on the basis of which each (group of) maker(s) can apply to attend. Sponsors are contacted that must have a connection to the Maker Movement, either in the way that they sell tools, technologies or services used by the community, or in the way that they include maker practices into their organisation (for example Hackathons). Besides individuals and smaller groups, local initiatives and educational institutions are invited to attend for the show-and-tell sessions in particular.

Groups are invited to organise a *Mini-maker Faire* on the German Maker Faire homepage and at the main Maker Faires. In principal, any group can apply at Heise, but in some cases local Mini Maker Faires are also stimulated

by the Heise Group or other sponsors like Thalia or Conrad. The organisation process begins with an open conversation between the local organiser and the management team at Heise Group, whose main objective at this point is to determine to what extent applicants are aligned with the Maker Movement, their financial background (do they have enough resources and are they prepared for risk?), and the suitability of the proposed location. If Heise's queries are satisfied, a sub-license agreement is made with the local organiser and the team at Heise Group support the event by providing guidance, feedback, assistance with finding sponsors and by promoting the event on the website and in *Make: Magazine*. When the event takes place, Heise Group sets up a booth to advertise the German edition of *Make: Magazine*. At times, the Heise team makes a concerted effort to discover local organisers for Mini-maker Faires in regions where events have not been held previously, this kind of effort saw Heise coordinate the Sachsen Maker Faire in eastern Germany, which stimulated a local network in the region and yearly events ever since.

For both the Maker Faires and the Mini-maker Faires, the organisers' main aim is to curate them as community events taking care to ensure that sponsors do not dominate the space

> The most important thing with a Maker Faire is that, no matter the scale [...] it's always a community event. [...] We have a rule of thumb that at least seventy-five, eighty percent of attendees should be makers, whether they sell on a small scale, or just show a project there, something they have developed in their garage, their basement, it does not matter. […] And then twenty, twenty-five percent or something like that are ultimately sponsors, so commercial companies. (Interview Daniel Rohlfing, 10/2016)

How are such curatorial practices perceived by the Maker Faires' attendees and participants? Essentially, our field research at the Maker Faires in Berlin and Hanover in 2016 and 2018 revealed that, while all the exhibitors, professional and amateur alike[xiii], as well as the visitors we interviewed, demonstrated an understanding of what a "maker" is, we also found disparate views on the extent to which they relate to the wider maker community.

Asked about their perception of "makers" and the "Maker Movement", a typical response from a *professional exhibitor* came from a representative of the Brick and Knowledge Project, an initiative that encourages young students to interact with electronics. From his point of view, 'makers try [...] to not just use products, but to make changes, to make oneself'. The exhibiting distributor of XYZ Printing defines 'being a maker' as somebody who likes 'to tinker with something until it works'. A representative of the university-developed senseBOX (a DIY sensor data kit) said that makers 'just try things that have never been done before, and just make some crazy ideas [work]'. Essentially, 'being a maker' is to create something new. However, the professional exhibitors clearly differ in the extent to which they relate to the maker community from two extreme ends of the spectrum. At one end you have exhibitors who are former makers and have subsequently professionalized their craft. An interviewee from PiTop (a build-it-yourself laptop powered by the Raspberry Pi) locates his company at the center of the Maker Movement, he told us that, 'the founders of the company are all makers themselves'. The other end of the spectrum is inhabited by individuals like a designer we interviewed from Future Heritage, an arts project that 3D prints craft objects. He said that he was 'very critical of the Maker Movement because a lot of it is jumping on the bandwagon, so to speak'. He went on: 'only ten percent [...] really add value; [...] as a designer, I [...] demand something different'. Between these two extremes, most of the professional exhibitors relate themselves to the Maker Movement, but do not necessarily position themselves at its centre. Nevertheless, as one participant—an originator of the German scene, a well-known *Mach flott den Schrott* ("repair the scrap") award winner and FabScanPi inventor—puts it: "The Maker Faire is simply a great place to meet the people you only ever have contact with online, live and on site." Typical of the statements we documented was what one interviewee told us, 'I see myself as a maker, unfortunately I have too little time in the day to tinker' (distributor from XYZ Printing).

We can reach a somewhat different conclusion if we take a closer look at the amateur exhibitors. When it comes to defining what makes a maker, with the amateurs we interviewed there was an emphasis on creativity, trying out new things, and practices of manufacturing, while even greater importance was placed on acts of sharing. One student, who was at the faire to present his chocolate 3D printing project, told us that a Maker is someone

who 'looks out for a project and then builds as much as possible for this project themselves [...] [and] then somehow shares his creations'. Furthermore, most amateur exhibitors relate to the Maker Movement much more than the professional exhibitors we spoke to. In part, the amateurs see themselves at the core of the community such as a student from the project laboratory of a vocational school who told us that 'through [their] hacker space, Portion' he definitely considered their project '[as] part of the Maker Movement'. Others appeared more distant but even they were attracted to the maker identity. A student of microelectronics and amateur exhibitor of SmArt Lights (a system for ambient lightening), for example, problematizes, 'we spent months in our cellar, tinkering [...] the whole time. Now we have something to show for it. Does that mean we are makers now? We do not know. We do not have much exchange, we do not know much about this ideology'. Despite his pessimistic tone, by attending the Maker Faire, he began to develop an attraction to his peers who were also in attendance. As another regular visitor to the Maker Faire, Berlin and an amateur exhibitor put it: 'So in the first place I'm here because the Maker Faire is the only place where everyone can meet. I don't really have that much interest in the whole maker branding because all that is presented here—at the gates of this truck there a nice toy and its funny, but it's not at the core of what these open spaces are about and I wouldn't be here now if it weren't for this link that leads towards other people being here that share my goals.'

Visitors to the faire and their level of affinity to the movement ranged from a "close relatedness" at one end of the spectrum to merely being an "interested tourist" at the other.[xiv] There are, for example, members of FabLabs, hacker spaces, and other tinkerers who defined themselves as makers before the name "maker" and the "Maker Faire" existed. For some visitors, *Make: Magazine* has been quite important in building their relationship to the maker community. As a male member of a FabLab told us, it is 'the big maker's newspaper from America' that he closely links to the organisation of the faire. Another typical statement came from a male visitor who works in the field of microelectronic hardware development. He said about himself: 'I'm interested in drones, multicopters; that's how I heard, via *Make:*, [about the] maker scene and the Maker Movement'. And he continues, drawing a line between the movement in a narrower sense and the practices of making more broadly: '[making] has always existed [...] that's just play and developing something with creativity'. Another typical statement came from a father and his twelve-year-old son, both interested in robotic programming, on their third visit to a Maker Faire, and—in the case of the father—long-term readers of Heise's computer magazine *c't*. They told us that they were interested in makers and the Maker Faire because 'you can do many things by yourself" (son) and because "people introduce their own projects' (father).

In summary, we can say that the franchise model of the Maker Faire has close parallels with that of *Make: Magazine*. Here, too, Maker Media—with corporate artwork, a specific corporate design, guidelines for organisation, and regular communication meetings—provide a curational framework for the Maker Faires. This framework is licensed and can then be acted upon differently by licensees who are responsible for organising locally. As far as how they put their license to use is concerned, licensees are allocated a fair amount of freedom which even extends to the possibility of sub-licensing, as was the case with the Heise Group. It was only in this way that it was possible to co-construct a globalised network of Maker Faires in just a few years.

6. Conclusions: Franchising and the curation of a pioneer community
Based on my analysis, we can now understand with more clarity the essential characteristics of Maker Media's franchising model and how it became a vital element in the co-construction of this pioneer community through its organisational elite. In essence, this model is characterised by two closely interlinked activities, namely, the act of franchising, the curation of a discourse and the act of franchising the curation of an experience.

Franchising the curation of a discourse arose around the establishment of *Make: Magazine*. In terms of the magazine, not only was "maker" coined as a term—as opposed to hackers, hobbyists, and tinkerers—the magazine and its online platforms have also managed to curate a discourse on what constitutes practice for a maker. The peculiarity of *Make: Magazine* is that it is—despite the national differences in the franchising process—a community magazine with the goal of reporting from the pioneer community for the pioneer community.

When *franchising the curation of an experience*, the aim is to use the Maker Faires to create local events in which the Maker Movement can be experienced directly. My analyses have demonstrated that the faire is an exercise in attraction. This affects both amateur exhibitors and visitors: local hacker spaces, FabLabs, educational institutions, and projects that did not originally see themselves as part of the Maker Movement are exhibiting and building relationships with this imagined community when they contribute to a faire. Visitors who might approach the Maker Movement differently can still experience related practices and projects directly and establish a relationship with the pioneer community.

Generally speaking, both approaches connect while maintaining the process of co-constructing the Maker Movement's pioneer community. Three benefits of the franchise model can be identified. First, there is the stabilisation of the pioneer community through (cautious) professionalisation and commercialisation. Maker Media's franchising efforts succeed in providing, over a long period of time, the resources necessary for the stabilisation of the pioneer community through an ongoing identity discourse (*Make:*) and the possibility of an extraordinary local experience (Maker Faires). Second, there is the narration of an imagined community. Through franchising, the curation of that narrative is afforded through the websites, the magazine, and the faires. Thirdly, the framing of the pioneer community's practices as "stylish", "innovative" and "countercultural" is made possible. With reference to the Maker Movement, we see here the co-construction of a new understanding of manufacturing, being simultaneously related to modern technology on the one hand and individualised manual labour on the other. It is perhaps in this new understanding where the unique appeal of this pioneer community truly resides.

Through their practices of curated co-construction, pioneer communities are driving forces in the process of 'deep mediatization' (Couldry & Hepp 2017; Hepp & Hasebrink, 2017): they contribute to the introduction of practices into everyday life that are—initially relatively experimental—comprehensively entangled with the latest digital media technologies. In the case of the Maker Movement, these are manufacturing practices that are regarded as innovative precisely because of their close relationship to digital media and their association with the vision of a "new economy" of the local or the creativity of its craftspeople. The decisive factor in their support of deep mediatization is not so much the extent to which such practices are actually stable or how experimental handicrafts lead to sustainable business ideas, what is genuinely crucial is how the activities of pioneer communities such as the Maker Movement increase people's general openness to cutting edge digital technologies. *Through this*, they are—curated by their organisational elites—driving forces in the processes of deep mediatization.

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i The RepRap is a 3D printer released under a GNU General Public License that is used for rapid prototyping and manufacturing.

ii The MakerBot is a cheap and easy-to-use 3D printer from MakerBot Industries LLC, New York City.

iii The Raspberry Pi is a single-board computer developed by the British Raspberry Pi Foundation. It is very simple compared to standard personal computers and was developed to promote the teaching of basic computer science, particularly to young people.

iv This interpretation is obvious as Nathan Parker introduced his initiative on Maker Faires to attract new members to the movement.

v For more information on our wider project, see https://www.kofi.uni-bremen.de [7.5.2018].

vi For an overview of this research see Combs, Michael, & Castrogiovanni, 2004; Elango & Fried, 1997; Nijmeijer, Fabbricotti, & Huijsman, 2014 and Verbieren et al., 2008.

vii See https://makermedia.com [accessed 22.04.2018].

viii See https://makermedia.com [accessed 22.04.2018].

ix Daniel Bachfeld mentions '2004' as a launch date in his interview but Make: magazine was in fact first released in 2005 as outlined above.

x Maker Media GmbH is a subsidiary of Heise Media, part of the Heise Group. Managing directors are Ansgar Heise and Alfons Schräder; see https://www.heise-gruppe.de/artikel/Maker-Media-2290712.html [accessed: 23.04.2018].

xi The Hobbythek was a monthly television program produced by WDR (Westdeutscher Rundfunk - West German Broadcasting) from 1974 to 2004 that covered a range of scientific topics targeted at the layperson, whose central concept was committed to a DIY ethos.

xii In 2019 a new conference format will be introduced to the German Maker Faires, which expands the educational day for schools with a conference aimed at a specialist audience.

xiii The term 'amateur' is problematic because it relates to what Andrew Keen (2007) has called 'the cult of the amateur': the idea that through the internet innovations developed by outsiders would change our society for the better. Sociologically speaking, many 'amateur exhibitors' at the faires are professionals in the sense that they have training in computer science, electrical engineering or other related fields. Thus, the term 'amateur exhibitor' does not mean 'inexperienced layman' but refers to the status of what they present: in the case of 'professional exhibitors' these are the commercially distributed products that are relevant to the Maker Movement; in the case of 'amateur exhibitors' these are new ideas and projects from within the Maker Movement itself.

xiv We use the term "tourist" here in the way as it is used to describe the carrier members of popular cultures and scenes, which describes the "novice", then "tourists", later, "buffs" and ends with "freaks" (see Winter, 1999).

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Cui bono? Nodes of Participation in the Maker Movement

- A Case Analysis of FabLabs and Makerspaces in German- and Arabic-speaking countries

Abstract

The maker movement is represented by autonomous Makerspaces and FabLabs worldwide. These open workshops enable people to transfer their ideas into physical objects. They deliver an infrastructure of digital manufacturing technologies and the corresponding knowledge to use this infrastructure. At the same time, they are regarded as the first pioneers of a new economy, in concrete terms: bottom-up economics. But what about the framework conditions of Makerspaces and FabLabs that are conditional to foster the participation in value creation, e.g. participatory design and co-creation? Based on a case analysis of FabLabs and Makerspaces in German- and Arabic-speaking countries qualitative interviews with FabLab representatives have been analysed. The attitudes of Makerspace and FabLab managers became clear; especially, their assumptions underlying their strategies of action according to participatory design and co-creation. How can the virtual and the physical participation be integrated? Which barriers prevent them from unfolding the full potential of their labs? And what measures promote their potential? The paper gives an overview of the country-specific results and allows general insights into the actual barriers and promoting measures. Based on the results, general recommendations can be given to foster participation in design and production processes. In the outlook, the development of bottom-up economics and its participatory characteristic can be illustrated by the analysis of the maker movement.

Keywords: Makerspace; FabLab; participation; co-creation; digital manufacturing

Introduction

3dprinters, laser cutters, milling machines… these technologies and more are offered by FabLabs and Makerspaces, mostly for free and open access for public. Anyone can produce anything (Gershenfeld, 2005). Therefore, FabLabs and Makerspaces represent first pioneers of bottom-up-economics (Redlich & Wulfsberg,

2011, Gershenfeld, 2005, Redlich & Moritz 2017). They enable anyone to participate in value (co-)creation if the one wants to prototype an idea or just tinker around.

After a short description of the status quo and the lack of research, we describe our approach to grasp the actual paradigm shift of value creation and, afterwards, how we conducted a case analysis of FabLabs and Makerspaces to analyse the central driving forces and obstacles of the development of FabLabs in different countries from the viewpoint of FabLab representatives. The attitudes of Makerspace and FabLab managers became clear; especially, their assumptions underlying their strategies of action according to participatory design and co-creation. Which barriers prevent them from unfolding the full potential of their labs? And what measures promote their potential? The paper gives an overview of the country-specific results and allows general insights into the actual barriers and promoting measures. Based on the results, general recommendations can be given to foster participation in design and production processes. In the outlook, the development of bottom-up economics and its participatory characteristics can be illustrated by the analysis of the maker movement.

FabLabs and Makerspaces
The FabLab idea is spread all over the world. Ultimately, more FabLabs can be found in Europe than in the USA (Ramella & Manzo, 2018). But there are only a few international studies about FabLabs and those focus on specific fields of the phenomenon. Dolata & Schrape (2016) grasp the phenomenon of a maker movement and common knowledge transfer. Thus, Smith et al. (2016a, 2016b) speaks of grassroots innovation (Blikstein, 2013). Voigt, Unterfrauner & Kieslinger (2017) conduct an in-depth case analysis of selected FabLabs and Makerspaces. Ramella & Manzo (2018) look into the Italian FabLabs. Troxler (2013) describes the international structure of FabLabs and the international associations FabFoundation and FabAcademy. Wolf et al. (2014) conducted research concerning the general aspects of the sharing-culture in FabLabs. Especially Arabic-speaking countries are underrepresented in research. At first Osunyomi et al. (2016a, 2016b) gives an overview of strengths and shortcomings of FabLabs worldwide as well as the FabLab ecosystem throughout the world: Only few approaches of knowledge transfer and collaboration between the FabLab and Makerspace organisations could be observed.

Osunyomi et al. (2016a) observed a lack of research according to the sharing of information and the culture of global co-creation. Further in-depth questions arise about people's attitudes and their basic convictions (see, according to sustainability aspects, Kohtala, 2017; Fleischmann, Hielscher & Merritt, 2016). How do FabLab representatives themselves reflect the maker movement, what hinders them, what are their strengths? According to the undisclosed field an explorative method is mostly suitable to disclose the following hypothesis: FabLabs and Makerspaces have a big potential in order to increase self-organized immaterial value creation through enabling and empowering multiple stakeholders to participate in value creation.

Theoretical background: changing terms of value creation
We are actually observing a paradigm-shift in value creation driven by globalization and new information and communication as well as production technologies (Reichwald & Piller, 2009; Redlich & Wulfsberg, 2011). Technologies like 3dprinters, laser cutters etc. enable stakeholders to co-create value in a decentralized, networked and collaborative manner (Redlich & Wulfsberg, 2011; Redlich et al., 2015). People are able to connect nearly anywhere and anytime via the internet. The new production technologies and the information and communication technologies have a massive impact on our ability to create value. Beside the well-known ´material value creation´, the ´immaterial value creation´, which has been nearly neglected in prior research, has to be included (Rifkin, 2014). This is part of the paradigm-shift in value creation and changes the configuration of value creation processes, structures and artefacts. From a social scientist´s point of view, it is important to describe why the actors in value creation show high engagement against the absence of any financial reward. Further values have to be integrated and show the importance of the understanding of the relationship between the producer and consumer in form of co-creation (Prahalad & Ramaswamy, 2004), and intangible assets (Daum, 2003) created by e.g. a crowd which is motivated by fame, fortune, fulfilment and fun (Marsden, 2009). The term and understanding of value creation is changing in the light of the analysis of the bandwidth of new value creation patterns (Prahalad & Ramaswamy, 2004; Prahalad, 2005; Redlich & Wulfsberg, 2011). For example, free products

are more distributed than the common user or decision maker might know (Tapscott & Williams, 2006; Rifkin, 2014). On the one hand the existence of free products are common to users, but on the other hand it is mostly unknown why business models are successful, what underlying implications there are and which consequences they will result in (Anderson, 2009; Rifkin, 2014).

At first, the insight into the new perspectives and opportunities of value creation is essential. Most of the decision makers understand e.g. crowdsourcing as an instrument of receiving low cost personnel or free research and development as well as marketing tools (Gassmann, 2010). In relation to the theory of the *Commons* (Ostrom, 1990) open approaches as Open Innovation, Open Production, Open Tourism, Open Data, Open Government are inspired by a mind-set of sharing and solidarity (Lakhani, Jeppesen, Lohse & Panetta, 2007; Egger, Gula & Walcher, 2016; Powell, 2012). The change of value creation processes, e.g. the so-called sharing economy will result in an attitude of more cooperation rather than competition (Howard, 2015; Basmer-Birkenfeld et al. 2015). We are in the middle of an ethical discussion which is connected to the new patterns of value creation. A value decision is underlying every value creation activity: Do I want to share my insights with a community? What business model suits my preferences best? Hence, it is necessary to look into the term value and derive the understanding of value creation as well as implications of value creation activities for the whole society (Rifkin, 2014; Moritz, Redlich & Wulfsberg, 2018).

> The meaning of value and the process of value creation are rapidly shifting from a product and firm-centric view to personalized consumer experiences. Informed, networked, empowered and active consumers are increasingly co-creating value with the firm (Prahalad & Ramaswamy, 2004, p.5).

Value creation is ambiguous as much as the term capability. A capability represents the capacities of an owner and, furthermore, his assets. The immaterial value creation moves beyond the immaterial assets in terms of accounting financial means (i.a. customers, patents etc.). The immaterial value creation also integrates knowledge, social relations and innovation capacity. Therefore, immaterial value creation has to be measured in terms of those elements, e.g. knowledge or social relations, which is hard to manage. Concluding, at first the central shift of value creation/bottom-up economics has to be recognized in order to get a clear understanding of relevant terms in the scope of a study according to FabLabs and Makerspaces (Redlich & Wulfsberg, 2011; Redlich et al., 2015; Tapscott, 2006). The concepts of co-creation and participatory design can be seen as two phenomena of the changing value creation in general. Already in 2004 Prahalad and Ramaswamy wrote about value creation that becomes less and less company-centric, but is mere an act of a common creation. The co-creation experience itself becomes the central base for value (Prahalad & Ramaswamy, 2004). Participatory design refers to including stakeholders in the design process and most parts or all design activities (Bratteteig & Wagner, 2016).

Research design: methodology and case selection
This article is based on findings on FabLabs and Makerspaces of the working group Value Creation Systematics at the Institute of Production Engineering at Helmut Schmidt University, Hamburg. At first Osunyomi et al. observed major shortcomings in the FabLab Community, published in 2016a, 2016b. Based on these insights we conducted the research project "Twinning for Innovation" that has been funded by the German Federal Ministry of Education and Research. The project has been initiated and conducted by the Working Group "Innovation" of the Arab-German Young Academy (AGYA) and the Institute of Production Engineering at Helmut Schmidt University in Hamburg.

The objective of the project was to enhance the collaboration and embedding of the Labs. The concept of twinning has been applied in development cooperation, business management and public administration (Askvik, 1999; Saha & Saha, 2015; Karré & Twist, 2012). "The concept thus promotes joint learning, understanding and collaboration" (Buxbaum-Conradi et al., 2018, p.85). Research subject are FabLabs and Makerspaces, workshops that offer (free or low-level) access to technologies. The general description of a FabLab as small-scale workshop where anyone can make almost anything with the offered machines conveys a great significance but does not yet convey the scope of the idea as it has been developed by Neil Gershenfeld, professor

at Massachusetts Institute of Technology (Gershenfeld, 2005). Buxbaum-Conradi et al. (2018) find that they not only offer users the opportunity to put ideas and projects into practice, but can also be understood as spaces of shared creativity, learning and experimentation as well as shared value creation.

The focus of research of "Twinning for Innovation" has been set on the themes of local socio-economic, socio-institutional structures and integration into the global and virtual cooperation and sharing infrastructure (Buxbaum-Conradi et al., 2018). As such, FabLabs and Makerspaces conduct cost effective research and development and the valorisation of bottom-up innovations. Nevertheless, the fundamental condition for the success of a FabLab is an appropriate embedding in local socio-economic structures and in the global virtual knowledge and practice community. Previous surveys at the Institute of Production Engineering (LaFT) at the Helmut Schmidt University (HSU) have shown that FabLabs have a significant influence on factors that promote innovation (Osunyomi et al., 2016a, 2016b). They can promote crucial development of key innovative practices by user communities, particularly in the fields of agriculture, (renewable) energy, health and education (Osunyomi et al., 2016a, 2016b).

Case selection
In table 1 the case selection is shown. The FabLabs and Makerspaces have been selected from the existing pool of German- and Arabic-speaking countries according to their suitability and availability for the study; there has been no further categorization before the study. As an explorative approach the cases have been treated as equal cases, chosen randomly and there has been no further ranking or priorisation.

Qualitative interviews have been conducted with the FabLab representatives alongside a guiding questionnaire in all cases. The interviewers were research assistants of the working group Value Creation Systematics that is part of the Laboratory of Production Engineering of the Faculty of Engineering at Helmut Schmidt University, University of the German Federal Armed Forces in Hamburg. The working group Value Creation Systematics is an interdisciplinary group, which focusses on research activities in the field of value creation, innovation and knowledge management especially from the viewpoint of the paradigm shift of value creation and observes the changes on different levels of value creation processes, structures and artefacts. The working group Value Creation Systematics and, thus, authors of this article developed the research approach, conducted the interviews and collected the data material; photos and video material in 2017. The researchers visited FabLabs and Makerspaces in Germany (8), Austria (2), Tunisia (3), Morocco (3), Egypt (4), Saudi-Arabia (2), Jordan (2), Oman (1), Lebanon (1), and Qatar (1). The years of founding of the FabLabs and Makerspaces show the relatively short time of existence of the labs, as well as the fact that the maker movement is in an early stage (see Table 1).

Table 1: Case selection and year of founding

	Name of FabLab/Makerspace	Town, Country	Year of Founding
1	FabLab Aachen	Aachen, Germany	2009
2	FabLab Kamp-Lintfort	Kamp-Lintfort, Germany	2015
3	FabLab Berlin	Berlin, Germany	2013
4	FabLab Bremen	Bremen, Germany	2013
5	FabLab Potsdam	Potsdam, Germany	2012
6	FabLab.SH	Kiel, Germany	2016
7	OpenLab Augsburg	Augsburg, Germany	2013
8	Dingfabrik Köln	Cologne, Germany	2011
9	Happylab Salzburg	Salzburg, Austria	2014
10	FabLab Innsbruck	Innsbruck, Austria	2016
11	El FabLab	Marsa, Tunisia	2015
12	El Space	Tunis, Tunisia	2013
13	FabLab Enit	Tunis, Tunisia	2014
14	Innotech	Alseeb, Oman	2016
15	FabLab Casablanca	Casablanca, Morocco	2015
16	FabLab Temara	Témara, Morocco	2015
17	Dare Space	Rabat, Morocco	2012
18	FabLab Egypt	Cairo, Egypt	2012
19	Assiut STEM FabLab	Assiut, Egypt	2012
20	Karakeeb Makerspace	Alexandria, Egypt	2014
21	FabLab 10th City	Th. Of Ramadan City, Egypt	2016
22	FabLab Irbid	Irbid, Jordan	2016
23	FabLab Amman	Amman, Jordan	2011
24	FabLab Dhahran	Khobar, Saudi-Arabia	2014
25	FabLab Arabia	Jeddah, Saudi-Arabia	2011
26	Innovation Factory	Beirut, Lebanon	2016
27	FabLab Qatar	Doha, Qatar	2011

Methodology

In each case the researchers conducted qualitative interviews in order to analyse the single cases and compare the respective outcomes (Yin, 2009; Buxbaum-Conradi et al., 2018). The interviews with FabLab and Makerspace representatives of each case have been conducted along a prepared interview guideline. The resulting transcripts were analysed based on qualitative content analysis by Atlas.ti, a software for qualitative data evaluation. According to the explorative research approach of a case analysis one has to keep in mind that each case can count as one experiment. A representative result is therefore not an objective of this explorative study, as one would expect at the end of a quantitative approach (Yin, 2009).

A comparison of the FabLab representatives´ statements and interference reveals certain basic assumptions that are available in the respective labs. Buxbaum-Conradi et al. (2018) published first insights of the research project: The FabCharter was nearly used by all FabLabs. The results showed different degrees of embedding in local institutional and economic structures that in turn resulted in the emergence of different types of labs. Besides, results confirm the lack of cooperation between the labs (Buxbaum-Conradi et al., 2018). Country-specific differences have been stated in the focus on exchange relationships:

> While the rentier states of the Middle East want to prepare for the post-oil period in this way, the Levant and North Africa are trying to create job opportunities for the young population (Buxbaum-Conradi et al. 2018; p.89).

In the following, general statements will be derived based on the most clearly emerging categories from the case analysis with relevance for our research questions.

Results: Strengthening and weakening factors, motivation and visions, potential

We identified the following results: strengthening and weakening factors (according to the development of a FabLab) from the viewpoint of the interviewed FabLab representatives as well as motivation and visions of the FabLab representatives and the potential of the new way of value creation which is enabled in FabLabs. At first, the strengthening and weakening factors are described in detail and exemplified by quotations from the interviews.

Strengthening factors: Creative spaces, collaboration, inter- and transdisciplinarity

FabLabs and Makerspaces enable collaboration alongside the whole value chain. Some of the interviewed FabLab operators reported that the traditional obstacles of limited disciplinary viewpoints have less effects in FabLabs and Makerspaces: Application-oriented group work and a common vision deliver an atmosphere of solidarity and effective collaboration. Direct user feedback is an apparent phenomenon in FabLabs. In FabLabs and Makerspaces the people overcome disciplinary restrictions and work together in an *interdisciplinary manner*. This emerges in *creativity* that contains new opportunities for design and making based on participatory design and co-creation.

> Without wanting to overestimate that now, but there are really many products that are modified a bit over the last few meters because you get direct feedback from users from another area. This allows you to react much faster to potential problems of the product in the future, because you get a very quick feedback. (interview partner FabLab, German-speaking country).

The knowledge about the *whole value chain* and the *transdisciplinary* exchange between e.g. craftsman, designers, and artists is another aspect that supports the development of a holistic understanding of design and production:

> They [designers] don´t learn […] anything about materials and those who are solving the critical problems are craftsman and production experts. But they don´t know anything about design. So we are stuck, unless we breach this, and we teach people (interview partner FabLab, Arabic-speaking country).

Weakening factors: Mistrust, demand, resources

In one case, clear competition and *mistrust* between regional FabLabs was reported. The mistrust was a consequence of different visions and business models. Knowledge sharing between organisations based on a common understanding of open source is not naturally given (Redlich et al., 2014). There is still a fear present that one might steal a good idea or concept for a marketable product. Despite common ideas and shared enthusiasm for the FabLab idea, Open Source Hardware and the maker movement, regional FabLabs and Makerspaces compete for resources, financial regional support and visitors or lab memberships. In principle, the labs whose financing is secured can be distinguished from labs that are exposed to greater competitive pressure. This leads to the fact that the lab operators also tend to focus on the competitive character and competitive advantages. The viability of FabLabs and Makerspaces depend on the *demand* of the spaces where the technology is accessible and people meet to make artefacts and share knowledge. But in nearly all cases we analysed, the FabLab idea must be actively disseminated to increase the demand. Some FabLab operators talked about a high share of their time that they invest in the announcement of the space and describing the idea of FabLabs and Makerspaces to the public. They have to do basic work in convincing users, customers and so on, either in view of the fact that the technologies exist or in view of the fact that it is a free offer not a service and the people have to work themselves.

> I think it´s [a] great opportunity for us. Suddenly people understand that they are able to do everything, since everything is available. So we benefit from this movement, there are many platforms where people share their ideas and inventions (interview FabLab, Arabic-speaking country).

While *transfer of knowledge* within a laboratory is a regular phenomenon, *the virtual sharing of knowledge* is not a commonplace. There is a gap between the wish to share and the actual amount of sharing. One reality that cannot be denied is the workload of the daily life that might hinder doing everything to live up to the vision of sharing. Technical documentation standards are missing and the time-effort necessary to invest in knowledge sharing online often runs counter to the vision of sharing in everyday life. Moreover, there are a lot of parallel structures that can be found in form of many documentation platforms via the internet as for example GitHub, Thingiverse and instructables (see Buxbaum-Conradi et al., 2018).

Motivation and visions of FabLab representatives
The core of the FabLab idea is technology – one might think at first. The observed motivation of the interviewed FabLab operators in German and Arabic-speaking countries, however, goes way beyond this. The motivation of the operators is not only to offer access to the new possibilities of technologies for their respective community, they want to deliver *low-level* access to new technologies, *connect* competencies, and use *Open Source* technology. This basic conviction has been found in almost all cases. There is no difference between German and Arabic-speaking countries according to the existence of such motivational arguments. Interestingly, there even cannot be simply stated a difference between FabLabs with different business models.

In the research study we found FabLabs with business models that are focused on initiating innovation and start-ups, but nevertheless, they were still convinced by the idea of open source, sharing and transnational collaboration. Some FabLab operators even looked at the possibilities of the laboratories from a superordinate perspective: They want to help with the next industrial revolution, bring back making and DIY, thereby turning the society from a consumer society into a producer society:

> The founders […] told us that the motivation was, you know, after the revolution everybody has a positive energy to shape something, that could be beneficial to the community. So, I think, the motivation was changing the mind-set of the […] community and the believe, that […] that the maker community will put [the country] on the right track, to overcome the circumstances and challenges that we face right now (interview FabLab, Arabic-speaking country).

We were also able to interview more "realistic" FabLab operators who regard their work as work and were not so visionary in their statements. These operators also say that the economy will not change so much as a result of the new technologies and open source movement. On the other hand, for countries with a high unemployment rate, FabLabs seem to raise hope and initiate visions of increased economic wealth that is necessary for these countries and the local people to participate in global value creation and reconnect in terms of globalisation.

Country-specific obstacles
From the perspective of some FabLab operators FabLabs are a method to overcome country-specific local problems such as unemployment or waste problems. FabLabs give people hope to change the mind-set of the people, to change the economy and to change certain policies. From this perspective the international network of FabLabs works as an intermediator to overcome intercultural differences and foster transnational knowledge sharing to find solutions for local problems. Further country-specific problems are a lack of resources in countries with a surplus of imports, *Brain Drain* as well as country-specific legal requirements for organisation forms in some Arabic-speaking countries. Brain Drain describes that well-educated people leave the countries and are no longer available for the local maker scene as they have ambitions to start their living and projects in countries with better conditions. And the legal requirements for the operation of a FabLab or Makerspace are difficult in some countries as one has to choose the organisational form (e.g. operate it as a small company or as an association). Another factor that proved to be an obstacle is language.

The exchange of technical documentation between Arab- and English- or German-speaking FabLabs is in most cases in English. This excludes, at least to some extent, makers in Arabic-speaking-countries that cannot fully

understand the English documentations. But according to the mentioned barriers, the FabLab representatives are already working on solutions: To overcome the *language barrier* some FabLab operators are working on a central platform to enable exchange between Arab- and English-speaking countries. In relation to the FabLab idea the operators are very interested in open access and open source and they are not driven by financial aspects. On the other hand, they need funding for their lab and have to develop suitable business models in the long-term.

Cui bono? What is the potential of FabLabs and Makerspaces?
The majority of FabLab operators do not see themselves as political stakeholders. Some FabLab operators mentioned that they do not want to be included in politics, because they want to avoid getting blocked by political factors, like corruption, nepotism, dependence etc. Nevertheless, the totality of operators interviewed can be ascribed a power within the local structures. In this power lies the chance to change mind-sets, overcome intercultural differences and (at least to some extent) change the economy.

Thus, even if the majority of lab operators see themselves as apolitical, they must be seen in their entirety as a movement as a political factor. It is a value decision to be part of the FabLab community that implicates the values described above, e.g. solidarity, sharing and collaboration. The identification with the maker movement cannot be dismissed in many cases and has also to be seen as a political statement.

A central achievement, but also cause of some problems, in our high-industrialized societies, is the division of labour. It can count as one reason for the widespread alienation from value creation. Participation is concerned with enabling people to take their part in processes that affect them directly or indirectly; in other terms: stakeholders. From this perspectives stakeholders are getting empowered within FabLabs. FabLabs are working as enabler for people, so that they are able to participate in value creation.

> The real issue in [name of the country] is that our parents and grandparents used to create things. And the issue for us is not to lose this culture and empower it with technology. So people who have our age and even younger start to lose the ability to make thinks and no longer make things (interview FabLab, Arabic-speaking country).

The paradigm-shift of value creation is a rethinking on a concrete level. FabLabs and Makerspaces deliver work on site and form a community that is crucial for bottom-up economics (Redlich & Wulfsberg, 2011). Intangible assets can be found in these achievements of FabLabs and Makerspaces that are not mentioned in the common balance sheets of economic organisations, but they maybe be observed by community developers.

General recommendations to foster participation in design and production processes
General recommendations can be given to foster participation in design and production processes. We have shown that there is a realistic and an idealistic approach to run a FabLab or Makerspace. The more realistic side recognizes fears of Open Source, the workload of the individual, who practically opposes the implementation of the sharing ideal. The representatives of FabLabs are conducting basic convincing and educational work. This starts with the concept of FabLabs, the new technology, sharing, Open Source and the DIY-mentality as well as creativity and an entrepreneur-mindset.

In relation to these points, firstly, political support could be promoting standards of Open Source licences and technical documentation.

Secondly, knowledge sharing (locally and globally) could be rewarded through incentives. Within a system, in terms of crowd-related effects, one can also integrate Nudge as a method to foster changes in mind-sets and communication to strengthen the sense of the future and protect against unnecessary risk taking (Thaler & Sunstein, 2008). For example, a sharing award for the best website or similar incentives.

Thirdly, the labs could be promoted through better financing. Human cooperation is usually relatively unstable. The central recommendation regarding FabLabs is to consider it as a value decision to initiate a FabLab and/or

engage in this local organisation. As shown above, the creation of values extends to the intangible area. So far, the underlying values which characterize co-creation processes have been neglected in wide parts of society. FabLab representatives try to raise awareness for those production technologies that enable to participate in value creation. The small-scale approach and the overarching standardization by MIT[i]is showing success. Most FabLabs are committed to the FabCharter (Buxbaum-Conradi et al., 2018). Instruments should be based on values of respect, solidarity and cooperation. If the conscious value decision of the implementation of FabLabs is conducted at the beginning, these values can also be shared with the community, and it develops value-oriented community-building at eye level in the long-term. Decision makers should be more aware of the underlying value decisions at the beginning and initiation of FabLabs. The involvement of different individuals requires a value-oriented support also by political representatives. In this sense, politics could foster programs to theme-centered interaction to accompany a greater part of local communities (Cohn, 2013).

However, more research is needed. Especially the effects of FabLabs and Makerspaces on uniting community-forces to support civil society in transnational crises and develop solutions e.g. to deal with the refugee crises. Troxler for example states that open design is already taken into account within the EU; but

> Understanding developments of common-pool resources and inverse infrastructures and policy recommendations aimed to promote more collaboration and networks is not sufficient (Troxler, 2013, p.190).

In a nutshell, a FabLab can be seen as node of participation, places paving the way for a new mind-set that reflects new value creation patterns. People have the chance to develop from consumers to makers, which is connected to a new mind-set. Barriers are especially the misunderstanding of new value creation patterns that one can find throughout all countries. Every single FabLab is working on changing preoccupied mind-sets and showing what is actually possible based on new technologies and community-building.

Without overestimating the movement, it can be said that FabLabs and Makerspaces represent an enormous value and nodes of interdisciplinary and intercultural community in regional development, community development, and technology education (Hamalainen & Karjalainen, 2017). This should not be underestimated, although these are parts of the immaterial value creation. In the end, the movement is still at the beginning and it will be interesting to follow its outcomes.

Conclusion

> Yes. I mean the maker movement is growing rapidly. But being part of a global network it always gives us the edge in terms of impact and that's why the impact of FabLabs around the world is way stronger and bigger than other individual makers. The global network has helped us to do new projects and it opens lots of doors within different industries (interview FabLab, Arabic-speaking country).

FabLabs form a counterpoint to our current consumer-oriented societies. They enable digital citizenship across language and country borders and work as nodes of participation and, thus, places of empowerment. FabLab operators are basically interested in solving local problems. They regard the empowerment of technology use and technology design for peer production as a central empowerment factor, which ultimately leads to a solution of social problems. FabLab representatives could also be considered as digital citoyens. Digital citoyens naturally know how to network with each other via the internet and to exchange information about the existence and availability of the infrastructure, but there is a lack of content exchange about technologies between FabLabs (Osunyomi et al., 2016a; 2016b); Buxbaum-Conradi et al, 2018). There are no underlying responsibility ascriptions among FabLab operators which would attribute the cause of societal problems, e.g. unemployment to the individual, for example, to the people themselves. Rather, most FabLab operators have a humanistic world view that motivates them to create technological infrastructures for their communities. However, as research by Osunyomi et al. shows, FabLab operators lack a true global network that promotes knowledge exchange. This can ultimately be attributed to the fact that FabLabs are still young and everyone is fighting for their survival in

one of the different types/models of labs mentioned (Buxbaum-Conradi et al., 2018; Branding et al., 2018; Troxler, 2013).

In general, the project enabled interesting insights into the actual status quo of FabLabs. The attitudes of Makerspace and FabLab managers became clear; especially, the assumptions underlying their strategies of action to foster participatory design and co-creation.

Limitation and outlook

> And not only for the founders, not only for the workers, or the people who use this place, but everybody in the community, everyone, who is linked in some sort of way. They get knowledge, get money, get space, get potential, get opportunities (interview, FabLab Arabic-speaking country).

The general recommendations are derived from the qualitative analysis of the conducted interviews. It has to be taken into account, that the qualitative research counts as a process of a hermeneutic circle and cannot deliver validated results in terms of a quantitative research. A general picture of the explored field can be shown and follow-up questions raised.

In terms of bottom-up-economics the vision has already been created that processes in development cooperation may be conducted at eye level and, in the long-term, has the opportunity to change from a top-down-oriented cooperation, determined by a power elite, to a collaboration-oriented industrialization (Basmer et al., 2015).

The development of the FabLab movement over the next 10 years will be interesting as most of the FabLabs are only a few years old (see Table 1). A follow-up study in 10 years would be most welcome, in terms of what has changed, especially according to the global FabLab development and the individual development of the young organisations. Further evaluation studies of long-term effects of FabLabs should be conducted and will give us more insights into the possibilities and successful strategies in the long-term. To what extent will the viability of the FabLabs depend on the individual committed digital citoyen?

To conclude, as we look for an answer to the question 'cui bono', one has to state that it depends on the country-specific framework a FabLab is embedded in, the motivation and the vision of the FabLab representatives as well as the described strengthening and weakening factors of the development of a FabLab and, thus, of a successful participation in the global maker movement.

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Making for humanity
- Why Makers Participate in Distributed Problem-Solving Humanitarian Projects

Abstract

There is a growing interest in makerspaces (collaborative workspaces for information and communications technology-powered design and production), maker events and maker culture as drivers of participative creation. Further, maker communities have a lot to offer as channels of fast, affordable and adaptable solutions. In need of a new business model and technological tools, some humanitarian organizations have demonstrated interest in these communities. However, no studies have empirically investigated maker's motivations for participating in humanitarian projects. To address this research gap, a qualitative semi-structured interview (N = 3) and a quantitative online questionnaire (N = 118) were implemented. As part of this study, a model of motivations to participate in distributed problem-solving was developed. The most significant motives for maker participation in humanitarian projects were found to be interest and enjoyment followed by relatedness, symbolic affinity and competence. The findings are discussed in terms of participation and motivation theories in a context of distributed problem-solving practices.

Keywords: motivation, participation, maker, humanitarian projects, NGO, communities

Introduction

In the last ten years, the number of people needing humanitarian aid has almost doubled, their context and needs have changed significantly, and the costs of providing aid have tripled (Betts & Bloom, 2014). The humanitarian sector is in urgent need of a new business model and technological tools to enhance preparedness and relief (Bessant et al., 2014). As channels of fast, affordable and adaptable solutions, maker communities (Anderson, 2012) have a lot to offer for the humanitarian sector. Recently, not-for-profit organizations in this sector, such as non-governmental organizations (NGOs), have demonstrated interest in maker communities. Field Ready, an NGO pioneering the use of 3D printers to manufacture disaster relief equipment locally, supports the online community of volunteers Humanitarian Makers which provide remote assistance by participating in design challenges and testing existing computer-aided design (CAD) files (James & James, 2016). In the same path, Amnesty International is using platforms (such as OpenIDEO) to crowdsource solutions to global issues.

Motivating the public to participate remains a weakness of community engagement strategies (Head, 2007). It can be inferred that these difficulties transfer to those cases where an organization seeks to engage a group of

people to address issues other than their social well-being or that will benefit others. The motivations to participate in crowdsourcing and open source practice have attracted significant interest, particularly with regard to digital products, such as software and application development (Lakhani & Wolf, 2005; Leimeister, Huber, Bretschneider, & Krcmar, 2009). However, little research exists in terms of why makers participate in humanitarian projects where there are seldom substantial material rewards. Understanding the whole range of maker motivations is essential for communicating in a way that attracts and engages them in innovation projects (Stacey, 2014).

The purpose of this study is to support maker engagement in humanitarian projects by providing humanitarian project organizers with relevant information about maker motives for participation. This paper analyses the importance of various forms of motivations to provide qualitative and quantitative answers to the following research question:

RQ. What motivates makers to participate in distributed problem-solving humanitarian projects?

We also develop and test a model of motivation based on goal-oriented motivations and motivations to participate in distributed problem-solving.
Based on a ranking of motivational constructs identified within a literature review, our study hypotheses are as follow:

H1: Product use-value is one of the most significant motives for maker participation in humanitarian projects.

H2: Interest is one of the most significant motives for maker participation in humanitarian projects.

Literature review
Motivation and self-determination theory (SDT)
Motivation refers to the degree to which an individual is 'activated', 'energized' or feels an 'impetus' to do something. This is a psychological phenomenon or state that varies in intensity (the strength of the impetus) and orientation (the underlying attitude or goal), both of which can affect the focus and quality (Ryan & Deci, 2000) or focus and effort – understood as time dedicated to a task (Roberts, Hann, & Slaughter, 2006) – with which it will be enacted. In this way, motivation affects performance – understood as a qualitative evaluation of how a task was performed with respect to one or several specific goals. There are many other factors that influence performance, such as relevant knowledge and skills.

Within the field of motivation psychology, goal-oriented behaviour is a causal product of motivation. Ryan and Deci's (2000) self-determination theory (SDT) is widely used and recognized to explain this type of behaviour. This theory makes a distinction between intrinsic and extrinsic motivations. Intrinsic motivations are defined as "the doing of an activity for its inherent satisfactions rather than for some separable consequence" (Ryan & Deci, 2000, p. 56). These motivations can be expressed as the satisfaction of psychological drives (such as enjoyment, competence, and relatedness) or task properties (such as task variety and complexity) that can satisfy these drives. These are associated with high-levels of learning and creativity, which are considered to reinforce effort levels (Roberts, Hann, & Slaughter, 2006). Extrinsic motivations have been associated with the "instrumental value" of the task or its "separable outcomes", such as rewards or punishment. SDT distinguishes between different types of extrinsic motivations based on the extent to which they are self-regulated or "internalized". These two groups of motivations can be organized along a continuum of internalization. At the lower end of the continuum are those categories of extrinsic motivation where the individual feels compelled to perform a task by an external force. At the higher end of the continuum are intrinsic motivations, where the individual feels compelled by the task itself.

SDT associates motivation with basic psychological needs rather than goals. This does not mean that behaviour is not enacted to attain specific goals. Instead, it means that these goals become motivating when they are associated with the satisfaction of basic psychological needs. Although some authors consider that a goal-based approach is more appropriate for studying motivation in virtual communities (Bishop, 2007), the needs-based approach is justified by research showing that the satisfaction of these needs can be used as a basis for predicting the level of performance and well-being in goal pursuit (Deci & Ryan, 2000). The three main needs identified are feeling autonomy (the need to feel oneself as the causal locus of one's actions), competence (the need to feel effective) and relatedness (the need to feel connected to others) (Ryan & Deci, 2000).

Makers and distributed problem-solving practices (DPS)
Making is closely related do-it-yourself (DIY), which is a broad term for traditional craft or tinkering activities, such as woodworking, taking place outside of a factory or other supportive infrastructure. Many makers develop products directly in their homes, garages or other places with relatively limited manufacturing tools, such as makerspaces (Anderson, 2012). Although the line is blurred, what distinguishes making from traditional DIY is the incorporation of information and communication technology (ICT) in the form of design tools (e.g, computer-aided design), production tools (e.g., subtractive or additive rapid prototyping machines like laser cutters and 3D printers) and product components (e.g., by including microcontrollers). The development of increasingly affordable ICT infrastructure and tools is gradually democratizing innovation while the standardization of materials and products that followed the industrial revolution have been particularly helpful to support collaboration, interoperability and modularity (Tanenbaum, Williams, Desjardins, & Tanenbaum, 2013).

Making is also referred to as digital do-it-yourself (DIY) and do-it-with-others (DIWO). Digital DIY is more adequate to describe those cases where individuals are working on their own and digital DIWO to describe those where several individuals are working together. There is a high level of interconnectedness between maker communities either through individuals that are part of more than one community or regional and international collaborations (Stacey, 2014).

The interconnectedness of maker communities and interoperability of the different ICT tools involved in making support distributed problem-solving (DPS). DPS is sometimes referred to as 'wisdom of the crowds' because it is considered to aggregate 'intelligently' millions of independent ideas supported by the development of the Web 2.0 and associated tools for decentralizing communication (Surowiecki, 2004).

Two popular distributed problem-solving practices (Lakhani, 2016; von Hippel, 2005) are open source practice and crowdsourcing. Brabham (2008, p. 81) underlines that open source practice involves "allowing access to the essential elements of a product (such as source code for software) to anyone for the purpose of collaborative improvement to the existing product, with the continued transparency and free distribution of the product through the various stages of open development." Open-sourced solutions and products thus belong to the public domain. Instead, crowdsourcing constitutes a form of outsourcing of labour meaning that solutions or products resulting from a crowdsourcing event become the property of the organization behind it.

One common form of DPS practice involves leveraging communities (Boudreau & Lakhani, 2013). Lakhani found that communities can be valuable sources of innovation because they "take responsibility for a collective output and integrate solutions across the entire spectrum of participants and tasks, […] involve joint problem solving, knowledge sharing, and accumulation over multiple problems" (2016, p. 118). Community approaches have had the largest impact in software development. The problem with this approach is that individuals may invest less in innovation as there are less opportunities for appropriation of the end result.

Makers, SDT and motivations to participate
Making is an activity that is intrinsically motivating: a passion (Dougherty, 2012) or something that is done 'playfully', because it is enjoyable to learn and create (Hatch, 2014). Kwon and Lee (2017) found that the most significant motivational factors in making, understood as developing and producing ideas, were symbolic use-

value and reward seeking and the most significant motivational factor in community participation, understood as asking or answering questions online and socializing with other makers, was product use-value. Further, although community participation was only found to have a slightly positive effect on making, it was found to have a significant impact on learning and performance. Community participation can therefore be considered to contribute significantly to the quality of making – not only for those actively participating in the community, but also those learning passively from it.

A literature review of studies on motivations to participate in three open source (Budhathoki & Haythornthwaite, 2012; Budhathoki, Nedović-Budić, & Bruce, 2010; Lakhani & Wolf, 2005; Roberts et al., 2006) and three crowdsourcing (Bretschneider et al., 2012; Kaufmann, Schulze, & Veit, 2011; Zheng, Li, & Hou, 2011) contexts was conducted. Based on the motivational constructs identified in these studies, we developed thirteen motivational constructs of our own (henceforth referred to as 'motives'). Following SDT's classification of motivation, these motives are split into two categories: extrinsic and intrinsic motivations.
The motives associated with extrinsic motivation are the following:

● Reward seeking
This is an extrinsic motive externally regulated by the promise of a reward, such as payment or a prize. Motivational constructs associated with reward seeking were found in four of the six studies: extrinsic motivation related to the pursuit of rewards (Roberts et al., 2006); monetary return (Budhathoki et al., 2010); payment (Kaufmann et al., 2011); to gain money (Zheng et al., 2011). Reward seeking was found to be the most motivational factor in the context of a paid crowdsourcing market (Kaufmann et al., 2011) and the second most significant motivational factor in an open source software development context (Roberts et al., 2006).

● Sanction avoidance
This is an extrinsic motive externally regulated by the threat of sanctions, such as being banished from a virtual community. A motivational construct associated with sanction avoidance was found in one study: action significance by external obligations and norms (Kaufmann et al., 2011), which is the compliance with obligations and norms to avoid sanctions. Sanction avoidance was not found to be a significant motive in this study.

● Symbolic surrender
This is an extrinsic motive regulated by introjection. It refers to those cases where an individual gives in to what are experienced as external norms, values or obligations. Although the values have been partially internalized, they are experienced as pressure. The individual can choose to surrender symbolically by doing what seems expected to relieve this pressure. Motivational constructs associated with symbolic surrender were found in four studies: feeling obligated to contribute as a user of the product (Lakhani & Wolf, 2005); trust in the way the system works (Budhathoki et al., 2010); indirect feedback from the job (Kaufmann et al., 2011), which is described as the prospect of receiving feedback from another person about the task performed; reciprocity, which is "a sense of obligation to give something back to the [organization behind a product used]" (Bretschneider et al., 2012, p. 3468). Symbolic surrender was not found to be a significant motive in any of the studies.

● Skill use-value, symbolic use-value, product use-value and distraction
These are extrinsic motives regulated by identification. They are associated with participating to obtain a separable outcome. The individual only participates for its instrumental value and could therefore easily choose another behaviour leading to a similar outcome. Skill use-value is the pursuit of skills that can lead to other separable outcomes, such as a better job. Motivational constructs associated with skill use-value were found in four studies: skill improvement (Lakhani & Wolf, 2005); learning and self-actualization (Budhathoki et al., 2010); human capital advancement (Kaufmann et al., 2011), which is associated with developing skills that can lead to future material advantages; learning to use a product more efficiently (Bretschneider et al., 2012). Skill use-value was among the second most significant motivational factors in open source software development (Lakhani & Wolf, 2005) and the third in crowdsourced work (Kaufmann et al., 2011). Symbolic use-value is the motivation to send a signal or symbolic message that can lead to separable outcomes, such as being noticed for a job

position. Motivational constructs associated with symbolic use-value were found in all six studies: non-product related needs (Lakhani & Wolf, 2005), such as enhancing professional status or reputation in the virtual community; status and career opportunities (Roberts et al., 2006); career opportunities, reputation enhancement, networking and social relation opportunities (Budhathoki et al., 2010); signalling (Kaufmann et al., 2011), which is described as doing something to send a strategic signal or message to others; to gain recognition (Zheng et al., 2011); capability signalling and recognition (Bretschneider et al., 2012), which are associated with getting positive reactions from others. Symbolic use-value was the most significant motivational factor in open source software development (Roberts et al., 2006) and the second most significant in a crowdsourcing contest (Zheng et al., 2011). Product use-value is the motivation to develop or improve a product that will be useful in obtaining a separable outcome, such as greater efficiency at work. Motivational constructs associated with product use-value were found in four studies: product use-related needs (Lakhani & Wolf, 2005); product use-value (Roberts et al., 2006); instrumentality, meeting own need and a wider project goal (Budhathoki et al., 2010); product improvement and individual needs for new product features (Bretschneider et al., 2012). Product use-value was the most significant motivational factor in two studies of the studies of open source practice (Lakhani & Wolf, 2005; Budhathoki & Haythornthwaite, 2012) and the third most significant in the third of these studies (Roberts et al., 2006). Finally, distraction is the avoidance of unpleasant psychological states, such as boredom, anxiety or stress. A motivational construct associated with distraction was found in one study: pastime (Kaufmann et al., 2011), which is described as boredom avoidance. It was among the third most significant motivational factors in this study.

● Symbolic affinity

This is an extrinsic motive regulated by integration. It refers to those cases where an individual participates because he associates separable values or meanings with an event, product, task or community that correspond to his own values or at least values he would like to uphold – such as those of a community he identifies with. Motivational constructs associated with symbolic affinity were found in four of the studies: a dislike of proprietary software and the belief that source code should be open (Lakhani & Wolf, 2005); a unique ethos, altruism, socio-political motives, supporting identity formation and community development (Budhathoki et al., 2010); action significance by external values and community identification (Kaufmann et al., 2011), where the first is described as compliance with values external to the task context and the second as being guided subconsciously by norms and values of the community within which the task is performed; identifying with the firm, which is associated with shared values, and altruism (Bretschneider et al., 2012). Symbolic affinity related to altruism and socio-political motives was found to be the second most significant motivational factor in open source wiki development (Budhathoki & Haythornthwaite, 2012).

Each of the intrinsic motives corresponds to a psychological drive or disposition. In detail, they are the following:

● Relatedness

Relatedness corresponds to the need to feel connected to others. Motivational constructs specifically associated with relatedness were found in three studies: enjoying working with the team (Lakhani & Wolf, 2005); social contact (Kaufmann et al., 2011), understood as part of participating; peer to peer communication (Bretschneider et al., 2012), which is associated with the need to feel connected to others. Relatedness was not specifically found to be a significant motivational factor in any of these studies, although one study found that intrinsic motivation was in general the most significant factor in a crowdsourcing contest (Zheng et al., 2011).

● Competence

Competence corresponds to the need to feel competent. It includes both obtaining confirmation of one's level of competence (for example, by obtaining feedback) and exerting one's competence (for example, through practice). Autonomy corresponds to the need to feel in control, to make decisions and be a causal locus. Competence and autonomy are closely related and are therefore sometimes associated with a same motivational construct. Motivational constructs specifically related to competence, autonomy or both were found in three studies: intrinsic motivation (Roberts et al., 2006), which was described as related to the needs for autonomy

and competence; the needs for self-expression, self-image, self-efficacy and freedom to express (Budhathoki et al., 2010); direct feedback from the job and task autonomy (Kaufmann et al., 2011). Autonomy was found to be the second most significant motivational factor in crowdsourcing work. Competence and autonomy were found to be the third most significant factors in open source wiki development (Budhathoki & Haythornthwaite, 2012).

- Interest and enjoyment

Interest and enjoyment correspond to those cases where a task is performed because it is inherently intellectually stimulating or agreeable. Interest and enjoyment are closely related and are therefore also sometimes associated with a same motivational construct. Motivational constructs specifically related to interest, enjoyment or both were found in four studies: intellectual stimulation (Lakhani & Wolf, 2005); personal enrichment, fun and recreation (Budhathoki et al., 2010); skill variety and task identity (Kaufmann et al., 2011), which are described as having to use a variety of skills and the tangibility of the task result; intellectual stimulation and fun (Bretschneider et al., 2012). Interest and enjoyment were among the second most significant motivational factors in crowdsourced work (Kaufmann et al., 2011). Interest was the third most significant motivational factor in open source software development.

Further, in order to identify the likely most significant motives overall, motivational constructs in each study were assigned three, two or one points depending on whether they were among the first, second or third most significant motivational factors in their respective study. A ranking of the motives was done by adding the points from motivational constructs associated with a same motive. The motives found to be most significant were product use-value and interest (7 points), autonomy (6 points) and reward seeking, symbolic use-value and enjoyment (5 points).

Creating a model of motivations to participate in distributed problem-solving
By combining the thirteen motives identified in the literary review with SDT, a model was developed (Figure 1). As none of the studies in the literature review took into account all thirteen motives, this model is more complete and is intended to support maker engagement in humanitarian projects by providing humanitarian project organizers with a framework.
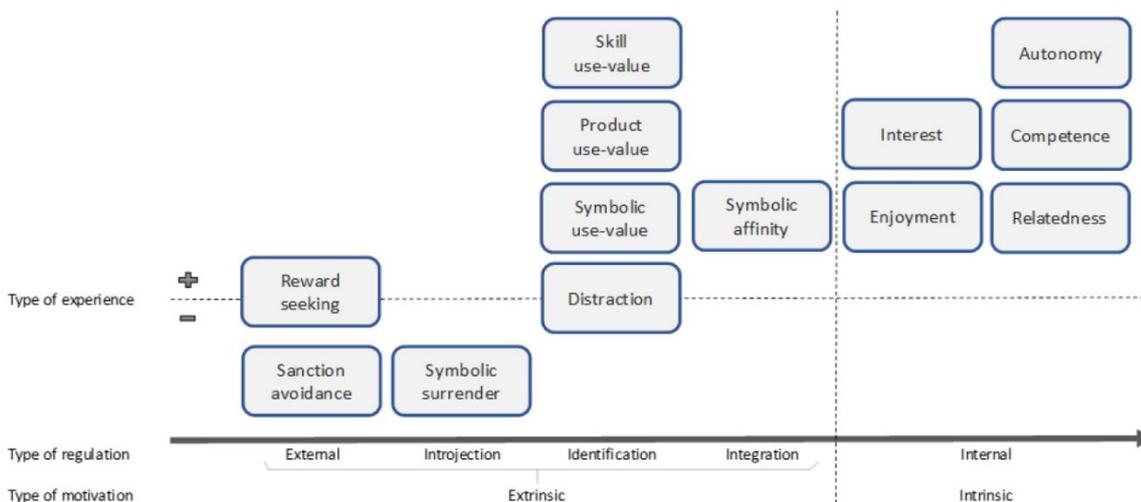

Figure 1. Model of motivations to participate in distributed problem-solving

The model is split horizontally (i.e. in relation to Ryan and Deci's (2000) continuum of internalization) and also vertically: two rows distinguish between those motives that are more likely to be experienced in a positive way (e.g. as related to personal goals and convictions) from those that are more likely to be experienced in a negative way (e.g. as external pressure or control).

Ranging from completely externally regulated to completely internally regulated, the motives developed are the following: reward seeking and sanction avoidance; symbolic surrender; skill use-value, product use-value, symbolic use-value and distraction; symbolic affinity; interest and enjoyment; autonomy, competence and relatedness. The last three motives are considered to be "deeper" forms of internal regulation, because they correspond to Ryan and Deci's (2000) three basic psychological drives.

Those constructs lying on the frontier separating positive from negative experiences can be experienced either way. For instance, distraction-motivated participation can be experienced negatively as "a waste of time" or positively as "a moment to relax". According to Ryan and Deci (2000), a task must satisfy to a certain a degree the needs for autonomy and competence to be experienced in a positive way. Some motives can be combined and even reinforce each other, while others conflict with each other. For instance, autonomy and competence can reinforce interest and enjoyment (Ryan & Deci, 2000) but sanction avoidance and symbolic surrender conflict with autonomy.

This model is used hereafter (i) to identify the most significant motives for maker participation in this context *and* (ii) to enable humanitarian project organizers to determine how these motives are regulated, how they interact with each other and how they contribute to engagement, learning, well-being, effort and creativity.

Method
Motivation has traditionally been studied by observing individuals' behaviour or asking individuals to report what motivates them. For instance, one popular way of measuring intrinsic motivation is by asking the individual to report on the level of enjoyment he associates with a task (Ryan & Deci, 2000). These self-reports can be collected using interviews or surveys. Online surveys are increasingly favoured, particularly for studying motivation in online contexts.

Our study was conducted in two stages. First, two qualitative semi-structured interviews and one open-ended questionnaire were used to test the completeness of our motivation model and develop a more specific and contextualized understanding of maker motives for participating in humanitarian projects. Then, an online survey was implemented on eSurvey Creator to test quantitatively the study hypotheses. Study participants in both stages had to meet two criteria: correspond to the maker profile and have experience participating in a humanitarian project as a maker.

The interviews and questionnaire were conducted in June 2017. The three participants were male engineers based in the U.S. and aged 24-54. All three were asked about how they participated in humanitarian projects, what enabled them to participate in this way, their motivations to participate and instances where they felt their participation wane.

The online survey contained a study-related question (How important were the following motivations in your decision to participate in humanitarian projects?) that had 13 items to measure the significance of the 13 motives in our motivation model. All of these items were measured using a 5-point Likert-type scale with 1 as "not important at all" and 5 as "extremely important". In addition, a form-of-participation-related question asked survey participants to select from a list the forms their participation took in these projects (i.e. Advice, Ideas, Design, Build, Program). The survey was actively shared between July and September, 2017 with eleven platforms or organizations associated with makers (e.g. Humanitarian Makers, Makers Unite, Manylabs, Nation of Makers, OpenIDEO, Maker Faire Zürich, Reddit, Tikkun Olam Makers) and received 118 valid responses. Based on the choice of platforms and organizations, we infer participants were mainly based in the U.S. or Europe. More than half of the 118 participants were aged 25-44 (60.2%), followed by those aged 18-24 (22.9%) and those aged 45+ (16.9%). In terms of experience, participants were equally split between those that had only participated in one humanitarian project (50%) and those that had participated in a few (50%). Around two-

thirds of the study participants (67.8%) had participated using technical skills (designing, building or programming). Of these, around one-third (33.8%) had participated using two or three different technical skills.

Results
The main objective of our study was to find out what motivates makers to participate in open innovation humanitarian projects. We found that, in overall, the most significant motives are interest and enjoyment followed by relatedness, symbolic affinity and competence.

Significant motives for maker participation in humanitarian projects
The first stage of our study provided qualitative answers to our research question. A first finding at this stage was that projects that combine multiple motivational factors are particularly engaging, especially those that allow participants to do something good (altruism) using their unique skillset (competence). For instance, interviewee 3 said: "I like solving problems...I guess that's why I am an engineer. If I can match my desire to solve problems with the alleviation of human suffering, then I'll choose those opportunities whenever I can."

A second finding was the importance of signaling the use-value of participating for the project's intended beneficiaries, which can be communicated via feedback from the beneficiaries or the project organizers. For instance, interviewee 1 spoke of 'gravitating' towards projects that many people have a need for and said: "If I contribute to something and then find out it's not effective, not useful, not wanted – that would probably kill the project pretty quickly for me."

A third finding was that interactions among makers can activate new interests that support learning and participation in new projects. For instance, interviewee 2 explained how a fellow maker had "triggered" in him a new interest to buy a 3D-printer, learn computer-aided design and participate in projects involving prosthetic designs.

The purpose of the online survey of the second stage was to determine quantitatively which are the most significant motivational factors in maker participation in humanitarian projects.

Items	Mean	SD
I hoped to win a prize	1.52	0.91
I was told that if I didn't, there would be bad consequences	1.38	0.76
I would have felt bad if I didn't participate	2.31	1.14
I wanted to develop a skill that I might need later on	3.36	1.08
I was working on a product that was also useful for me	2.59	1.28
It would send a good signal or message to others	3.18	1.26
I was looking for a distraction	1.97	1.05
It was something I had to do because of my values	3.54	1.17
I found it very interesting	4.12	0.79
I really enjoyed it	4.08	0.92
I could do it my way	2.81	1.21
It was an opportunity to use/test my skills/knowledge	3.53	1.04
It was an opportunity to do something with others	3.55	1.03

Table 1. Overall answers to question about motives for participating (Mean, Standard Deviation)

Table 1 shows the mean and standard deviation of each item of the study-related survey question (N = 118). The most significant motives were found to be interest (*M* = 4.12 out of 5, *SD* = 0.79) and enjoyment (*M* = 4.08, *SD* = 0.92). These motives were on average considered to be very important. The second most significant motives were found to be relatedness (*M* = 3.55, *SD* = 1.03), symbolic affinity (*M* = 3.54, *SD* = 1.17) and competence (*M* = 3.53, *SD* = 1.03). The third most significant motives were found to be skill use-value (*M* = 3.36, *SD* = 1.08) and

symbolic use-value (M = 3.18, SD = 1.26). These motives were on average considered to be moderately important. No significant differences were found in relation to age.

Figure 2 shows these results in relation to Ryan and Deci's (2000) continuum of internalization.
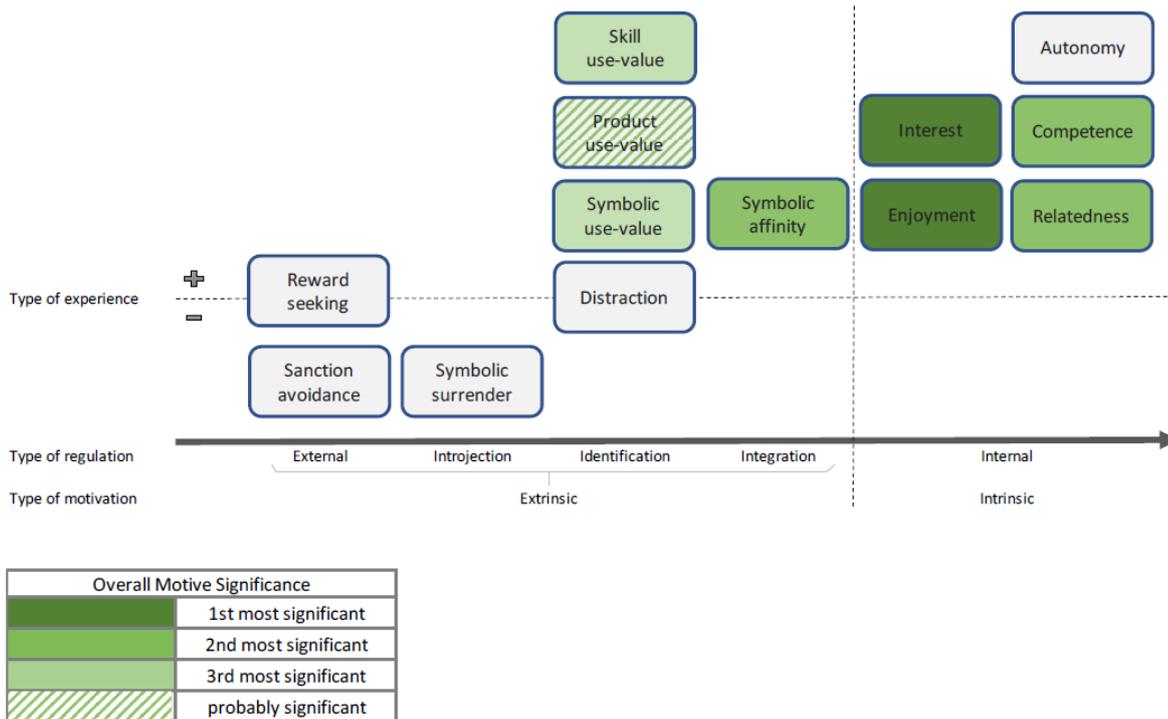

Figure 2. Significant motives for maker participation in humanitarian projects

In overall, it was found that the most significant motives for maker participation in humanitarian projects were interest and enjoyment, which are closely interrelated in this context, followed by relatedness, symbolic affinity and competence. Product use-value relative to the participant was not found to be significant at this stage. The overall results suggest that the significance of some motives for participation in distributed problem-solving (such as interest) may be stable across different contexts, while that of others (such as symbolic-affinity, relatedness and competence) are specifically significant in the context of maker participation in humanitarian projects.

Support to the completeness of the motivational model proposed
No new motives for participating in humanitarian projects were identified during the first stage of the study, which supports the completeness of the model proposed.

Discussion
The main objective of this study was to find out what motivates makers to participate in distributed problem-solving humanitarian projects.

All motives identified as significant for maker participation in humanitarian projects correspond to forms of intrinsic motivation or highly internalized forms of extrinsic motivation. Located on the right or 'high' side of the internalization continuum, the motives identified correspond to desirable forms of motivation associated with greater engagement, learning, well-being, effort and creativity (Ryan & Deci, 2000; Roberts et al., 2006) – which should support innovation and human capital building within virtual communities for innovation (Bretschneider

et al., 2012). Moreover, these motives are all likely to be experienced in a positive way – for example, as related to personal goals and convictions.

Interest and enjoyment were found to be the most significant motives for maker participation in humanitarian projects, supporting H2. Both are intrinsic motives regulated internally. Interest seemed to be primarily associated with finding solutions for technical challenges using very constrained resources. Enjoyment seemed to be associated with both the satisfaction of solving these technical challenges and the satisfaction of doing something good. These two motives were found to be deeply interrelated within this context. As those aspects that made participation most interesting and enjoyable were in direct harmony with the project goals, these intrinsic motives should not be associated with undesirable behaviours that could have a negative impact on project performance (Roberts et al., 2006) Instead, enjoyment-driven participation is associated with good performance, particularly in terms of idea quality (Bretschneider et al., 2012).

Relatedness and competence, two of the three second most significant motives, are also internally regulated intrinsic motives. Relatedness seemed to be associated with the need to interact with people with similar interests and build friendships. Competence seemed to be associated with the need to use unique technical skills – skills that participants felt particularly confident in.

Symbolic affinity, one of the three second most significant motives, is an extrinsic motive regulated by integration. Makers driven by this motive participate because the values or meanings they associate with the project community, the project itself or its beneficiaries correspond to their own values or at least values they would like to uphold. Within the context of our study, symbolic affinity was found to be primarily associated with altruistic values and identification with the project community. Identification with project beneficiaries was also found to be a supporting but not essential motive. Symbolic affinity was found to be particularly significant for participants that have participated in more than one humanitarian project. This is supported by Budhathoki and Haythornthwaite's (2012) observation that regular participants are motivated by the drive to support their community. Supporting the community, for example by sharing knowledge and experience, contributes significantly to the quality of making (Kwon & Lee, 2017).

Skill use-value and symbolic use-value, the third most significant motives, are extrinsic motives regulated by identification. Makers driven by these motives participate because of the opportunities to develop skills or send signals that can lead to separable outcomes, such as being noticed for a job position. These motives were particularly significant for the 18-24 age group. This can be explained by the fact that members of this age group are either completing their education or just starting their careers and therefore allocate more importance to opportunities to develop their professional skills and be noticed by potential employers. Participation driven by symbolic use-value is also associated with good idea quality (Bretschneider et al., 2012).

Although product use-value was not found significant during the second stage, there were indications in the first stage that it is significant. This divergence can be explained by a difference in types of product use-value. The survey tested for the significance of product use-value relative to the participant – this was found to be insignificant. However, participants in the first stage spoke about the importance of feeling that the product was useful for its intended beneficiaries. In other words, participants were not significantly motivated by how useful the product they worked on was for them, but how useful it was for its intended beneficiaries. H1 is therefore partially supported.

The positive and highly internalized motives for participation identified on the maker side of humanitarian projects indicate that the conditions are right for durable and productive open innovation for the humanitarian sector. It is up to humanitarian organizations to learn how to reach and engage these makers. Although most of the motives identified as significant can be self-activated, specific humanitarian projects still need to compete with other projects to reach and engage participants. In other words, our study has shown that many of those makers that have participated in humanitarian projects are individuals driven by feelings of altruism and the needs to be intellectually stimulated, experience enjoyment and relatedness, and feel competent. These drives

and feelings can be satisfied in different ways. In order to attract participants, humanitarian project organizers need to reach these individuals with information about their projects and engage them. As Leimeister et al. (2009) noted, organizational measures and tools can be designed to support behaviour activation by reinforcing incentives. It follows that humanitarian project communications and organization should be designed to support those motives that were found to be most significant.

Our study indicated that at least some makers participate in humanitarian projects because they allow them to satisfy multiple motives simultaneously – particularly altruism, competence, interest and enjoyment. Indeed, at least some makers are attracted to humanitarian open innovation projects because they prefer using their unique skillset to help others, which is both technically interesting and enjoyable. Humanitarian open innovation projects can communicate about this unique way of participating to stand apart from humanitarian projects that do not offer this. Competence, interest and enjoyment related to technical challenges can be incentivized by designing tasks that are varied, complex and allow for a certain level of autonomous work (Ryan & Deci, 2000; Zheng et al., 2011). Feelings of competence can also be reinforced by giving participants positive performance feedback (Leimeister et al., 2009) and interest by encouraging participants to share and discuss their work with makers internal and external to the project. Indeed, our study showed that makers interest each other in new projects. Relatedness and community identification can be incentivized by promoting the development of virtual communities for innovation – for instance, by providing online platforms that support communication between members and communicating in a way that emphasizes the shared identity. Skill use-value and symbolic use-value can be incentivized for young makers by framing participation as an opportunity to develop professional skills and signal competence to potential employers. Product use-value can be incentivized, on the one hand, by communicating as intensely as possible beneficiaries' satisfaction with the product and, on the other hand, by making sure participants get necessary feedback to develop useful solutions from project organizers or beneficiaries. External incentives, such as tangible rewards, competition pressure and threats should be avoided as they were not only found to be insignificant but can also be experienced as external behaviour controllers, thereby conflicting with positive internal motives.

With regard to the model developed, from a scientific perspective, it brings together motivational constructs from different studies of distributed problem-solving practices and Ryan and Deci's (2000) continuum of internalization. From a practitioner's perspective, this model provides a framework for identifying as many motives for participating as possible and classifying them relative to engagement, learning, well-being, effort and creativity in order to support engagement and qualitative participation in open innovation distributed problem-solving practices.

Conclusion

This study sought to find out what motivates makers to participate in humanitarian projects. For the purpose of this study, a model of motivations to participate in distributed problem-solving was developed. It was found that the most significant motives are interest and enjoyment followed by relatedness, symbolic affinity and competence. Symbolic affinity was found to be particularly significant with older and more frequent participants, while relatedness and competence were relatively stable motives across different age and participation frequency groups. Product use-value relative to the participants was found to be insignificant, although there were indications that product use-value relative to its intended beneficiaries may be a significant factor. Skill use-value and symbolic use-value were also found to be moderately significant, particularly with young makers starting their professional careers.

Limitations

This study had a number of limitations. First, there were some limitations concerning the study design. Motivation was studied based on self-report, which is vulnerable to different biases – especially social desirability bias. Second, there were some limitations concerning the impact of the study. Given the difficulty of reaching makers that had been involved in humanitarian projects and were willing to participate in our study, certain population groups were more represented than others: participants were all U.S.-based male engineers and most of the groups that agreed to share the survey were either based in the United States or in Europe. Third, there

were some limitations concerning data. Some respondents had not really been involved in humanitarian projects but in general social good projects. Although definitions of what a humanitarian project involves were provided for participants of the study, it is possible that other participants were also referring to general social good projects rather than humanitarian projects. Also, potentially relevant demographics such as more precise age groups, gender, employment status, profession and location were not studied.

Future research is needed to increase our understanding of maker motivations to participate in humanitarian projects. More quantitative research is needed to test the significance of different motives, in particular of product use-value with regard to beneficiaries. Qualitative research is also necessary to better understand certain motives within this context, such as symbolic use-value and skill use-value. It would also be useful to conduct further research to identify efficient communication- and task-design elements for incentivizing motivation based on motives identified as significant.

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Ballerup Bibliotekernes Makerspace

- Eksempel fra praksis

Bibliotekets formål er at fremme oplysning, uddannelse og kulturel aktivitet som beskrevet i biblioteksloven (Kulturministeriet, 2013). Det gør vi allerede i stor stil ved at stille fysiske og elektroniske materialer til rådighed. Men med Ballerup Bibliotekernes Makerspace går vi skridtet videre ved også at stille den nyeste teknologi til rådighed for borgerne for at skabe nye fællesskaber omkring læring og innovation.

Ballerup Bibliotekernes kerneopgave er defineret som: "Vores kerneopgave er at formidle kultur, viden og oplevelser i et frirum, hvor borgerne er medskabere. Vi er stifindere og skaber sammenhængskraft."

Ballerup Bibliotekernes Makerspace er i høj grad med til at understøtte kerneopgaven, bibliotekets formål, samt Ballerups Vision 2029 (Ballerup Kommune, u.å.) som har udpeget 4 temaer ("Åben for nye idéer", "En stærk uddannelsesby", "En grøn by i balance", "En førende erhvervsby" samt hovedtemaet "Vi skaber fremtiden sammen").

Vi er ikke et Hackerspace eller Fablab, da det ville begrænse vores maskinpark og tilgang (Cavalcanti, 2013). Makerspaces har et bredere fokus, som ikke tager udgangspunkt i en bestemt maskinpark eller elektronik. Det har blandt andet betydet at Ballerup Bibliotekernes Makerspace indgår som en mere naturlig del af Ballerup biblioteks aktiviteter og dannelsesprojekt.

Kernen af vores Makerspace er et værksted, som alle kan lære at bruge. Her kan du både møde kreative sjæle, iværksættere, pensionister, teknologi-interesserede, børnefamilier, jobsøgende, studerende, foreninger og andre nysgerrige mennesker.

Maskinparken består af en lang række maskiner, der kan understøtte og virkeliggøre borgernes ideer. Der er både maskiner til at lave fysiske prototyper som 3D printer, laserskærer, CNS-fræser, storformatprinter og computere med programmer til at skabe digital grafik.

Budgettet for at opretholde et Makerspace er omkring 65.000 kr. om året. Budgettet indeholder udgifter og indtægter på materialer, supportaftaler, softwarelicenser, arrangementsudgifter til materialer, småindkøb af nyt

værktøj/maskiner og vedligehold. Budgettet indeholder ikke afviklingsudgifter på maskiner eller personaleudgifter.

Digital Dannelse

Ballerup Bibliotekerne arbejder med digital dannelse og er blevet inspireret af Dansk IT's anbefalinger (Steen-Hansen, 2016) til styrkelsen af danskernes digitale kompetencer, som er udarbejdet sammen med Danmarks Biblioteksforening (ibid.) i 2016. Anbefalingerne er stadig et udkast.

Anbefalingerne består af

Digitale brugerkompetencer:	**Digitale skaberkompetencer:**	**Refleksive digitale kompetencer:**
Kende til og forstå digitale værktøjer At besidde grundlæggende tekniske færdigheder og viden.	**Omdanne information** At kunne tage afsæt i, udvælge og omdanne tekst til bestemte formål.	**Anvende information trygt** At kunne forstå og håndtere etiske og lovmæssige problemstillinger i forbindelse med digitalt baseret kommunikation.
Tilgå og evaluere information At kunne finde, hente samt bedømme relevans, integritet og brugbarhed.	**Skabe information** At designe og udarbejde it-produkter til bestemte målgrupper og formål.	**Identitetsskabelse** At kunne agere hensigtsmæssigt i forhold til, hvordan man ønsker at fremtræde som et digitalt formidlet individ.
Håndtere information At kunne kategorisere, organisere og lagre information på en effektiv og genbrugelig måde.	**Dele information** At kunne forstå og bruge digitale værktøjer til at samarbejde, kommunikere og udveksle informationer.	**Samfundsforståelse** At kunne forstå hvordan den digitale udvikling påvirker samfundet og dets institutioner og virksomheder.
	Konstruere At kunne forstå og bruge strukturer og algoritmer, herunder at forholde sig skabende til dem.	**Digital dannelse** At kunne udfolde sig og deltage i alle samfundsmæssige forhold.

Anbefalingerne har været med til at skabe et overblik over de mange digitale tilbud vi tilbyder: IT-hjælp, debatarrangementer om digital sikkerhed, udvikling af tilbud til læsesvage, understøttet læseglæde ved hjælp af en humanoid robot, samt vores Makerspace-tilbud.

Maker-fokus

Man kan groft opdele maker-bevægelsen inden for udviklingen af 4 hovedområder: Digital prototype, Elektronik, Tekstil og Håndværk. I Ballerup Bibliotekernes Makerspace har vi fokuseret på Digital prototypeudvikling samt elektronik. Vi udvidede med elektronik-indsatsen efter halvandet år.
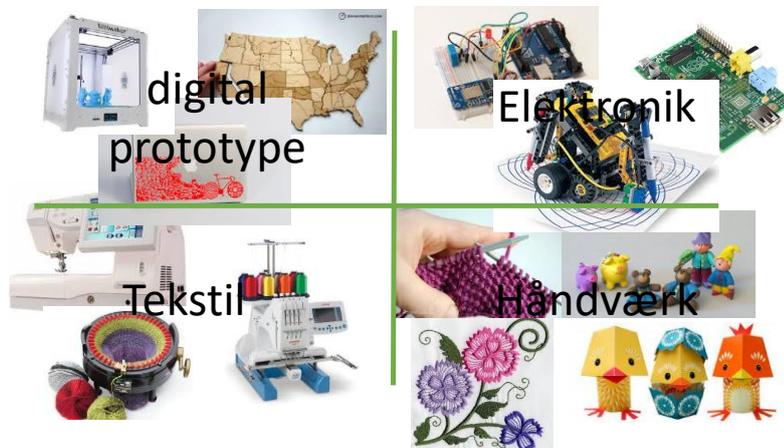
Elektronik-delen er hovedsagelig aktivitetsbaseret med events inden for f.eks. Lego Mindstorm (Lego Group, u.å.), Lego Art Machines (Ryan, 2016), Little Bits (Littlebits Electronics Inc., u.å.), Ultra:Bit (DR, u.å.) og Arduino (Arduino, 2018).

Digital prototype-delen understøtter vi med Åbent Hus, hvor vores åbningstid er 13-19 mandag til torsdag, samt lørdag en gang om måneden fra 10-14. Næste år udvider vi lørdagsåbent til alle lørdage, da det har vist sig at være en stor succes. I åbningstiden står bibliotekets ansatte klar til at give en hånd med at bruge stedets maskiner. Maskinerne kræver, at man bliver introduceret til deres muligheder og begrænsninger, før man kan bruge dem. Personalet udfører ikke, men understøtter det borgeren gerne vil skabe. Alle er velkommen til at komme ned og arbejde eller bare se værkstedet i vores betjente åbningstid, og borgerne behøver ikke at reservere tid for at bruge stedet eller maskinerne.

Derudover holdes introkurser, som afholdes af vores kompetente gruppe af frivillige. Introkurserne foregår en gang om måneden (undtaget ferierne). Vi afholder desuden kurser til folkebiblioteket som led i folkeskolereformen, hvor folkeskolen som led af de nye læringsmål skal inddrage virksomheder, foreningen og andre interessenter i deres undervisning (SIV, u.å.). Derudover afholder vi aktiviteter i alle ferierne. Typisk et arrangement om dagen. Arrangementerne har bestået af f.eks. Makey Makey hvor man spiller arkadespil på bananer eller lignende, 3D print af fidget spinners eller bogmærker, 3D skanning af dig selv med efterfølgende 3D print, sæbebobletryllestave, højtalere af toilet og køkkenruller til din smartphone, kuglebaner, vinyltryl på t-shirts, samt lav dine egne smykker og badges.

Borgerne kan lære maskinerne og softwaren at kende og udvikle kompetencer inden for fremstilling med digitale redskaber. Fokus er derfor på forløbet fra idé til færdig model og ikke på produktion, og som bruger må du derfor kun lave et enkelt eksemplar af deres design. Vi har derfor også begrænset materialerne til prototype-udvikling og ikke færdige produkter.

De fysiske rammer for Makerspace
Makerspace består af 5 rum: Showroom med plads til leg og læring, maskinpark, undervisningslokale, mødelokale og et rum til laserskærer og CNC-fræser. Disse rum understøtter alle forskellige dele af den innovative proces og er indrettet derefter. Rummene er i konstant udvikling og der er blevet foretaget 3-4 større indretninger på 3 år.

Fra at have haft maskinparken i makerspace i fokus, har vi, inspireret af det arbejde som Future Classroom Lab laver med makerspaces i folkeskolen (Future Classroom Lab., u.å.), herunder udvikling af nye læringsbegreber (21skills (Center for Undervisningsmidler, 2018)), ændret lidt på vores tilgang til brugen af makerspace. Leg og læring er kommet lidt mere i fokus i stedet for maskinerne, så brugerne kan starte ud med materialer og færdigheder de allerede kender og besidder. Og først i næste led introduceres de for maskinerne, der hvor det giver mening. På den måde kan leg med Lego føre til Lego Mindstorm, Tegning og piberenser til 3D print, osv.

Hovedrummet er dog stadig maskinparken som er indrettet som et værksted og har et større arbejdsbord i midten af rummet.
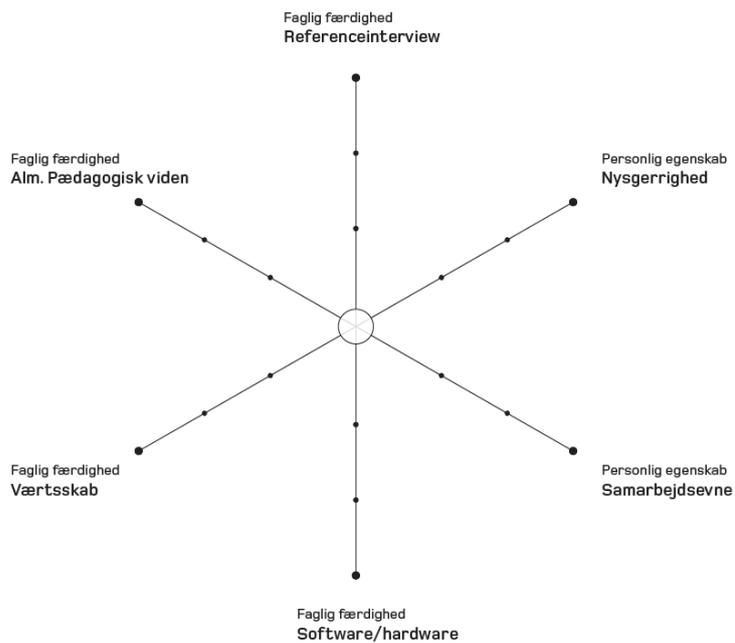
Hvordan lykkedes vi
De frivillige spiller en stor rolle i Ballerup Bibliotekernes Makerspace i form af afholdelse af de mange introkurser, der efter 3 år stadig er en stor succes. For at benytte sig af maskinparken kræver det nogen grundlæggende færdigheder som alle har mulighed for at lære på introkurserne.

For at sikre sammenhængskraften med biblioteket er der indsat personale til at afholde åbent hus og afholde aktiviteter. Dette har krævet en længerevarende kompetenceudvikling. For at understøtte denne proces har Maker-gruppen i fællesskab udarbejdet et kompetencespind med 3 niveauer, fra laveste niveau (centrum) til

højeste niveau (yderst), gående fra kendskab til kunne og mestre. Kompetencespindet bliver udfyldt som led i de årlige medarbejdersamtaler (MUS), og der er udarbejdet makerskills som alle skal kunne.

Kompetencespind for rollen

Makerspacevagt

Faglig færdighed
Referenceinterview

Faglig færdighed
Alm. Pædagogisk viden

Personlig egenskab
Nysgerrighed

Faglig færdighed
Værtsskab

Personlig egenskab
Samarbejdsevne

Faglig færdighed
Software/hardware

FAGLIG FÆRDIGHED

Referenceinterview

Opgavevurdering
Begrænsninger
Inspiration

FAGLIG FÆRDIGHED

Alm. Pædagogisk viden

Coaching
Sidemandsoplæring/sparring
Undervisning

PERSONLIG EGENSKAB

Nysgerrighed

Nørde
At synes at det er sjovt
Mod til at prøve tingene af

FAGLIG FÆRDIGHED

Værtskab

Elevatortale
Opsøgende
Facilitator / Henvise
Lokalkendskab

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Software/hardware

Maskiner
Materialer
Programmer

PERSONLIG EGENSKAB

Samarbejdsevne

Tværfagligt
Sparring og videndeling
Fx. at se muligheder i at kombinere
fagligheder og samarbejde mellem
for eksempel skøn og børn eller
Makerspace og Lab

Grafisk software	
___	Afmask objekter i photoshop med at bruge lagmasker
___	Afmask objekter i illustrator med en udsnitsmaske
___	Kende til lag og flytte rundt på objekter inden i Photoshop, Illustrator og Indesign
___	Kende til de forskellige farvesystemer CMYK, RGB og HEX
___	Forstå forskel på vektor- og pixelgrafik og kende til opløsning (ppi)
2D filer til lasercut, vinylcut og plotter	
___	Forstå streger og flader i Illustrator og kunne ændre farver og tykkelse på disse
___	Bruge 'billedevektor' (eng.: image tracing) til fx at lave skærestreger
___	Bruge 'penneværktøj' (eng.: pen tool) til at lave skærestreger
___	Gemme en Illustrator-fil i PDF og i EPS-format
___	Printe en EPS-fil på Roland VersaWorks (vinylcutteren)
___	Oprette dokumenter i InDesign i den størrelse, som man vil printe
___	Placere en fil i et InDesign-dokument (filer>indsæt eller Ctrl+D)
___	Printe på Epson storformatsprinteren fra InDesign
___	Kan udføre et automatisk nozzle check og rens på Epson plotteren
Laserskæring	
___	Kende til sikkerhed i materialevalg og maskinbrug
___	Kan rense de tre spejle og linsen
___	Kan indlæse fil i laserens program
___	Kan indstille materiale og betjene laserprogrammets basale funktioner
3D print	
___	Skifte filment på Ultimakeren
___	Åbne tinkercad og lave en model eller finde en model online
___	Få en STL fil ind i Cura, indstille printet og få det på SD-kort
___	Printe på Ultimakeren fra SD-kortet
___	Kalibrere printpladen

Der er sikret en bred personalesammensætning bestående af klassiske bibliotekariske profiler (børne-, og voksenbibliotekar) til andre akademiske profiler. Dette har gjort at Makerspace er en fuldt ud integreret del af biblioteket og ikke et biprodukt.

Fremtiden
Ballerup Bibliotekernes Makerspace er i konstant udvikling. Maskinparken udvides med nye maskiner, der skal nye kompetencer til og vi indgår nye samarbejder. I 2018 forventer vi at 500 børn, 800 folkeskoleelever og 300 borger vil gøre brug af makerspace.

I forbindelse med Ballerup Biblioteks samarbejde med innovationsuddannelsen på DTU, som blev indgået sidste år, har studerende kodet vores humanoide Pepper robot (Softbank Robotics America, Inc., 2018) til at kunne vise rundt i makerspace. Bl.a. kan den fortælle om vores 3D printere, laserskærer mv.

I efteråret 2019 gennemfører vi er innovationsforløb i makerspace i samarbejde med det lokale gymnasium Borupgaard og DTU Diplom. Her skal de studerende sammen med borgere i Ballerup udvikle prototyper der relaterer sig til FNs verdensmål. Forløbet afsluttes med en fælles videnfestival "verdens Bedste Løsninger LIVE!".

Vi har på biblioteket skelet til MITs PLIX program (plix, u.å.) med læringsforløb i makerspaces. Her ser vi et fremtidigt potentiale hvor elever, studerende og almindelige borgere kan indgå i videns- og læringsforløb i tværfaglige projektforløb. F.eks. kan man koble vores byhaver i Skovlunde til bygning af Food Computer (England, 2017) i makerspace.

Generelt er makerspace også en øjenåbner for de studerende. De udfordres i deres grundforståelse af et bibliotek som "kun" bøger, og viser en umiddelbar interesse i at bruge biblioteket mere. Vi har udviklet på vores studiemiljø for alle elever og studerende. Her spiller makerspace også en rolle i at tiltrække flere og nye brugere. Makerspace bruges bl.a. til at "pimpe" deres opgaver op, ved at udvikle prototyper, forbedre layout mv.

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Anmeldelse:

De skjulte algoritmer: Teknoantropologiske perspektiver

De skjulte algoritmer: Teknoantropologiske perspektiver, af Klavs Birkholm og Niels Frølich (red.), Djøf Forlag (2018), 272 sider.

Hvad forstår vi egentlig ved en algoritme, er det en formel, en regnemodel eller noget mere komplekst? I sin grundlæggende betydning kan man ligestille en algoritme med en forskrift, en formel eller en regnemetode. Algoritmer i dag forbindes med computere og data. Fx har de fleste søgemaskiner en 'ranking' algoritme, der sorterer søgeresultater efter forskellige typer af relevans. Andre algoritmer kommer med anbefalinger af indhold på websites, baseret på brugerpræferencer, 'likes' og tidligere aktivitet. De sidste 10 års udvikling indenfor digitale medier, sociale medier, 'internet of things' etc. har medført en stigende interesse for data, især de data brugere af digitale platforme og enheder kan levere igennem deres forbrug. Det problematiske er, at mange brugere ikke er bevidste om, i hvilket omfang de leverer data til fx Facebook eller Google, ligesom mange heller ikke er bevidste om, hvad disse data kan bruges til.

På den måde kan titlen 'De skjulte algoritmer' siges at være velvalgt, de digitale platformes algoritmer opererer under radaren. Vi kan ikke se dem, eller få adgang til dem, og hvis vi kunne ville vi ikke være i stand til at gennemskue dem.

Bogen udgøres af en samling af artikler med forskellige bidragsydere, og udgør således en samling af forskellige perspektiver på algoritmer og måden hvorpå de påvirker vores hverdag.

Bogen indledes af en længere introduktion der sætter scenen for bogen. Bogen er tænkt som en debatbog, der har til formål at pege på og problematisere måden hvorpå internettets algoritmer i stigende grad influerer vores tilværelse.

I den forbindelse bliver vores opfattelse af digitalisering problematiseret og der peges på hvordan centrale begreber, indenfor det seneste årti, har fået en betydningsmæssig forandring. Fx betyder digitalisering ikke som

i den oprindelig betydning overgang fra analog til digital, men har fået tilført en klang af effektivisering og et fokus på værdiskabelse. Digitalisering handler nu om at udføre arbejdsopgaver smartere, mere effektivt og nyttigt. Moderne automatiseringskultur handler således om værdiskabelse. Vores kulturarv digitaliseres ikke af alene af hensyn til bevaring og adgang for kommende generationer, men foregår snarere med kapitalisering for øje.

Det gennemgående tema i bogen er, som titlen antyder, algoritmens særegenhed. Algoritmer er i princippet altid usynlige for brugere fx af sociale medier – en algoritme er i sagens natur en formel sorteringsmekanisme – men det særlige er at algoritmer håndterer, syntetiserer og korrelerer store mængder af data i en størrelsesorden der ligger udenfor den menneskelige bevidstheds fatteevne og at dette sker i det 'skjulte' forstået således, at den enkelte bruger ikke har mulighed for at 'regne efter' eller gennemskue forudsætningerne for og konsekvenserne af algoritmens informationshåndtering.

I flere af bogens kapitler peges der på den etiske og politiske udfordring der knytter sig til en tilsyneladende blind tro på algoritmens autoritet. Klavs Birkholm viser hvorledes der er en tilsyneladende tæt sammenhæng imellem digitalisering, disruption, algoritme og AI, og benævner dette 'Big Data-hjulet'. I Big Data-universet tilskrives disse begreber afledte betydninger, hvor digitalisering oprindeligt knyttede sig til en informationskultur, dvs. remediering, nu knytter sig til en automatiseringskultur. På samme måde peger forfatteren på at 'algoritme' ikke længere blot betyder en regneforskrift, men et program, der rummer mange regneforskrifter, fx nævnes Facebooks news-feed-algoritme som et program med mere end 50 millioner linjer kildetekst. AI er blevet synonymt med stor datakraft og disruption er et nyt modeord der i sin oprindelige engelske betydning betyder forstyrrelse eller at afspore, men som snarere på nydansk er blevet synonymt med udviklingen af nye digitale markedspotentialer. Klavs Birkholm rejser her en relevant og vigtig debat ift. vores blinde tro på algoritmens autoritet. Algoritmer er koder, og er programmeret til at opføre sig på en særlig måde, dvs. algoritmer er hverken neutrale eller uafhængige. Når Facebook fx justerer sin algoritme har det konsekvenser for hvilke informationer der tilflyder de enkelte brugere. Klavs Birkholm peger endvidere overvågningsproblematikker, på flere problemstillinger ift. håndtering af sundhedsdata og ikke mindst på hvem der ejer disse data. Klavs Birkholm frygter ganske enkelt at den legitimitet og autoritet vi tillægger 'algoritmen' suspenderer etisk og politisk refleksion.

De efterfølgende kapitler omfatter en divers buket af forskellige indlæg, der diskuterer risikoen og faren ved den digitale udvikling, hvor algoritmer, kunstig intelligens og robotteknologi bliver mere effektiv, og i stigende grad bedre til at udføre komplekse opgaver og håndtere data, og i sidste instans kan ende med erstatte mennesket. Således skriver Massimo Mazzotti i bogens 2. kapitel om dataismen som en mulig fremtidsvision.

I bogens 3. Kapitel skriver Carole Cadwalladr om hvordan Googles søgealgoritme kan favorisere yderst problematiske resultater. Fx har højreradikale grupper været dygtige til at koble deres hjemmesider i netværk, som påvirker Googles søgealgoritme. Carole Cadwalladr demonstrerer således hvordan søgninger på jøder og kvinder giver tophits der fremmer jødehad og had mod kvinder. Hun skriver endvidere om den mørke side af disruption, at magt og magtpåvirkninger skjuler sig bag algoritmer, og at der i dag udkæmpes en krig om information på internettet.

Flere af bogens øvrige kapitler handler om hvordan algoritmerne trænger ind i vores dagligdag og bliver nærværende ift. bankers kreditvurdering og forsikringsselskabers fastsættelse af forsikringspræmier (kap 4) samt 'internet of things' hvor for vi som forbrugere leverer stadig flere data om os selv til internetgiganterne (kap. 5). Spørgsmålet bliver i høj grad om hvem der har ejerskabet og rettighederne over vores data, og om vores teknologibegejstring og bekvemmelighed fører til en form for magtblindhed (kap. 6), hvor vi ikke længere er i stand til at gennemskue, hvordan algoritmerne påvirker vores holdninger og værdier.

Niels Frølich (kap. 7) efterlyser et etisk kodeks for software udviklere. Når nu den digitale udvikling er global, må vi have en human etik, der går på tværs af såvel geografiske/nationale grænser som virksomheders og aktionærer interesser.

Kap. 8 peger på det globale overvågningssamfund, hvor nye teknologier med ansigtsgenkendelse, dels giver brugere nye mulighed for sikker identifikation fx til at låse telefoner op med, og dels giver uoverskuelige muligheder for global overvågning, for hvem har og kan få adgang til de data vi frivilligt uploader til fx Apples servere.

Kap. 9 og 10 udfolder risikoen ved automatisk sagsbehandling, fx hvordan sikrer vi vores retssikkerhed, hvis vi ikke har mulighed for at gennemskue hvorfor en algoritme er nået frem til et givent resultat?

Bogens sidste kapitel diskuterer, igennem en række eksempler, hvorledes algoritmisk regulering i sidste ende kan blive politikkens død.

En af bogens vigtigste pointer synes at være at de skjulte algoritmer er ved at overtage styringen i flere af samfundslivets facetter, og vi – forbrugerne – finder os i det og afgiver frivilligt mere og mere af os selv til tech-giganterne.

Bogen tegner således et dystopisk billede af hvordan tech-giganterne og computeralgoritmer i stigende grad vil påvirke og regulere vores liv. Data kan bruges og misbruges, og det er denne problemstilling debatbogen ønsker at rejse - hvordan sikrer vi at vores data ikke misbruges, og ender i digitale it-monopoler. Debatten er velkommen, og yderst relevant, omend debattørerne synes at være ensidigt udvalgte kritikere. Som nævnt skal bogen læses om et debatoplæg, men en oplyst debat kræver synspunkter fra begge sider. Bogen her synes i overvejende grad at indtage det kritiske syn på it-udviklingen, og frygten for at algoritmerne skal tage magten fra os.