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GRASSROOTS MAKER SPACES: A RECIPE FOR INNOVATION?

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ABSTRACT

Makerspace has become an increasingly fashionable term that many community spaces use to label themselves. In this paper, we identify makerspace as an experience-led community space where people gather to make things together with the assistance of both digital and traditional making tools. This paper takes the inspiration from both Tuan's definition of place and Lefebvre's 'triad spatial model' and offers a unique analysis of what makerspace is in relation to makers' experience. In addition, we would also like to discuss how these insights could inform future makerspace design.

Keywords: Makerspace, maker movement, community space, innovation

1 INTRODUCTION

"Experience is a cover-all term for the various modes through which a person knows his world."

Yi-Fu Tuan

Makerspaces have recently become a popular umbrella term, though researchers have long analysed things within such environments. To the best of our knowledge, no one has yet analysed the makerspace itself with respect to "the social relationships embedded in it" according to Lefebvre (1991). He debates that space produces society and simultaneously society produces space. In contrast to other production, social space is produced by (and produces) power to serve its goals.

Open innovation, knowledge sharing, and peer-to-peer learning in these spaces are central to the maker movement's ideology (Capdevila 2013). We observed that these elements when combined together create a place for makers to fulfil their making desire, to mobilise their knowledge, to socialize with other makers, and to generate collective innovations.

The primary objective of this paper is to define two models that explain the fundamental function of makerspaces and the people's experiences within them: as both a community space and a space for communities. A secondary objective is to identify how these two different experience models affect the innovation happening in makerspaces. Ultimately the paper attempts to answer the question, what are the implications for makerspace design?

The insights included in this paper came from a three-month ethnographic study. The study has helped to better understand the values that underpin the possibility, momentum, and challenges of grassroots innovation in makerspaces. The main case studies involved makerspaces in England and Scotland, such as

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Hackspace Manchester, Maklab Glasgow, and Fablab Manchester. We begin by describing the ethnographic fieldwork with maker communities that led to our focus on community and space. Next, we describe the features of the two operation models in terms of how different community activities are facilitated and how these models intend to contribute to the innovation process. Finally, we use these community space experience models as an analytical lens for reflecting on lessons learned from our experience in creating a successful makerspace, and from this, develop several insights for successful community space design. We highlight the difficulties in projecting a sense of community into space design for the maker movement and recognise the value of community sense as a guiding design principle throughout the development process.

2 BACKGROUND

In Tuan's term, when humans give meaning to spaces, places come into being. A location is separated from the undefined surrounding spaces when it is identified or given a name. There are places that hold more vigorous meanings, names or definitions comparing to other places. In this way we conceptualise 'Makerspaces' as spaces where communities engage in both digital making and traditional crafts. They are spaces that are intended to stimulate both social and technological innovation.

As Tuan (1975) recognised that "There is, however, an important distinction between the passive and active modes of experience: the sensations of the passive mode are locked inside individuals and have no public existence." In this investigation of grassroots makerspaces, what we explore is an active experience that people would like to share and express, i.e., the experience with public existence. With respect to passive experiences, the sensitivity is hard to articulate, which makes it unlikely to be shared the way we imagined it could be.

Space is abstract which differs it from place, according to Tuan (1975). Space lacks content, hence it is broad, open, and empty, which invites fulfilment of imagination, substance and illusion. It is "possibility and beckoning future" (Tuan, 1979). Place, by contrast, contains both the past and the present. It stands for stability and achievement. Therefore, when Lefebvre was writing about space, what he meant in Tuan's understanding was actually place rather than space. They both were talking about a spatial concept with meaning.

Lefebvre's 'triad spatial model' describes a space as the combination of conceived space, perceived space and lived space (Lefebvre, 1991). It helps us to understand the makerspaces in relation to the activities happening in the space. In this paper we will mainly focus on the 'lived space' i.e. people's spatial experiences in makerspaces. We understand the lived space experience is of critical importance to many community space developments. In the context of a makerspace, the prioritisation of community functions when designing the operation of the space can significantly improve the efficiency and effectiveness of the spatial experience. Thus it could potentially help to avert a mismatch between the community's needs and the 'conceived space'.

3 METHODOLOGICAL GROUNDING

3.1 CASE STUDIES

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Aspects of case study approach have particularly pertinence to the nature of this research. In particular, this project is concerned with three very specific cases, of makerspaces in England and Scotland: Hackspace Manchester, Maklab Glasgow, and Fablab Manchester. Case studies tend to collect in situ data and study the phenomenon in context (Robson, 2011). Both characteristics exist in this project. However the fact that, with this project, the characteristics emerged (as opposed to being planned) is incongruent with the norms of case study design. One further factor is the consideration that "in one sense, all projects are case studies" (Robson, 2011). As such this project consists of a series of case studies, but given the substantive emergence of this project one could hardly say that the method or methodology adopted is a case study methodology, at least not without considerable qualification.

3.2 AN ETHNOGRAPHIC INVESTIGATION

In a similar vain to case study approaches, some aspects of the ethnographic tradition seem to have a good fit for our research. Ethnographies tend to: gain an insider perspective to understand shared cultural/social meanings; feature interaction with the context; and the use of narrative to communicate findings (Robson, 2011). Another point of interest is the generally accepted principles that ethnographies are timeless, without a specific end point, and usually do not have a rigid structure at the outset (Trochim, 2006). These points are applicable to this project, and are in fact quite definitional features of how this project evolved.

Although it appears clear cut that this study is an ethnographic one, there is a crucial parallel between some elements of ethnographic theories, and the emergence of this project. Ethnographic studies can be explained in terms of 'subtle realism' as described by Hammersley (1992). The assumption is that knowledge can be explained in terms of uncertain beliefs. Validity, through confidence, is likely and does not depend on the demonstrability of empirics. The aim of research can, perfectly legitimately, be to represent an understanding of reality from a singular perspective. Precisely the same epistemic foundation underpins this project's conclusions.

3.3 GROUNDED THEORY APPROACH

When it comes to transferring qualitative data into findings with validity, grounded theory has been deployed by researchers to serve this purpose (Suddaby, 2006). Grounded theory as a method, shares a key similarity with methods employed for this project, that is they take into account details as they emerge. Grounded theory applies a systematic approach to coding of data in order to arrive at a theory. Given the quantifiable or in this project, codifiable data, grounded theory is an appropriate to synthesize the findings of the research.

The acceptance and realisation of the value that can be garnered by changing a project's direction should not be underestimated. Accepting a degree of flux, and believing in that usable detail will emerge, takes a degree of trust. Grounded theory is a good example that in practice these usable details invariably do emerge. This is an understanding that was embraced when allowing the theme on experience in space in this project to emerge.

3.4 TELLING THE RESEARCH STORY

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Researchers are storytellers in some way. We inevitably end up telling the story of our own research, *per se* narrating we found out. This is an assumption that narrative research leverages. Statistically centred projects will need to tell the story in terms of internal validity and chi-squared tests (Wilson & Hilferty 1931). Similarly, the data that informants, collaborators and interviewees contribute to a project that generates qualitative data are *their* stories. Narrative analysis ignores assumptions and aspirations of objectivity, but rather focuses on the opposite. Narrative analysis techniques focuses on understand why events or perceptions are connected, in order to arrive at meaningful conclusions (Riessman 2002).

Narrative plays a strong part in this project, although not in terms of narrative analysis *per se*. Use of narrative in this project is particularly helpful, by turning the findings of the project into a story, it allows the reader to understand why those findings have merit and are rigorously researched. Given the way in which information was collected and data gathered – by living the experience - narrating the project provides a window for what the moments described were really like to experience, and how/why they're significant to the findings.

3.5 METHODS CHIMERA

The method employed for this project is a chimera. It takes elements of each of the methods reviewed above and puts them to work in order to detect and amplify the reality being studied, and it is within that reality that useful and interesting research observations emerge.

The aim of the study is to expose the detail of challenges and opportunities for social innovation in makerspaces by conducting research *in situ*, at makerspaces. The adaptive and reflective features of grounded theory were employed throughout in order to reassess both what and how the project could deliver. Researcher immersion in the context is central to how meaning and rigour are derived; these elements are very much taken from the ethnographic tradition. The emphasis on personal immersion and experience in fact goes beyond the primarily observational paradigm generally utilised by ethnographers. It is because of the personal immersion that an appreciation of the value of phenomenology needs to be incorporated in the method fusion constructed here.

Finally, narrative research has been employed to meet two purposes. Firstly as an efficient communication tool to convey both the sense of the method employed and also to provide an overview of the findings. The second use of narrative element was to inform ourselves, the researchers, as to what the essence of our argument is. By writing, recording, and then setting our narrative to visuals we gained a much deeper understanding of what the core of the message is, and how best to communicate the value of this research.

4 A RECIPE FOR INNOVATION?

4.1 THE CURRENT ECONOMY MODEL

Lindtner and Li identified (2012) while studying makerspaces in China that there has always been a constant and unresolved issue of financial sustainability inherent to them. This is also true for all the makerspaces in our research; the financial stability is a subject of continuous reflection. There have been

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makerspaces wrestling with funding bodies, for example institutions on whether, how and when to seek or accept support from them. In this session, we will take a look at what financial resources these makerspaces have relied on.

MAKlab Glasgow was originally from the Fab Lab network, however, it has been self-sufficient after receiving start-up capital funding from both the Fab Lab foundation and other funding bodies (including the Scottish Government) in the first two years. Maklab now fully relies on the membership system that it has grown over the past three years. After using the capital funding to set up the place, the maintenance and daily running cost of the space is covered by membership fees and venue hire income.

Hackspace Manchester has been an absolute community space since its birth. HacMan has always relied on its members for funding. The machines that they used to set up the space and even the first rent of the space all came from the original funding members or from donations. The maintenance cost is now contributed to by all members, while the board members are paying the highest membership plus managing the space on a volunteer bases.

Madlab is a self-funded enterprise “there are no big backers and we’re not stacked with cash ... so mostly by begging, borrowing or stealing” as they describe themselves on their website. Madlab runs as a space for communities, with a handful of staff and a few volunteers coordinating and facilitating the space. The money that keeps Madlab up and running are from the courses that run in the space, venue hire rent, and various items of funding that the organisers applied for. It does not have a community base to gather membership fees.

Fab Lab Manchester is owned by The Manufacturing Institute, managed by its technical staff. Also as it belongs to the Fab lab network (and has done since its creation) so there’s help coming from the Fab Lab foundation as well. Fab lab, as described previously, is a community space that also has the feature of space for communities. This is mostly defined by its business model, as Fab lab has its member community which provides membership fees as income. Because it belongs to the Manufacturing Institute, there is also an unstated wish of profit from the institute. Thus Fab Lab has to host different school groups or other temporary communities for their events for the sake of profits.

LuneLab makerspace as a makerspace is still trying to stand on its own feet. Encouragingly, it has just received the first batch of membership fees and some members donated machines to start the space. While writing this paper, LuneLab is still recruiting more members and applying for capital funding via social enterprise foundations. It is hard to say whether LuneLab could become self-sufficient at such an early stage.

The Biospheric Foundation, among all the other makerspaces we have studied, is the only one fully relying on capital funding from enterprises, local government and academic funding bodies. There is also a small amount of income from the organic shop attached to the farm and limited sales of urban farm goods to restaurants and supermarkets.

While reviewing how these makerspaces survive, it is sad to see there are still no successful business models apparent for any of this space to follow. This fact has left us wondering whether a sustainable economic model is what

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makerspaces should be looking for. As a result, we opened up the to discuss our understanding of how to sustain a makerspace.

4.2 PEOPLE AND COMMUNITY

As stated above, makerspaces are not set up for profit and in fact, a lot of them are not even finically sustainable, then what is the power that sustains all these spaces? All of the participants of the makerspaces that we have visited have told us the same thing – that the people gathering at the makerspace are very like-minded. When we were interviewing Jack from LuneLab, we asked him what makes a successful makerspace, his answer was “people, and the mentality people have”. Also Teresa from HacMan summed up that any makerspace “is all about the community”. Teresa is the board member from HacMan and she also works for MadLab as an assistant manager. Before moving to Manchester, Teresa has been a member of several other hackspaces across England. However, as we mentioned during the introduction on the makerspaces, even though we have visited many of these hackspaces and studied those that claimed to be community makerspaces of some sort, we want to make it clear that we believe they are not the same. Taking two polar examples from all six spaces, the Hackspace in Manchester is a space that exclusively serves its members, even during its weekly Open Wednesday, hardly any non-member users come to visit or use the space. Madlab on the other hand is a space open for any group of people or communities to hire the space as an event venue. After spending time in each makerspace and talking to their members and staff, we propose two different community space models: the community space and the space for communities.

The community space is a space that serves a specific community group in order to support the events and activities that the community would like to have in the space. In the case of makerspaces, the community space usually appears as a space for members and mostly members only. It is exclusive. Therefore, easy access is not a necessity for the community space. For instance, although Hackspace Manchester is located in the city centre of Manchester but it is not on a main road, and it does not even have a clear sign on the main entrance. Also as it is a shared entrance for a few other organisations, it is not straightforward to find the HacMan even after entering the main entrance. Taking the LuneLab as another example, the location of LuneLab constrains this particular makerspace to lean more towards the community space direction. This is because it is located in a small town outside of Lancaster without good public transports link to the space. Even driving to the space can prove challenging as it is on the north side of the Lune river which separates most Lancastrians on the south side. Additionally, the only bridge to LuneLab is a rather small one.

When a makerspace is a space for communities or when having the space for communities features, it no longer serves one on-site community only. Therefore, makerspaces could be seen as a temporary community of makers. Like any venue that may be hired, people could gather together at the space for events such as workshops, meet-ups, and hackthons.

For more detail on the differences of the two models, please see the below table.

	COMMUNITY SPACE	SPACE FOR COMMUNITIES
Community group	One specific community	Multiple communities

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Easy to access	Not necessary	A must
Funding resource	Mostly membership	Other resources

Table 1 – Difference Between Two Community Space Models.

By applying the detailed differences of the two space models to the various makerspaces that we have visited we present the results of this classification in a schematic diagram below.

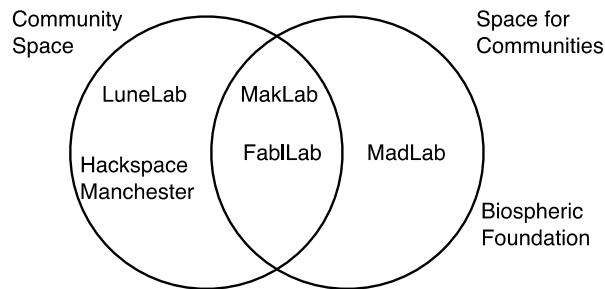


Figure 1 – Makerspaces studies in two different models.

We have finished the review on people and community models of the makerspaces, but one vital aspect of makerspaces that we have omitted so far is the funding model.

4.3 WHAT'S NEXT FOR MAKERSPACES?

After Gershenfeld (2005) introduced the Fablab model, some observations have been made about the impact of FabLabs and Troxler's (2010) research is one of the most complete ones. He identified that Fablabs' impact on technological innovation and production processes is still small; their innovation ecosystem is often limited and they have not yet found a sustainable business model (Troxler 2010). In opposition, he pointed out that community bonds and individual empowerment are the two main achievements. Bauwens' (2005) study helps us to understand the reason behind this phenomenon. A sharing culture can be looked upon as a form of gift economy where mutual reciprocity can reinforce social relationships. Gauntlett (2011), however, provided another perspective that this is only partially true since in a peer-to-peer approach, there is no obligation of reciprocity involved. The creation of social capital in makerspaces seems to rely heavily on a "do-it-together" approach (Dougherty, 2012). By "making together", "connections" between things, ideas and people are generated.

Therefore, it is of critical importance to fathom how to support these emerging physical social networks in makerspaces and what potential they have in relation to social innovation.

We have explored what goes into making a makerspace and a maker community in today's UK. Here, we will discuss what comes out of a makerspace, not in the sense of end product but their impact. In doing so, we would like to challenge

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two common myths about makerspaces: first, that maker culture is essentially apolitical, (we doubt there is hardly anything apolitical) and second, that innovation is limited and bond to wealth production comes from "ideas, knowledge, skills, talent and creativity" (Lindtner & David 2012) happening in post-industrial or developed regions.

The innovation happened in makerspaces could be classified as social innovation. One of the mechanisms recognised by Phills et al. (2008) is the exchanging of ideas and values between different sectors including public, private and non-profiting. A makerspace here is where this innovation could take place, and it is also a party that is involved in the process. For example, people's individual empowerment is mentioned by over 40% of the FabLabs as one of their main prides together with grass-root innovation (Troxler 2010). Instead of new product innovation, economic models, makerspaces should make their vision more about community building, individual empowerment, in other words, socially shaped innovation.

It is possible that makerspaces could evolve into a hub of social innovation. The current trend is that social innovation is becoming the interest of very diverse fields. As Mulgan identified, these fields includes social entrepreneurship, design, technology, public policy, cities and urban development, social movements and community development (Mulgan et al. 2007). After taking a look at the events that have been hosted in makerspaces and the people who attend makerspaces, it is clear that they touch almost all of the fields that are listed as taking an interest in social innovation. This brings us to consider the next step for makerspaces, how could a makerspace promote itself to other fields?

5 FINAL REMARKS

When it comes to the innovation process and idea generation in makerspaces, people always, by default, define the concept of innovation as involving technological innovation only. From our research, we found that not so many people are aware of the social innovation aspect that is emerging and blooming in makerspaces.

In this paper, we have discussed how makerspaces could be tools to stimulate social innovation. By reviewing ethnographic studies across makerspaces from both England and Scotland, we established two separate community space models and illustrated how a makerspace should be set up.

Latour argues that we shall not move "away but toward the gathering, the Thing" we are inquiring (Latour 2004). Treating makerspaces as a matter of fact, we move away from the complex network of actors, contexts, and situations that must be gathered in order to give birth to specific effects (Latour 2004). On the contrary, a move toward embracing this network should be the aim of inquiry if a rich understanding of the complementary relationship between the social value of makerspace and the role makerspace plays in creating this value is what we strive toward.

Why does a glass break when hit by a stone? British philosopher Gilbert Ryle's turns our attention to dispositional properties by giving two rather different explanations. It could be either explained, "the glass broke because the stone hit it," or it could be explained in a slightly different manner by saying, "the glass broke when a stone hit it because it was brittle" (Ryle 1949). When a glass, as illustrated by Ryle, breaks, there is not just one, but many possible reasons, and

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they all relate to the dispositional property of the glass: brittleness. It might be erroneous to make the cause absolute, say the stone is the reason for the glass to break. A more rewarding way, according to Ryle, is not to isolate an effect and its cause in a 1 to 1 relation, but rather to "go beyond" the effect in order to unfold the rich network of multiple relations involved in the creation of the effect.

Ryle's broken-glass illustration serves as the best possible metaphor, which imagines innovation as a dispositional property of the makerspace. Makerspaces, therefore, can be predisposed to produce all kinds of outcomes, but the innovation of/in makerspace is determined only after the confrontation between the space designer's intention and maker's perception (Akrich 1992). If we turn our attention away from value as a matter of fact and instead make value a dispositional property of design, value should then be approached as a "task verb" and not as an "achievement verb" (Ryle 1949).

From our research, we find that the value of makerspaces as social hubs should be bonded around a technology rather than subservient to the technology itself.

We consider our research as a starting point to shift the focus of innovation-oriented studies in makerspaces. We call upon a human-centric reevaluation of what is typically considered to be a techno-centric environment. Implications of such reevaluation, therefore, will require further validation and understanding.

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