"I have so little time [...] I got shit I need to do": critical perspectives on making, sharing and innovating in Manchester's FabLab

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Abstract

This paper argues for rethinking economic geographical of sharing and making in light of the recent proliferation of open innovation, makerspaces and maker movements. Using empirical research from an example of one such makerspace - Manchester's FabLab - and engaging with a range of geographical literatures on making, sharing economies, and digital fabrication, we develop a critical account of sharing in principle and in practice. The portrayal of open innovation spaces, such as FabLabs, as novel makerspaces of alterity and sharing is a common and underpinning theme in both academic and marketing literature (Aldrich, 2014; Anderson, 2012; Doherty, 2012, Gershenfeld, 2005; Fab Foundation 2012; Suire, 2019). However, our findings suggest that the values espoused by the FabLab, of involvement, connection and affinity are quite literally being revised and rejected by makers who use the space. Time, labour and knowledge were for the most part described by participants as precious commodities to be savoured rather than shared. Thus, while sharing is an ordinarily economic practice, this does not mean it is always, inevitably or evenly employed by economic actors and communities, especially within counter-cultural networks. If these are to be the economies of the future, we implore economic geographers to critically engage further with the complexities of and within maker spaces.

Keywords: sharing economies, making, makerspaces, FabLab, Manchester

1. Introduction

The proliferation of sites of 'open innovation', including 'open workshops', hackerspaces, makerspaces, FabLabs, living labs and urban laboratories has attracted burgeoning attention from within in beyond academia. Brook (2011:1) claims that "hackerspaces are the digital-age equivalent of English Enlightenment coffee houses. They are places open to all, indifferent to social status, and where ideas and knowledge hold primary value'. Social scientists have shown particular interest in the products produced (Walter-Herrmann and Büching, 2013, Stacey, 2014; Suire 2019), educational uses (Schelhowe, 2013; Halverson and Sheridan, 2014) and contribution to a 'third industrial revolution' (Aldrich, 2014, Laplume *et al.* 2016). Within geography the focus has been upon these sites as localised spaces in which innovation, making and creativity occurs (see for example Capdevila, 2017, Schmidt and Brinks, 2017; Schmidt 2019). While there is indeed plenty of scope for learning more about the economic and social possibilities and outcomes for entrepreneurs and local communities from these spaces, this paper pauses to reflect upon a key assumption undermining much research – that these spaces are sites of sharing. Wrapped up in discourses around 'open innovation' there are often explicit or implicit references made to 'sharing', but without sufficient critique or empirical research as to what this involves in practice.

This paper positions our empirical research on Manchester's FabLab within literatures on sharing economies and maker movements. We develop emerging literature that argues for sharing as an established part of many existing economic activities, rather than as an alternative economic principle (Belk 2007, Frenken and Schor 2017, Hall and Ince 2018). The portrayal of open innovation spaces, such as FabLabs, as novel

makerspaces of alterity and sharing is a common and underpinning theme in both academic and marketing literature. It has led to assumptions, too, that the underpinning ethos and activities are also based on sharing and innovation, in many different forms. However, we show this not to be the case in practice. We argue for the importance of applying a critical geographical framework to this contemporary phenomena and to emphasise that sharing (and making) are varied in definition and form.

The paper is structured thus: the theoretical section of the paper examines sharing economies and making in the context of open innovation spaces, including FabLabs. The review of literature identifies limitations in the criticality of existing understandings of the practices of sharing and making. Section 3 outlines the methodological approach taken. Our findings are presented in Section 4, structured around our three key findings, i) envisioning sharing and making in the FabLab, ii) spaces of sharing in and beyond the FabLab, and iii) obstacles to sharing in the FabLab. The final section presents our conclusions, raises questions about the sustainability of the FabLab model and develops reflections on future research avenues in the fields of making and sharing.

2. Economic geographies of sharing and making

Makerspaces are often cited as important sites of sharing and making (Aldrich, 2014; Anderson, 2012; Doherty, 2012, Gershenfeld, 2005; Fab Foundation 2012; Suire, 2019). As such, this paper reviews existing literature on makerspaces and FabLabs,

sharing economies and making and consumption and highlights the research gaps that we seek to address.

FabLab digital fabrication spaces

The last 15 years have witnessed the global emergence and expansion of different types of open innovation spaces, providing an arena for individual and collective creativity through the creation of craft-based products and experimentation with business or creative ideas using innovative technologies such as 3D printing or CNC [computer numerical control] milling machines (Schmidt, 2019). Such spaces are described using terms such as 'open labs', 'open workshops', 'makerspaces', 'hackerspaces' and 'FabLabs'. Individuals are able to utilise new technologies and digital tools to become 'hi-tech do-it-yourselfers who are democratizing access to the modern means to make things' (Gershenfeld, 2012: 48). FabLabs are one type of digital fabrication space that can be differentiated from other spaces due to their origin, motivations and objectives. Emerging out of the Center for Bits and Atoms, at MIT, FabLabs offer access to a range of low-cost fabricators and many of them operate on a commons-based peer production approach (Benkler, 2006).

As for a definition, a FabLab is 'a collection of commercially available machines and parts linked by software and processes' (Gershenfeld, 2005), including laser cutters, CNC milling machines and desktop 3D printers. This enables FabLab users to design, make and prototype items using digital technologies. Open access to these technologies was the motivating factor for the first wave of FabLabs established in 2002 in India, Costa Rica, northern Norway, inner-city Boston and Ghana (Gershenfeld, 2005). FabLabs can be differentiated from other types of makerspaces

as they have open hours that are free to the public rather than the paid membership model typical of many maker or hackspaces. They also typically have more digital equipment (such as 3D printers) and a standard core set of equipment common to all FabLabs, designed to facilitate knowledge exchange across FabLabs globally.

The broader aims of the Fab Foundation (the umbrella organisation overseeing FabLabs) are that the labs are technical prototyping platforms for innovation and invention 'providing stimulus for local entrepreneurship' and as a platform for learning and invention: 'a place to play, to create, to learn, to mentor, to invent' (Fab Foundation, 2018). The emphasis on play is significant as it generates more experimental practices in the FabLabs, rather than making repeat items or micro-manufacturing. The Fab Charter – which all FabLabs adopt – lists what is in a FabLab: 'an evolving inventory of core capabilities to make (almost) anything, allowing people and projects to be shared'; that the FabLabs are 'a community resource, offering open access for individuals as well as scheduled access for programs'; and that one of the three most important responsibilities of FabLab users is to 'contribute to documentation in instruction'.

The philosophy of sharing is core to FabLabs, both in the Charter requirements of conduct and in the engagement with open design, the use of open source software and sharing of designs through open sources such as Thingyverse. Wolf et al. (2014 p. 2) highlight that 'FabLabs have the ambition to share digital fabrication blueprints as well as operating instructions for using the machines in the worldwide community'. They hold altruistic values of open and reciprocal knowledge sharing and implicitly understand knowledge as a public assets, as a commons (Hess and Ostrom 2007a;

Verschraegen and Schiltz, 2007). Yet, comparatively little is known about how knowledge is generated and shared between makers, nor what the outcome of those interactions is. This is due in part to the paucity of empirical ethnographic research on the topic, which this paper seeks to address.

The FabLab concept has been shared and adopted in over 1,000 FabLabs globally (Fab Foundation 2018). FabLabs tend to emerge organically from the bottom-up, often led by a handful of motivated makers and financed typically through charity, goodwill, government grants and occasionally through public-private initiatives. FabLabs either emerge where sufficient interest and resources can be operationalised within the local maker community or where an organisation or institution (such as a charity, local government or education establishment) connects with the maker community to achieve policy goals around community engagement, outreach and digitisation of the economy. The deliberate lack of organisational governance of the FabLabs by the Fab Foundation has resulted in diversity of business models, motivations and outcomes. Yet, much extant literature (Doherty, 2012; Gershenfeld, 2015; Suire, 2019) treats makerspaces and FabLabs as homogenous in scope and operation, and insensitive to the everyday place-based practices upon which they are based.

Geographical sensitivities of context and place are significant, for 'while many Fab Labs or makerspaces look alike, their users often create their own social rules within the spaces and continuously reflect upon further elements that might be integrated into or subtracted from their local spaces' (Schmidt, 2019, p. 9). The FabLabs therefore strike a balance between sensitivity to place and the demands of standardisation. Hess

(2008) claims that FabLabs share 'a persistent type of commons-like thinking: a belief in the common good and working toward shared outcomes based on voluntary participation and reciprocity'. So while the FabLab community emphasises its altruistic and sharing nature, many questions in the literature still remain about the ways in which individuals share their knowledge, the physical space of the labs and the potential outcomes of those interactions.

Sharing and sharing economies

In seeking to tackle the question of if and how makers share, we can learn from emerging literature in geography about sharing economies. It now widely acknowledged that sharing economies are incredibly varied in their definition and form, and as Acquier et al. (2017, p.1) argue, 'one of the rare points scholars agree on is how hard it is to define the sharing economy and to draw clear conceptual and empirical boundaries. The sharing economy has become a catch-all label with strong normative underpinnings'. Part of the reason for this definitional vagueness may come from the fact that sharing is a relatively open concept: 'as the division and distribution of something – be it profits, goods or knowledge – amongst several people' (Hall and Ince 2018, p.4). Moreover, there are questions about what is being shared, and how: for 'we can share not only places and things, but also people and animals (to the extent they are ours to share), as well as our ideas, values, and time' (Belk 2007, p.127). As a result, the sharing economy takes on a limitless capacity, with the potential to be applied to many elements of social, political and economic life.

Slippages in use and understanding also come into play when considering the difference between 'sharing economies', 'sharing and economies', and 'the sharing economy' which are important for our positioning here. For 'although *the* sharing economy might be considered a contemporary phenomenon [...] it is not the only way that sharing and the economy intersect' (Hall and Ince 2018, p.4). As Frenken and Schor (2017, p.3) articulate:

> 'One reason is due to a common misconception about the sharing economy: its novelty. Participants in the sharing economy employ a discourse of trendiness, technological sophistication, progress and innovation. However, this characterization betrays both class and race myopia, as well as what historians call "presentism," or blindness to the past. Humans have always shared.'

This is not to say that sharing economies do not offer any capacity for prefigurative political formation. Rather, that sharing economies are not especially new or extra-ordinary, but are part of a whole array of long-standing everyday economic encounters (Belk 2010, Round et al. 2008, Stenning 2005). Values of gifting, caring, collaboration, collective sentiments and intersubjectivity are also often interlinked with sharing, part and parcel of economic practice (e.g. Banks 2006, Hall 2011, Jones and Murphy 2010), that are lost in current conceptualisations of sharing economies as *exceptional*. The empirical case presented in this paper highlights the everyday and rather mundane nature of making in the Makerspace.

In seeking further clarity, Belk (2007, p.126), argues that 'sharing is an alternative form of distribution to commodity exchange and gift giving. Compared to these

alternative modes, sharing can foster community, save resources, and create certain synergies'. This is a popular position occupied by numerous contemporary theorists, that sharing offers an economic alternative, and is perhaps why FabLabs as ethos and spaces have become synonymous with alternative economic practices. Positioning sharing as an alternative economic principle is, however, somewhat a hasty and misleading assumption. Indeed, as Hall and Ince (2018, p.2) comment, 'some of the most powerful examples of sharing economies are the everyday, informal practices of mutuality, solidarity and resourcefulness that all-too-easily go unnoticed'. Frenken and Schor (2017, p.3) elaborate on this point when they state that 'the sharing economy is creating enormous amounts of wealth, and that it has been using a socially-progressive feel-good rhetoric to do so'.

Similar to critiques of moral economies, sharing economies may be argued to have limited capacity to work as true alternatives to capitalism modes of production and consumption because they operate within the very systems they (are presumed to) seek to reinvigorate or counteract. Furthermore, sharing is often posited as a 'ubiquitous consumer behaviour [...] more characteristic of the interior world of the home rather than the exterior worlds of work and the market' (Belk 2010, p. 716). In this case, it would be difficult to envisage how and where sharing can offer radical economic alternatives, if its political potential is limited to consumption practices. Thus, like Frenken and Schor (2017, p.3), 'we believe it is crucial we start asking [questions about sharing economies] in a more analytical, empirical and critical manner'.

In light of new technologies, mediums and interfaces for sharing as economic practice - what Belk (2014, p.1595) calls 'phenomena born of the Internet age' - there has been a notable shift in geographers' attention in recent years towards the capacities of sharing economies. Examples such as Airbnb, Zipcar, Wikipedia, YouTube, Flickr, Facebook, Freecycle, and Twitter (Belk 2014, p.1595) are becoming regular features in geographical writing of sharing economies (see Ince 2016, Richardson 2015, Roelofsen 2018). Albeit, this is not to say that geographers do not engage in further critical work beyond digital platforms. Richardson (2016), for instance, has written of shared working and coproduction in creative writing practices, and co-working offices (Richardson 2017). Likewise, housing remains a staple of geographical research interest in sharing (and) economies, including digitally mediated house sharing (Maalsen 2018), hospitality platforms for home sharing (Hellwig et al. 2018), collaborative housing (Sargisson 2018) and extended family households (Gibson et al. 2018). Furthermore, in a recent collection on *Sharing Economies in Times of Crisis*, examples of sharing economies written from a geographical perspective include seed-saving (Pottinger 2018), to indigenous land claims (Gombay 2018), illuminating what the editors argue to be 'the ambiguous practices, politics and possibilities running through sharing economies' (Hall and Ince 2018, p.11). This paper highlights the wealth of unanswered questions on sharing, particularly around the ways in which sharing practices begin and are sustained, how/if those who share develop a collective vision or set of ideals around the why, what and how of their sharing practices and the barriers to sharing. Here we use the Manchester case study to interrogate the often implicit assumptions around sharing and the expectations of the sharers.

Making and consumption

Current geographical literature appears to offer limited concerted engagement with sharing economies beyond ideals or practices of consumerism; that is, writing on sharing economies of making, production and manufacturing remains quiet (see Richardson 2016). This is perhaps unsurprising, given that since the 'Cultural turn' in the 1980's, consumption has been celebrated as a source of fulfilment, veering from dominant economic perspectives that place production as more important than consumption (Driver and Martell 1999). As a result, there has been a steadily increase in academic works on this subject, paralleling the consumer boom of the 1980s (Goss 2004). Terms such as 'produser' (Bruns, 2008), 'co-creation' (Prahalad and Ramaswamy, 2004; Ramaswamy and Ozcan (2014) and 'prosumption' (Troffler, 1980; Ritzer, 2014; Ritzer et al., 2012; Ritzer and Jurgenson, 2010) have emerged in order to combine the interrelated processes of production and consumption. Prosumption is a generic process that subsumes production and consumption into a wide range of processes that exist along a continuum (Ritzer, 2014), intensifying in the Internet age (Ritzer and Jurgenson, 2010) and has parallels with the idea of makers as consumers and producers (more below). For Bruns (2008) consumers can become cultural producers and distributors, bypassing traditional organisations leading to 'produsage'. This mixture of production and use has shifted from the factory to society (Negri, 1998) and is supported by 'free labour' (Terranova, 2004).

However, situating all economic practices of consumption and production as simultaneously prosumption does not serve to fully address the nuances of these practices in situ (see Sayer 2003). We contend that these concerns have been

elucidated within recent writing on the geographies of craft and making, which seek to critically approach the spaces between production and consumption as an area in need of further exploration. Economic geographers are thought to have been preoccupied with product lifecycles, biographies and social lives (see Smith et al 2002) at the expense of understanding everyday economic practices of making (see Carr and Gibson 2016, Hall and Jayne 2016, Holmes 2015, Price and Hawkins 2018).

It is posited that reframing discussions around *making*, in particular, makes way for thinking beyond the monetary value of products and their use, to develop a more complex interpretations of relationships between/within production and consumption. For Carr and Gibson (2016, p. 299) this reframing allows for a move away from presumptions and binaries of 'small-scale "craft" and large-scale "manufacturing"', towards 'a focus on making (as disposition and practice across and within both scales and modes of production)'. Price and Hawkins (2018, p.15) likewise identify a 'diverse patchwork of sites at which making takes place', within which there is an 'interweaving of the professional and amateur' (p.17), where people seek 'material and mental solace from busy consumer worlds' (p.15). Furthermore, and importantly for our discussion, Carr and Gibson (2016, p.299) contend that 'the semantic and ontological shift from manufacturing and craft towards making is an attempt to reframe debate about ‘economy’ [...] to capture the need to move onwards from the modern capitalist paradigm of profit-driven, high-throughput production of physical things'. The suggestion here is that a focus on geographies of making lends itself to alternative, 'counter-cultural' economic practices and formation (ibid, p.299). Again, we come to a familiar impasse - that making and alternative economic practices are assumed to be based on an alternative ethos or social formation; an all too easy elision

of sharing and making. We contend that this vision is also reductive and uniform, leading us to question the degree to which a plurality of views on making can coexist or even compete within makerspaces. The maker community is diverse and individual makerspaces are local spaces of making and sharing, whilst also embedded in local economies and wider maker networks. However, extant literature does not currently extend our understandings of the degrees of such embeddedness, nor the implications for the outcomes of making and sharing.

With this paper we aim to develop these critical theoretical reflections on digital fabrication, sharing and making, through the empirical example of the Manchester FabLab. We are particularly interested in how, and if, values and practices of making and sharing are manifest in the daily workings of the FabLab as a microcosm for understanding economic geographies in action. The focus of our analysis, as derived from our review of existing literature, is upon the ways in which the FabLab community has developed ideas and visions of sharing and their common understandings of their making practices, the embeddedness of the Manchester FabLab in wider networks of making and sharing, and the obstacles to sharing. We now describe the research study upon which our findings are based.

3. Methodology

Our case study, the Manchester FabLab, was selected for several reasons; it was first FabLab established in the UK; it had high levels of reported users; between opening in March 2010 and 2014 over 11,000 individuals visited the lab (Manufacturing Institute, 2015); and the site had many days open to the public each week. The FabLab was funded by a consortium of organisations including the Manufacturing

Institute, National Endowment for Science, Technology and the Arts (NESTA), the Manchester Innovation and Investment Fund, and the Manchester Knowledge Capital organization. The Manchester FabLab was located in the Chips building, a new flagship mixed-use building in the recently regenerated area of New Islington (historically part of Ancoats, the heart of the manufacturing district in industrial Manchester). Surrounded by canals on three sides, and facing a derelict industrial warehouse, the Manchester FabLab presented itself as the epitome of the digital post-industrial era.

The initial consortium funding covered only the initial three years of the Manchester FabLab and the lab developed a funding model that was heralded – within the Fab Foundation network – as particularly sustainable. In practice, the FabLab was supported by the Manufacturing Institute, a UK-based charity funded by manufacturers which works with companies to improve skills and productivity, and to preserve the historical legacy of manufacturing in the UK. A primary motivation of the Manchester FabLab was to provide free access to the tools to make things. The FabLab opened three or four days a week to the public, for free without membership fees and additional commercial days in which businesses paid to use the equipment and staff resources. The Manchester FabLab business model was therefore based on support from the Manufacturing Institute and income generated by providing consulting and prototyping for commercial businesses.

Our research methodology utilised a mixed-method approach, using ground field research methods (Auderbach and Silverstein, 2003). We combined semi-structured interviews and participant observation as part of a reflexive methodology that

responded to the challenges of the research context; gaining access and trust and developing knowledge of the digital 'fab' technologies. As such, the empirical research was conducted in three stages. First, several key individuals in the Fab Network were approached to gain permission to research in the Lab and for interview. This provided a broad oversight of both the Fab movement and the positionality of the Manchester FabLab within the Fab Foundation. Second, time was spent in the Manchester FabLab to increase familiarity with the digital technologies, to note how, and by whom, the technologies were used in the FabLab and to observe general usage levels and interactions between users - or what we herein refer to as 'makers' (see Carr and Gibson 2016) - in the Lab. The Manchester FabLab was a relatively small, open-plan area which facilitated observation. Third, semi-structured interviews were conducted with FabLab makers. In total twenty-seven interviews were conducted between July 2015 and May 2016 (see Table 1). Interviews lasted between one and three hours and all were transcribed verbatim. Interview questions related to maker backgrounds, usage of the lab (frequency, type of use, equipment used), knowledge and use of digital technologies, the Maker Movement and entrepreneurial activity. Interviews were conducted in the casual seating area of the FabLab.

Visits to the FabLab occurred on different days of the week, each visit for a minimum of two hours, often longer. During these visits both interviews and participant observation were conducted and observations recorded in a field diary. The total number of participant observations hours totalled 90. The participant observation and interviewing informed each other. For example, participant observation highlighted the regular 'core' FabLab makers to be approached for interview, as well as the relatively high number of occasional or first-time makers.

The interview and observation data were analysed using both manual coding and NVivo analysis software. We identified the initial, first-order, codes for analysis. This revealed a wealth of data on sharing which emerged from the data rather being a defined research question during the research design and execution. In consequence we revisited 'sharing' codes and devised an expanded set of sub-codes to interrogate and reanalyse the data. This was an additional layer of free-hand inductive analysis whereby coded data extracts were analysed and aggregate theoretical dimensions identified. These theoretical dimensions formed the basis for presenting our analysis in Section 4 below.

4. Findings: making and sharing in Manchester's FabLab

Our data on sharing economies in the Manchester FabLab emerged organically. The interview and participant observation data yielded some unexpected findings on the realities of sharing economies in a makerspace. The processes of analysis have revealed three key themes, structuring the arrangement of our findings below.

4.1. Envisioning sharing and making in the FabLab

Throughout the interviews and field discussions, the 'idea' or 'vision' of and for sharing in the FabLab was a prominent topic of conversation. The language of imaginaries, dreams and hopefulness came through strongly in participant's narratives, conveying a somewhat romantic, even fantastical vision of what the FabLab may (or ought to) have been or become.

Matthew: I was telling an older student about a project I was trying to make

with Arduino, and he said "have you heard about FabLab? It's a great place where you can make things".

Harvey: At the moment it is about people being evangelical about it. Spreading their thoughts about it, saying to friends and family 'have you seen what I can do?' Like every time I tell friends about it, they are always amazed; and they think that it is great. But then they never seem to follow up on it.

In theory, then, the FabLab was held up to be a 'great place', one that participants relished telling their friends and strangers about, sometimes in a bid to convert them to being a user of the space. There was a sense that participants felt the success of the FabLab depended on how well propagated the ideas were. And yet there was very little substance in this personal marketing ('where you can make things'). Nor did their efforts come to much, because - and this was a regularly identified trend in the data - the people they told 'never seem to follow up on it'.

As noted earlier, sharing ideals and principles are often critiqued as sitting somewhat apart from the economic reality of sharing in practice (Frenken and Schor 2017), and the Manchester FabLab was no exception. However, as work on geographies of making also identifies (Carr and Gibson 2016, Price and Hawkins 2018), this criticism is typically levelled at economies of scale, rather than those which are more localised and individualistic. Typically, close physical proximity is taken as synonymous with visible and regulated production practices, of being close to and with materials (Hall and Jayne 2016, Price and Hawkins 2018). And yet, when it came to realising

everyday sharing and making within the FabLab, participants went out of their way to identify how the dream and reality shaped up.

In fact, many narratives typically pivoted on the crucial 'but' (as italicised below), indicating this short-fall of expectation:

> Paul: *What this lab lacks*, which would be a must if you were opening a new one, is a space where you can make a bit of a mess and use manual tools. So it is nice that everything is tidy and carpeted and cleaned, roughly, *but* the manufacturing process means you need to hit things with a hammer sometimes, you need to make a mess and not worry about everything being clean and tidy.

> Phil: We just had a deal…with the Ultimaker company. They produce what I call consumer 3D printers, so desktop 3D printers. The people who designed that were the founders of the FabLab in Utrecht. They have created a worldwide business out of these machines. *But* they [Utrecht as opposed to Manchester FabLab] have a very open philosophy.

There was a sense that the Manchester FabLab always fell short of the dream, that it did not quite fulfil its potential as a space of alterity and altruism, a counter-cultural hub of sharing and innovating (Carr and Gibson 2016, Frenken and Schor 2017). It was also typically discussed in relation to the comparative success of other FabLabs across Europe, particularly Barcelona and Utrecht. This also works against the discourse of a shared vision or goal within the FabLab 'community' (Davies 2017, Wolf et al 2014), where instead these maker spaces were being characterised by competition, of a money vs. markets economy (Sayer 2003).

There was less awareness, however, of the rather different business models underpinning those Fablabs which have less free, open time for the public. According to Phil, this meant that if an idea was developed in Manchester, 'someone in a FabLab in Nairobi, for instance, can then take that idea and then either improve it or replicate it for themselves and reproduce it using that write up'. However, in all discussions concrete, tangible examples of this shared form of working were very thin on the ground (also see Wolf et al. 2014), and participants rarely cited instances of where these visions had been seen through. The technologies enable sharing across geographical spaces, and the umbrella organisation, the Fab Foundation actively encourages such sharing, yet there was a presumption that the FabLab model does work, because they willed it to work. The Fab Charter makes it clear what is expected of makers, but this is interpreted as an ideal rather than an everyday practice.

As already suggested, an additional observation within the data was around the plural, competing and in many way contradictory demands within the FabLab. Individualistic demands and norms emerged strongly within some participants' narratives (Sayer 2003). For example:

> Peter: I think the hardest thing is explain to people why I do this for free. Because all this, economical presumptions people have in terms of why you have to work for money, or work to get a career, and all this. Why are you spending so much time on open source for others to use?
>
> Ken: Classical economics dictates that resources are scarce, but information and technology isn't like that. When you share it, people learn about it. If anything their ability to contribute grows and I think it is that complete

opposition to classical economics through the internet that makes these things possible.

Paul: Because people realise it is a service that has been given for free, the sort of people who come here are just so appreciative that even if they might be frustrated by a system, or something not going right, you are giving me this for free, so if I don't like it, I can just go or stay. And I think that people have got the right attitude in that, users are not held to account like you are if you pay for a service.

In each of these extracts, the ethos of the FabLab is discussed in direct contrast to 'economical presumptions' and 'classical economics', offering a prefigurative alternative to commodification (see Belk 2007).

FabLab makers expressed what they considered to be 'counter-culture' viewpoints (see Carr and Gibson 2016), often referring to *themselves* as 'makers', or even 'post-makers' (users who have evolved to be able to critique maker rhetoric). Several participants who obtained an income from making and selling items strongly denied that they were entrepreneurs, preferring instead to identify their making as amateur and experimental (Price and Hawkins 2018). However, these 'alternative' views are frequently contradicted by much of the interviewees' discussions of their lives, livelihoods and activities in the FabLab. For example, Peter, who argued so strongly for open source sharing has patented and commercialised two products to financially support himself; Alex, who only now describes himself as an entrepreneur having left the FabLab and Steve, who uses the FabLab to make 3D printers which is he sells commercially (including to the Manchester FabLab).

While participants expressed that they were trying to work against the grain of socialised and cultural norms of capital accumulation and profit-making (see Carr and Gibson, 2016), this was also deemed important to the vision and ethics of the FabLab. It was taken as a given that 'of course' (Ken) people help one another in the Lab, making 'it a welcoming space, as relaxed as possible' (Paul). Furthermore, a number of participants were forceful in their rejection of key principles such as ownership, property rights and intellectual property, claiming:

> Ryan: that is my philosophy, share information and I don't like corporate greed. I don't like, the thought of making money out of something sickens me to be honest.
>
> Martin: I don't want to make and sell stuff, I want to create designs and release them open source and see what people make of them.
>
> Jason**:** Intellectual property is a disaster. It has caused more damage to humanity than almost anything else.

Participants' impassioned claims about a rejection of 'corporate greed', 'sell[ing] stuff' and 'intellectual property' were key to an ethos of the FabLab being not-for-profit (also see Belk 2007, Carr and Gibson 2016, Sayer 2003). These claims mirror the underlying principles of the Maker Movement rather than the specific themes of the Fab Charter. The Charter states 'designs and processes developed in FabLabs can be protected and sold however an inventor chooses, but should remain available for individuals to use and learn from' (Fab Foundation, 2012). Here FabLab makers were expanding upon the basic 'rules' of the Fab Charter to incorporate their own philosophies and viewpoints, but did so unevenly. Taking these findings on shared

visions, principles and ideals, next we pay further attention to the context of the FabLab and the tangibility of what was being (or aspired to be) shared.

4.2 Spaces of sharing in and beyond the FabLab?

Contemporary perspectives on makerspaces suggest that these spaces are nodes within a larger community of making (Suire 2019; Schmidt 2019). At the time of the research, there was only one other makerspace in Manchester. The Manchester FabLab makers emphasised that the FabLab was different to that makerspace:

> 'What the process is, so that is what makes the FabLab quite unique really. Because people being able to just come in, do a 20 minute health and safety and then jump on a laser cutter or CNC machine and then you know, there is no other place you can do that' (Martin)

FabLab makers conveyed a sense of superiority about other makerspaces, citing the more advanced technology in FabLabs and more pleasant, 'less grubby' (Matthew) working environment. This was also related to the origins of the makerspaces, with FabLab makers appearing to benefit from external validation of their activities: 'yes, well, they [FabLabs] generally get funding whereas other Makerspaces don't' (Jason).

When asked about how they engaged with the makers in the other Manchester makerspace, the FabLab makers explained that they did not visit the other space (nor vice-versa) mainly because of cost:

> 'The only other place is a Manchester Makerspace over there….[points] but that is a paying thing. My income is pretty low so I try to avoid paying for things' (Jason)

> 'There is HackMan, that has a far, far, better set up. But I don't go there because it is subscription. That is the only reason, purely financial' (Mark).

No interviewees articulated that the Manchester FabLab was preferable to other makerspaces on any grounds other than being a free resource. They did not cite any differences in the types of activities taking place, nor in the functioning and outcomes of the two maker communities. This disconnection from other activities was mirrored in the positioning of the Manchester FabLab in the wider city ecosystem.

> 'We have no formal connections outside the FabLab, no. We have informal connections, I mean, we work with all the universities. The Manufacturing Institute, its founders were the universities and the large businesses in Trafford Park anyway. We don't connect people to business support agencies, no' (Phil).

There were therefore few mechanisms by which FabLab makers could share and collaborate beyond the FabLab due to the paucity of connections to other makerspaces and local institutions. Business support agencies were not invited to visit or support the Manchester FabLab due to the lack of commercial activity taking place, and the general reticence of the makers to do so (as discussed in Section 4.1). Engagement with local universities was predominately through students using the FabLab during peak times in the semester when university facilities were booked (source: fieldwork diary).

Similarly, when participants discussed social relations specifically within the Manchester FabLab - as an outcome of sharing economies regularly identified within literature, a space for meaningful encounters (see Belk 2010, Stenning 2005) - there

was a notable absence and interesting use of language of solace (see Price and Hawkins 2018). This extract from Ian's discussion with X, below, is a case in point:

> Ian: I'm running out of equipment to use at home, obviously there's a lot more technical equipment out there that I can't afford to use. *I also like to meet other people and to, what do they call that now?*
>
> X: Networking?
>
> Ian: Networking! I wanted to network with people. But I have come down to make stuff, but I like to listen to what other people have done. Just, to be basically part of something, because you can feel very alienated when you are working in your own studio at home, and if you don't *brush alongside* other people, you don't learn as much because they have got talents that I might need help with.

Here, Ian talks about the FabLab as a place for making things as well as connections, based primarily on the common feature of being physically near to other people. Tellingly, he describes these social encounters as 'networking' and 'brushing alongside', each with loaded (as well as geographical and spatial) connotations, and neither of which indicate 'genuine' friendships (see Hall and Jayne 2016). In fact, none of the participants discussed meeting up outside the space of the FabLab, not even to the bar four hundred metres down the road (Source: fieldwork diary). Nor did existing makers approach and welcome new makers following their initial induction to the FabLab (Source: fieldwork diary). In fact, the space was often quiet and still as something of a stark comparison to the inspiring hustle and bustle presumed to fill makerspaces (Gershenfeld, 2005).

Furthermore, these social relations come secondary to, and potentially in the way of, participants' aims for pushing a product 'forwards'. Ian's comments resonate with similar remarks made by other participants, such as Harvey. He describes how 'the first three times I came I didn't even touch any of the machines, I just watched other people, talk to them, watched what they did on the software'. Colin also spoke of how he 'work(s) with Johnny a lot in the corner', again using a spatial metaphor to denote distance, or at least a lack of closeness. Our participant observation revealed that individuals worked in isolation and the only shared spaces (two tables with chairs) were used for eating and drinking. Those individuals choosing to break to socialise discussed contemporary issues and topics, never specific projects. Those discussions were 'held one-to-one and in hushed tones' (Source: fieldwork diary). And Ken said of his designs 'I've just downloaded the software that I need to use it on. So I can design it all at home now'. So while skills and knowledge were occasionally being shared, the lab can not confidently be described as a space or interface of sharing (e.g. Belk 2014, Richardson 2017, Roelofsen 2018), but more as a nodal point of momentary contact.

This lack of a sharing environment and meaningful sharing relations was something that participants were all too familiar with. Mark, a highly qualified IT engineer, even described how the Lab was actively trying to encourage collaboration, though again there is a Freudian slip in his choice of language towards the end of the extract (in italics):

> Lloyd: I look at some of these other FabLabs and look at what they are producing. They are producing stuff that is big and clearly more impressive than what we are doing here and I am really interested in structures that allow

> for that. So to me….we are opening on Thursday afternoons, evenings and all anyone is *allowed* to do is collaborative work. So it is *a way of enforcing collaborative work.*

The notion of 'allowed' and 'enforced' collaboration seems somewhat of an oxymoron, particularly in an environment that espouses to be welcoming, creative and open. Indeed, there was often an emptiness, even sadness to the way participants described the space and use of the Lab: as a 'shell room' (Warren), for 'multi-usage' (Heidi), where 'the mindset is about individual work' (Lloyd), a place to 'pass information backwards and forwards' (Ian), and sharing as a 'culture [that] doesn't exist here' (Colin). In an interview with Mario, a college lecturer, he discussed - and without a hint of sarcasm - that he wanted to make PCBs [printed circuit boards], and 'there was one guy using it but he was busy at the time, so I spent all day and I learnt how to use it one day only from the youtube videos'. The imagine of Mario spending more time looking at his computer screen than engaging with other FabLab makers is a rather powerful one. So while participants spoke about how they would 'like to collaborate' (Colin) with others, this is as far as the collaboration went - in their talk.

In some instances, participants spoke openly, and more consciously, about the limits of their willingness and capacity to share their ideas and projects. For instance, Colin spoke of how 'my designs are my designs [...] if I want to develop my electric vehicle or develop my designs so I can start a business, I wouldn't put them online'. Ryan also implored: 'don't copy what I have done, improve it. If it can be improved'. Ken also described the social isolation we have also observed, in that 'nine times out of ten people are building their own projects and that project isn't linked in any way to any of the other projects that are going on'. Typically, FabLab makers were working in

their own isolated bubble, meaning the extent of the 'sharing' went only in so far as the materiality of the building and equipment, rather than sharing ideas, conversation or companionship (see Hall and Jayne 2016, Price and Hawkins 2018). One participant even expressed shock at the notion of sharing beyond these means: 'someone came in on Wednesday and they do an Aquaponics lab. It is bloody brilliant. It is the first instance here of people working together [he whispers this]' (Mark). That Mark whispers this gives a sense of a confessional, but also that it is not a view he wishes to share too widely. These claims sit very much at odds with the visions of the FabLab (or indeed maker movements more generally) identified previously, of sharing ideals and skills as a public good, rather than for private gain. This theme of limitations to the realities of sharing continues into the following section.

4.3 Obstacles to sharing in the FabLab

Sharing as economic practice is commonly posited as a way to save time, resources and energy, by working, residing or playing collectively (see Belk 2017). However, the FabLab was instead described by participants as a drain on key resources of time, energy and imagination. Ken, a quadcopter enthusiast, for example, described how he would 'be absolutely knackered if it wasn't for other people who knew what they were doing'. In particular, there was considered to be a limit as to how much time people could or would devote to helping and supporting the projects of others. Typically, time was considered an inflexible, precious and finite resource, and one that was also associated with profit:

> Martin: I'm sure it wouldn't take too much time, some of the printing takes a long time so if I print something and it cocks up, I haven't got 6 hours to wait, so if I cock up it sets me back a week.

> Nick: I have so little time and I just can't really find the motivation to go and sit in that kind of environment and just chat with people. I got shit I need to do.

However, this is not to say that a lack of time investment was considered an always reasonable explanation. Lloyd, for example, critically described how 'people are nervous of doing something wrong' and likewise Warren said "why should I go out of my way to do anything', that's their attitude from what I have gathered'. Ben described how, contrary to expectations, this attitude tended to be displayed least often by self employed members using the space, who 'have to look a bit more where the work is coming from' and yet 'are more out-going'. Rather than enabling an open platform for sharing skills and innovative knowledge, participants saw others as actively rallying against it.

Perhaps as a direct result of a generally perceived lack of time to devote to helping and supporting others, when participants discussed their support of the FabLab this 'giving back' tended to be quantified in financial terms. This, in many ways, sits at odds not only with the altruism of sharing and makerspaces, but also the FabLab model. *All* designs should be shared (although how is not directly specified in the FabLab Charter) yet our fieldwork observations and interviews yielded very few examples of this occurring. However, as Ryan and Phil describe in the following extracts, their ability to support the FabLab in this way was considered distinct, unusual and credible (emphasised with italics):

> Ryan: I haven't paid for that yet! [Laughs] I do buy materials, I can buy them cheaper myself but a little bit of the profit from this goes back into the Fablab

so, *it is giving back*.

Phil: So if you don't want to share, that is fair enough. But *you have to pay for the use of the lab*. The lab is being funded for people to share knowledge and create knowledge and grow that knowledge and build innovation. That works quite well. Obviously we do get the odd person who wants to get it free of charge and not share but we deal with that, as we do.

Time in the FabLab is divided in two: 1. Public - free to use, but with the requirement to share ideas and designs and 2. Private– time and expertise is charged at a fixed rate and ideas and designs are not shared. This causes makers to have clear ideas around what should and should not occur during 'their' public time. Commercial activities (for example, making goods to sell) are frowned upon as they drain resources by taking up too much time on the machines and the makers are unwilling to share their ideas and designs. However, our fieldwork observations did not reveal any attempts to enforce this, despite Phil's claims to the contrary. Nor did we see any clear instances of makers 'giving back', beyond examples such as bringing in milk for tea and coffee and Ryan's purchasing of materials from the FabLab.

Makers such as Alex - who owns a successful international business based on a product developed in the Manchester FabLab – who are most able to 'give back' in terms of expertise and resources, articulated the necessity of returning to help, but then rarely do so. Commercialisation is seen as the beginning of the end of makers' relationship with each other and the FabLab, as makers aim to transition from 'maker' to 'entrepreneur':

> Alex: So, the start-up community in Manchester is vibrant, helpful, friendly and scrappy. It's not as well funded as the London ones, but the thing is, as soon as you give funding to the people, they often go off into their own offices…..And that actually creates a certain amount of insularity……So then they stopped then inhabiting those shared working spaces, which are Makerspaces, FabLabs, other co-working spaces.

Rarely do these makers return to the FabLab. Warren stated that 'I don't go back very often [to the Manchester FabLab]. If I do it is to see a friend or talk to someone really'. He does not go back to share, whether sharing the space, his skills or his time.

Hence, the case of the FabLab raises questions about the scope for genuine altruism within makerspaces and localised sharing economies. In practice and in their narratives, participants placed profit at the core of their motivation. In the context of participants freely describing attitudes such as 'I want to make some money' (Warren), 'the requirement to draw revenue' (Gideon), and patenting their ideas because they 'thought it would be a good idea to make a little bit of money' (Martin), it is difficult not to situate personal and individualised motivations as an obstacle to sharing. When considering the 'success' of the FabLab, Alex, the only interviewee who described himself as a 'successful entrepreneur', measured this not according to the principles and visions discussed in 4.1 above, but rather according to individual and financial success: 'what you actually want is a FabLab populated by people who have successfully exited. That's your ideal. Who would have built a company, delivered and exited and are comfortable and have time on their hands'.

Similarly, Joyce, a furniture maker and regular at the FabLab, berated those makers

who did not see this as their ultimate mission:

> Joyce: They don't really commercialise their ideas, they come in to do like Christmas cards, they come in and do wedding invitations and they do small things like a box for something or a present for a friend.

There was a sense by some participants that makers were wasting the valuable time and resources afforded by the space if they did not commercialise their ideas; as Warren also expressed 'I can do better than this. Even if it is a toss room in a mill somewhere'. There was a tendency to talk down the collaborative possibility that the FabLab presented, seeing it not as exceptional or reciprocal (see Belk 2007, Wolf et al. 2014) but as an extension of the market, a means of turning a profit and developing entrepreneurial experience (see Banks 2006, Gernshenfeld 2005). The language of rational, profiteering *homoeconomicus* seeped into the ideals, practices and future envisioning of participants from the FabLab, as a space less for sharing and more for individual innovation.

5. Conclusions

With this paper we have offered an empirically rich, critical perspective on sharing and making in principle and in practice, using the example of Manchester's FabLab. While the FabLab ethos professes a wholesome vision of collectivism, altruism and sharing, of ideas, skills and things (Frenken and Schor, 2017), when we peel back the layers of these assumptions we see prevailing norms of competition and individualism. Not only were individual makers isolated within the space of the Manchester FabLab, the lab itself was disembedded from the local economy. Much of the rhetoric around maker movements and spaces like FabLabs is that they are a

means by which things are invented, tested and developed in and for the future. These spaces are framed as innovative, collaborative economic spaces in which 'magic' happens, creating entrepreneurial opportunities and advancing society in general (Gershenfeld, 2005; 2012). However, our findings show makers resisting entrepreneurial rhetoric and the values espoused by the FabLab, of involvement, connection and affinity (see Davies 2017, Doherty 2012), whilst also failing to engage in sharing practices. While sharing is an ordinarily economic practice (Belk 2010, Round et al. 2008), this does not mean it is always, inevitably or evenly employed by economic actors and communities.

Furthermore, our findings also reveal some of the barriers and challenges to sharing in this makerspace. In the Manchester FabLab sharing is limited in scope, and the makers themselves revealed much about how they understand sharing and their use of space while sharing (or not). This sits at odds with emerging literature on open innovation spaces that assumes sharing is occurring (Hess, 2018), and with literature on sharing economies that presumes sharing to be 'an alternative form of distribution' (Belk 2007, p.126). Unpicking the lived realities of sharig and making in the FabLab reveals these spaces to be much more complex than currently acknowledged.

Perhaps the strongest evidence of these findings is that the Manchester FabLab closed in early 2017. Throughout the research period Fab Foundation managers, Manchester FabLab staff and makers highlighted concerns around the sustainability of FabLab business models. After the closure Manchester FabLab moved its equipment to a smaller FabLab located in a public library in Altrincham (a nearby very affluent suburb). The Altrincham FabLab closed in November 2018. We argue that the

Manchester FabLab makers, through their resistance to *both* entrepreneurial and sharing values, actively undermined the makerspace ethos. Where made items are successfully commercialised, makers tend to leave the community without making a knowledge or resource contribution. Carr and Gibson (2016) argue that in order for making to reframe the economy it is essential that it moves away from modern capitalism and profit making, which is needed to collectively speak back to socio-environmental issues in a volatile world. However this 'solution' is undermined when individualism prevails. We suggest that this reframing of the economy requires both making and sharing to occur simultaneously.

It is clear that more critical insights into the day-to-day economic activities and sociabilities taking place in makerspaces is needed through more in-depth and comparative research. Such research might include experimental auto-ethnographic, participatory or digital/visual methods, to interrogate the experience of sharing economies and makerspaces as they are lived. If digital, open and sharing economies are where economies are moving towards, geographers should be placed at the centre of critical discourse about their form, function and futurity.

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Table 1: Anonymised maker activities

Maker	**Maker demography**	**Making what**	**Making for**
Baxter	Male, white, 70s, British	Celtic designs on wood	Family, free art displays, friends
Colin	Male, white, 20s, British	Girlfriend makes beauty products; Colin and his Dad repair and modify household items	None is for commercial benefit.
Dom	Male, white, 20s, British	Plastic (3D printed) figurines for a promotional video	Himself and a friend – for their emerging business
Harvey	Male, white, 20s, British	Decorative map; lamps Mother made golf markers	Himself; mother made for her fiancé.
Ian	Male, white, 40s, British	3D models	College course, competitions etc.
Jason	Male, white, 70s, British	Variety of useful objects: gates, storage, signs.	Himself and friends.
Johnny	Male, white, 80s, British	A wide variety of things such as an electric bike.	Himself, other FabLab makers, friends.
Joyce	Female, white, 30s, Polish	Uses example of Christmas cards She has made jewelry, lamps and furniture	Family and friends. One piece of furniture was a wedding present.
Ken	Male, white, 50s, British	Parts for quadcopters	Himself and other members of his quadcopter club
Keri	Female, black, 20s, Ghanaian	Architecture student using equipment for her masters.	Herself - education
Lloyd	Male, white, 50s, British	All sorts, computer-based, electronics. Radio	Himself and friends
Mario	Male, white, 30s, Polish	Electronics, storage, engraved phone covers; customized T-shirts	Himself, his wife, friends and the college he works for; he also works at the Museum of Science and Industry
Mark	Male, white, 50s, British	Key ring Toys T-Shirts and hoodies	Family Club
Martin	Male, white, 30s, British	Aquaponics i.e. pH controller, heat exchanger (retro-engineering products)	Everyone, esp. developing world

Matthew	Male, white, 20s, British	Makes commercial products – ideas initially developed in FabLab but are now commercialized. On day of interview he was making a ramp for Dachshund dogs. Also save-the-date cards for his sister's wedding.	Commercial. Personal projects are for himself, friends and family.
Murphy	Male, white, 40s, British	T-shirts (vinyl)	Friends
Peter	Male, white, 30s, Brazilian	Aquaponics i.e. pH controller, heat exchanger (retro-engineering products)	Everyone, esp. developing world
Philip	Male, white, 18, British	3D printed figurines for games	Himself and family
Ryan	Male, white, 30s, British	Makes 3D printers	Himself. Commissioned to make a 3D printer for the FabLab (commercially)
Stephanie	Female, white, 20s, Spanish	Earrings and necklace	Sister and her friends
Warren	Male, white, 30s, British	Now makes 3D printers to sell. When in the FabLab he made components for 3D printers	Commercial
Management			
Charles	Male, white, 50s, British	Did not make in the FabLab	n/a
Gideon	Male, white, 40s, British	Did not make in the FabLab	n/a
Paul	Male, white, 30s, British	Worked on commercial projects and ad hoc assistance with public user projects	Businesses and makers
Phil	Male, white, 40s, British	Did not make in the FabLab	n/a