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AN INTERDISCIPLINARY PERSPECTIVE TOWARDS MAKERSPACES: 5 CASES FROM LONDON

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MAKERSPACE'LERE DİSİPLİNLERARASI BİR BAKIŞ:
LONDRA'DAN 5 ÖRNEK

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4) Production
5) Identity

In memory of my father, forever and ever.

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LIST OF ABBREVIATIONS

AHRC	Arts Humanities Research Council
CCC	Chaos Computer Club
CNC	Computer Numerical Control
CODA	Craft Organisation Development Association
Covid-19	Covid-19 Pandemic
DFT	Digital design and fabrication technologies
DGML	Design global-manufacture local
DIWO	Do-it-with-others
DIY	Do-it-yourself
HWF	Healthcare Workers Foundation
MIT	Massachusetts Institute of Technology
NLA	New London Architecture
OWN	The Open Workshop Network
PM	Per month
PPE	Personal Protective Equipment
RSA	Royal Society for the Encouragement of Arts, Manufactures and Commerce
SDGs	Sustainable Development Goals
SLMS	South London Makerspace
SoC	Sense of community
STEM	Science, Technology, Engineering and Mathematics
UCL	University College of London
UK	United Kingdom
www	World Wide Web

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ABSTRACT

A makerspace is a workspace that encourages the maker community through collaboration by providing them (physical) space, tools and knowledge for making. This dissertation examines makerspaces as a dynamic social phenomenon in its continuous state of change, aiming to inquire into and theorise them. Specifically, the dissertation raises questions about the positioning of makerspaces, particularly about connections between makers, their community, physical space, neighbourhood and production process in a makerspace.

In this sense, the study constructs a theoretical framework for makerspaces by offering a case study methodology needed to be responsive to makerspace characteristics and necessities. The research design employs an interdisciplinary perspective, from social theories to architectural discourse, and includes observation of makerspaces through site visits and semi-structured interviews with makers and directors from Makerversity, Blackhorse Workshop, South London Makerspace, The Warehouse, and Sugarhouse Studios, all based in London, United Kingdom. These interviews with makers were also released as podcast episodes regarding a selected method for the dissertation.

This dissertation presents perspectives that makerspace possesses distinctive qualities, while the makerspace community positions making at the core of their social connections. Therefore, makerspaces' unique characteristics and contexts are discussed, while this is finalised in the construction of "makerspace identities". With the help of cases, makerspaces are defined as "community with an entrepreneurial mindset in the city", "collaborative environment empowering innovators", "community-led workshop with an online visibility", "open-access factory for everyone to co-create", and "hub for cross-disciplinary studios with a social network". These identities are to open up a discussion for the future makerspaces located in other cities or contexts; and to be aware of the relations

between makers, inner maker community, and neighbourhood as well as the physical space and the urban context. Additionally, makerspaces may evolve into or challenge the concept of thirdspaces, enabling more collaborative settings.

The significance of this dissertation is making contributions to literature using an interdisciplinary perspective, from social sciences to architectural discourse, and framing a systematic standpoint for future studies.

Keywords: Architectural space, community, makerspace, production, identity

ÖZET

Makerspace kavramı, komünite, (fiziksel) mekan ve çeşitli araçlar ile yapma eylemini teşvik eden işbirlikçi bir çalışma alanıdır. Bu tez ile, sürekli değişim halinde olan ve dinamik bir sosyal olgu olarak tanımlanan makerspace'leri örnekler üzerinden incelemek ve disiplinlerarası teoriler üzerinden araştırmak amaçlanmıştır. Bunu yaparken, bir makerspace'in kendi üyelerinden oluşan komünitesi ile bulunduğu çevredeki topluluklara; kentsel konumundan ve mekânsal tasarımına kadar yapma eylemi ile olan ilişkileri üzerinden nasıl oluştuğu sorunsallaştırmaktadır.

Bu anlamda çalışma, makerspace özelliklerine ve gerekliliklerine duyarlı olması gereken bir vaka çalışması yöntemi sunarak makerspace'ler için teorik bir çerçeve inşa etmektedir. Vaka çalışmasının yapıldığı Makerversity, Blackhorse Workshop, South London Makerspace, The Warehouse ve Sugarhouse Studios makerspaceler Londra, Birleşik Krallık'ta yer almaktadır. Araştırma sürecinde mekânsal gözlemler ile yarı yapılandırılmış görüşmeler yapılmıştır. Aynı zamanda, makerlar ile yapılan görüşmeler podcast bölümleri olarak da yayınlanmıştır.

Bu tez makerspace'lerin farklı disiplinler ile ilişkilendirilmiş özellikleri üzerine bakış açıları sunarken, maker topluluklarını, mekan ve üretimi ilişkilendirmeyi odağında bulundurur. Tezin tartışma bölümünde, kendi kimliklerini yaratan makerspaceleri tanımlamak için araştırmanın sonunda; "kentte girişimci bir zihniyete sahip bir topluluk", "yenilikleri güçlendiren işbirlikçi bir ortam", "çevrimiçi görünürlüğe sahip topluluk odaklı bir atölye", "birlikte üretmek için açık erişimli bir fabrika" ve "sosyal ağa sahip disiplinlerarası stüdyolar için bir merkez" gibi kimlikler tanımlanmıştır. Bu kimliklerin amacı, makerpace'lerin karmaşık özelliklerine ve onları çevreleyen ekosistemlere dikkat çekmektir.

Bu tezin önemi, sosyal bilimlerden mimarlık disiplinine kadar farklı bakışlarla makerspace literatürüne katkıda bulunması ve gelecek çalışmalar için sistematik bir çerçeve oluşturmasıdır.

Anahtar Kelimeler: Mimari mekan, komünite, makerspace, üretim, kimlik

INTRODUCTION

With an undergraduate degree in architecture and a master's degree in urban design, I tend to see concepts through the context of the physical environment and their creative outlines. Being a part of Ph.D in Communication, I developed an interest in the interfaces between different research areas based on critical thinking and intellectual integrity through the philosophies, theories, research, and practice in the field of communications. Accordingly, the journey of this research started with my interest in alternative work environment approaches that lead to novel forms of making.

Over the past fifteen years, the term making has been an influential concept which combines social and technological crafts. Making has also grown considerably as grassroots hackerspaces, maker studios, open-source 3D printers, and physical computing platforms have become more widespread. Through making, I was motivated to study mainly makerspaces, as well as open-access workshops, hackerspaces, fabrication labs and co-working spaces. A makerspace can be defined as a collaborative workspace which aims to foster the making by providing specific facilities. I will also explore the definition of a makerspace in the coming sections, but it is good to build a visual in your mind when you hear the makerspace; it is two separate words. So that if we reference etymological roots, the makerspace is formed by making and space, which also leads to the discussion of how we know whether a makerspace is more making or more space.

Will Holman[1], a director of a makerspace and an architect, claims that makerspaces are a new type of institutional structure and architecture as well as an example of the sharing economy; Holman, however, has raised questions as to whether makerspaces will last (2015). Indeed, as well as the design ideas behind

[1] Will Holman is the founding Executive Director of Open Works, a makerspace in Baltimore City, and he has a background in architecture. Open Works has 7 workshops, 2 classrooms, a computer lab, a mobile makerspace, 115 studio spaces, and a coffee shop, making it one of the largest non-profit makerspaces in the United States. See the website https://www.openworksbmore.org/about-us/

makerspaces, they also have an important relationship with the community. This has led me to explore the manifestation of makerspaces, with their physical and cultural contexts, not limited to the physical structure or spatial layout. For instance, a makerspace's physical environment encourages emerging relationships in their own maker community (Nonaka et al., 2006). As physical spaces seem to be one of the fundamental aspects of a makerspace, it necessarily comes into being with people and tools. Makerspaces have been an area of research which has been extensively investigated in the last decades. However, there is a lack of research into the components of a makerspace that could provide an ecosystem for the makers. With this perspective, I will investigate the physical and social parameters of these maker environments regarding their past, today and future.

This study will explore the cultural and spatial conditions of makerspaces, such as community engagement, spatial data, and production processes, by focusing on various debates in these contexts. I will also investigate how architecture can enrich makerspaces and expand their community. More notably, urban context and location is also a challenge how a study on makerspaces is required to react. In other words, this research will offer an alternative way to look at the relationships between collaboration, space, and innovation.

While this research is grounded in communication studies[2] as a discipline, it will draw on several fields of knowledge, including architecture, urban studies, politics, economy, and organisational studies. In line with this, the makerspace phenomenon will be defined as an interdisciplinary notion by examining the boundaries of making, space and community, whereby it is essential to collect, investigate and explain how these perspectives relate to one another. Therefore, the links between these fields have been framed for makerspaces, such as community making and the public sphere, architectural space, and process of production.

[2] Communication studies is a wide field of enquiry that studies communication as a social activity. Communication studies draw on cultural and media studies as well as other disciplines, including sociology, politics, information technology, psychology, history and linguistics.

Regarding the study site, I will focus on makerspaces in London. As a recent resident of London, I have had the opportunity to see the diversity of the makerspaces, their physical space and observe how they connect with their communities through production. Kirk and Morgan-Hatch state that "London, like other urban centres, has undergone major changes in all scales of making and production in the last 150 years - from heavy manufacturing down to more artisanal activities" (2015, p.14). Accordingly, Nesta[3], implies London has much more makerspaces than the rest of the United Kingdom (UK) combined (2015). With these increasing opportunities for production, London offered me the chance to carry out an in-depth study of makerspaces and their environments. As New London Architecture (NLA)[4] stated, London's economy has experienced a resurgence of enthusiasm for making and crafting locally sourced goods, and a celebration of bespoke in recent decades (Murray, 2016). As I will explore London makerspaces, it is essential to go through making related to the people and the space. Accordingly, Tim Ingold claims that making puts a significant contribution with its relationship to environment:

> [w]hat then is the relation between thinking and making? To this, the theorist and the craftsman would give different answers. It is not that the former only thinks and the latter only makes, but that the one makes through thinking and the other thinks through making (Ingold, 2013, p.6).

As Ingold explores, making through thinking or vice versa is possible (2013). When people think of the portrayal of a makerspace, the first picture that comes to mind could be a set of various tools waiting for someone to use them, or various 3D printers lined up to print. These images can make someone believe that all it takes

[3] Nesta, formerly NESTA (National Endowment for Science, Technology, and the Arts), is an innovation agency for social good. Through a variety of activities, including investment, policy, research, and the establishment of partnerships, the organisation promotes innovation across a wide range of industries. See the website https://www.nesta.org.uk

[4] New London Architecture (NLA) is an independent information resource and discussion forum dedicated to the built environment of London. To spread knowledge, NLA produces research, exhibitions, events, and publications. Some of the NLA's research studies are: WRK/LDN: Office Revolution, Opportunity London, London Design Capital, The Changing Face of London, London Boroughs 2020. See the website https://nla.london/

to create a makerspace is to install these distinctive components. However, a makerspace needs to have a sufficient support system more than the space or the tools; for this reason, defining a “makerspace” is crucial.

As the makerspace phenomena has been researched in multiple countries, institutions and academic environments - from arts and humanities to the social sciences and technology perspectives - there are various views for the purpose and definition of a makerspace. The term makerspace typically refers to community-led, open places where people gather frequently to collaborate on creative commons-oriented projects while sharing resources and leveraging open-source hardware and software (Niaros et al. 2017). Of course, there are many ways to interpret makerspaces, and as they evolve and become more varied, so does the definition itself (Sleigh et al., 2015). Therefore, it is essential to discuss the image of a makerspace from different perspectives, such as organisational, social innovation, entrepreneurship and business points of view. However, a general definition is provided by Sleigh et al. in that a makerspace is a place where people of all skill levels and backgrounds can go to learn new skills and share what they've made (2015). In this respect, it is good to have an example of a makerspace; how do we understand it, differentiate it from other working environments, or define it as a makerspace?

According to the proposed definition with a greater emphasis on activities by Bagley (2014), makerspaces are community workshops that serve as an environment for knowledge exchange and entrepreneurial experimentation through making. Despite the similarities in the purpose, location, access, business model or community engagement, the process is totally intrinsic to makerspaces. From the workshop perspective, Cavalcanti defines a makerspace as a manufacturing and innovation space, allowing people to proceed with various interests, including art, electronics, woodcrafts, sewing crafts, mechanics, computer software and robotics (2013). As I discuss further in Chapter 1, these makerspaces act like spaces, facilitators, and driving forces of making with the vision of a new economy. Most

importantly, however, their applications and contributions to communities are viewed as important milestones. I will also explain the aims of makerspaces in Chapter 1. For example, some makerspaces mainly focus on encouraging entrepreneurs, founding a start-up company or creating innovative products, whereas other makerspaces explore materials, crafting or making. In this perspective, some makerspaces celebrate new forms of entrepreneurship, learning through making or alone-together creating.

To examine the makerspaces, it is also necessary to describe who a maker is. In his seminal book Makers: The New Industrial Revolution, Chris Anderson[5] highlights inclusively, claiming, "[w]e are all Makers. We are born Makers (just watch a child's fascination with drawing, blocks, Legos, or crafts), and many of us retain that love in our hobbies and passions" (p.13, 2012). However, Dougherty associates making with social and cultural developments and represents makers as toolmakers, artisans, inventors, innovators, do-it-yourself-ers (DIY)[6], hackers, hobbyists, tinkerers, and YouTube influencers (2016). As Dougherty's and Anderson's portrayals of makers are general, I will also mainly focus on Chapter 1 with makers from diverse backgrounds like art, architecture, design, engineering and innovation. Accordingly, Gollihue portrays an autonomously placed "maker" in the design and production of physical goods, from craft to electronics (2019). The primary intent here is that when a maker comes to the makerspace, she/he searches for new methods to innovate, produce or create. On the other hand, from the community perspective, defining makers leads to thinking about people collaborating, rather than typical entrepreneurs. As Gutiérrez (2018) points out, a

[5] Chris Anderson is an English American entrepreneur and author. He spent seven years at *The Economist* before joining *Wired* magazine in 2001, where he served as editor-in-chief until 2012. He is the cofounder and current CEO of the drone manufacturing company 3D Robotics. *Makers: The New Industrial Revolution* (2012), written by Anderson, was based on his 2010 article *Atoms Are the New Bits*. The article *From Do-It-Yourself to Do-It-Together*, published in the *Harvard Business Review* in February 2012, highlights the ideas he presented, such as crowdsourcing of ideas, utilising available low-cost design and manufacturing tools, and evaluating options to outsource capital-intensive manufacturing.

[6] The expression DIY first appeared in literature in 1912 and largely refers to actions performed by non-professional practitioners engaged in home improvement and maintenance (Gelber,1997; Williams, 2004). According to Kuznetsov and Paulos (2010), the spread of affordable tools and the rise of novel sharing mechanisms have sparked a renewed interest in the DIY movement.

maker's mindset should underline sharing, collaboration, critical thinking, and resilience while developing collaborative projects. In this respect, Hartmann and Mietznel (2017) state that there are different ideas about why people make, create or manufacture and exchange knowledge collectively, whereby they characterise DIY as a more individualistic attitude, while do-it-with-others (DIWO)[7] described a more collaborative approach.

Regarding the needs and purposes of makers, they continue to search for new ways of doing and creating new services, products or artefacts both in the digital and physical worlds. As a result, makers are accidental entrepreneurs who act in a variety of networks and generate fresh ideas and innovative thinking (William Barrett et al., 2015). With the same point of view, Morozov (2014) believes that makers are interested in designing and manufacturing or developing their skills by attending classes in well-equipped makerspaces. On the other hand, a maker wants to share with other makers, including the tools, expertise and ideas in a makerspace (Browder et al., 2017). Accordingly, as we can understand from a maker's perspective who is a member of a makerspace, they look for the potential of a makerspace, including communication with their peers or expanding their network of contacts while designing or manufacturing. This can be seen in the recent literature, where there is a lot of discussion about the potential of makerspaces. These can be classified[8] under social innovation, collaboration, creativity, and alternate entrepreneurship. Makerspaces welcome makers for social and technological experiments about fabrication and the act of making (Ingold, 2013).

A makerspace has physical and social dimensions, connecting makers to others through tools and resources. They also welcome makers for social and

[7] In 2006, Furtherfield, a non-profit organisation and community located in London, coined the phrase do-it-with-others (DIWO) to describe and reflect its own participation in a series of grassroots experiments. See the Furtherfield's website https://www.furtherfield.org

[8] For social innovation see; Unterfrauner and Voigt (2017), Hochgerner (2012); Gauntlett (2011), Smith (2017); for collaboration and creativity see Baichtal (2012), Britton (2012), Wenger (1998), and Menichinelli (2020); for alternate entrepreneurship see Fawcett and Waller (2014), Browder et.al (2017).

technological experiments about fabrication and the act of making (Ingold, 2013). However, the most prominent component is the community, which reunites makers with other makers, local inhabitants, and the neighbourhood itself. According to Dougherty, the connection between makers and community is the heart of the maker environment (2012). Moreover, community means cultivating collaborative relationships with a global network as well as with local maker communities. According to the Library as Incubator Project, the mindset of community engagement, collaboration, and the invention is more important than any particular collection of materials or physical space in the formation of makerspaces (Batykefer, 2015). From this perspective, the community is an essential element in sustaining other parameters of a makerspace. Founders of makerspaces seem to accept that community is the ultimate element that frames and supports them (Baichtal, 2012; Britton, 2012). Previously, makers could only unite while they were at work, in school, or at home, whether in a garage or a laboratory (Browder et al., 2019). In today's world, makerspaces frequently host groups of makers who share a similar interest in experimenting and who gather to create.

Makerspaces have also been described under the Maker Movement, named the next industrial revolution, pointing to its novel characteristics and technologies (Anderson, 2012; Berman, 2012; Hatch, 2014; Maietta & Aliverti, 2015). The movement is associated with the "maker" idea, which emerged when Neil Gershenfeld[9] published his book on FabLabs and 3D Printing in 2005. After that, Dale Dougherty[10] launched Make Magazine, which has been acknowledged as the beginning of the Maker Movement, and promoted technology, creativity, and enjoyment. Since then, making has become popular in the world of communications

9 Prof. Neil Gershenfeld is the Director of the MIT Center for Bits and Atoms, the founder of a global network of over 2,000 fab labs in 125 countries, the chair of the Fab Foundation, and the head of the Fab Academy. See the website http://ng.cba.mit.edu

10 Dale Dougherty is the CEO and Founder of Make Media, publisher of Make Magazine. Since he created both the magazine and the first "Maker Faire" in 2006, he has been labelled the "godfather of the Maker Movement." Dale was influential in founding the Maker movement, which is transforming science and technology education and offering unprecedented economic opportunity for youth and a revival in urban manufacturing. For more information see the website https://makercity.com/team/dale-dougherty/ and https://makerfaire.com

and commerce (Hartmann & Mietznel, 2017). On the other hand, many scholars believe that the Maker Movement originated from craftworks earlier. While Burke (2015) points out that hobbyists, arts and crafts groups, practical education and science fairs have existed for a long time, he also agrees that the Maker Movement gained its purpose with the Make Magazine launch. Holm, on the other hand, thinks that the Maker Movement promotes entrepreneurs in three ways:

> [f]irstly, the Maker Movement attracts more individuals into product design and thus may launch more accidental entrepreneurs if they find that their user solutions have a market. Secondly, the Maker Movement generates dense but diverse networks, creating new ideas and innovative thinking. Lastly, the Maker Movement lowers the costs for prototyping, making initial sales and acquiring outside funding more realistic (2015, p. 24).

In makerspaces, makers working on hardware and software tools develop and design objects as part of the Maker Movement. Some makers develop and manufacture for local needs, expanding upon something utilised or just starting for the joy of creating something unique and different (Maker Media and Intel, 2012), while others work on prototypes for something they hope can be commercialised (Maker Media, 2014). This potential commercialization increases the inevitable entrepreneurial conjecture in the makerspaces, which I will examine more deeply concerning innovation and creativity contexts. According to Fawcett and Waller, the Maker Movement can transform the supply chain design (2014). This leads to a discussion of how makers produce, respond to manufacturing activities, and play a role in the supply chain.

According to Lefèbvre, new social relations demand a new space (1991). The reason for this is that social space is related to form (a fundamental aspect of space), structure (real spatial experiments) and function (socio-cultural aspects of space). Therefore, based on Lefèbvre's concept of space, I will argue that a makerspace creates a social space. In this regard, I will explore the spatial design of space, while adapting its form to the socio-cultural aspects such as community, neighbourhood and the city itself. It is also critical to discuss why physical space matters, while relating makerspaces to urban space and the public sphere. In the recent literature,

there is a range of critiques of makerspaces, which I will examine under the themes[11] of the Arts and Crafts Movement, gender equity and ethical frameworks. Accordingly, I will discuss contradictions and tensions rooted in making, the Maker Movement and makerspaces.

Makerspaces involve many aspects that can impact the making process and the work and role of makers, from specific spatial attributes and social preferences to layouts of space and tools affecting production. Therefore, the main focus of this thesis is to identify the characteristics of makerspaces that facilitate community interaction, production processes and help better understand the relationships and interdependencies between the social parameters and physical space. The thesis will indirectly narrate my journey from being an architect to being a pluridisciplinary researcher. Therefore, I aim to systematically analyse the physical environment's role (in different scales) and cultural environment in the making context. The three main goals of the study are as follows:

1. Build a comprehensive understanding of how makerspaces form their community in their being and within the public sphere.
2. Discover the significant aspects of makerspaces related to their design and spatial features.
3. Witness and assess the production process of makers in terms of the creative value chain.

I have organised the questions of this research in a way to discuss these aims through clusters of research questions considering the theories of community-making and spatial design. In line with the definitions above, my main research question is: How can we investigate the impacts of community, space and production on the characteristics of makerspaces?

[11] For the Arts and Crafts Movement, see Morozov (2014); for a holistic approach, see Holman (2015); for gender equity and feminist hackerspaces, see Fox (2015); Buechley (2014) and Chachra (2015); for ethical framework and sustainability, see Kohtala (2015), Smith and Light (2017).

I will articulate the main question concerning three sub-questions, which also form the chapter structure: First, what does mean a community of a makerspace? This is followed by, how communities engage through making? Second, what are the spatial notions of makerspaces? How have the form, function and structure emerged in a makerspace? Third, to what extent do makerspaces assist production? Can we see any alterations in the creative value chains affected by the making process in makerspaces? In the context of widespread interest in makerspaces, these questions will help investigate whether a makerspace is a self-contained phenomenon or requires other narratives. This structure will allow me to understand makerspaces and their impact on community, space and production. The research questions will also allow me to explore the spatial necessities of makerspaces by identifying different forms, functions and structures through the idea of a collaborative environment. Accordingly, these questions will be addressed by examining my case studies and the data drawn from selected makerspaces in London.

Regarding the scope of this study, there are some areas that this research does not attempt to address. Firstly, I will not include makerspaces in libraries, museums, schools and other educational institutions. I will instead focus on self-governing ones functioning as a makerspace in their physical setting. Secondly, I will exclude the makerspaces as learning environments, supporters of the educational system or STEM[12] learning. Instead, I will concentrate on the innovative aspects of production and collaboration. In order to address the above research questions, I will examine the makerspace phenomenon and its position through the following methodology and methods. Having investigated a wide range of qualitative research methods, I feel that the makerspace as a multidisciplinary subject is ideally examined by using constructivist paradigm. The constructivist paradigm considers knowledge as a "human construction" that acknowledges "multiple realities" and views research as a process in which "the researcher and the participant co-construct understandings"

[12] STEM stands for Science, Technology, Engineering and Mathematics. See the website https://www.education-ni.gov.uk/articles/stem-strategy.

(Hatch, 2002, p. 13). According to Silverman (2013), from the perspective of the constructivist approach, knowledge is created as opposed to discovered and sustained through social processes and interactions between individuals, including the researcher, and communities.

The choice of a suitable methodology and related methods always comes from the research purpose. I will try to apply constructivism to my multi-case study research, in which I will explore the experiences of makers so as to produce a rich and deep understanding of the field. Therefore, I will follow the case study methodology suggested by Yin (2014), and conduct an exploratory, holistic multi-case study. The development of my pattern language of makerspaces will be based on relations between people and their environments. Consequently, several cases from diverse contexts were required to increase the external validity, as indicated by Yin (2014), and to transfer the findings to new situations while maintaining the replication logic.

One of the empirical methods for approaching makerspaces was through selected makerspaces located in London. According to the scholars, there is no ideal number of cases for the multi-case study, but several recommendations have been provided. Eisenhardt suggests that between four and ten cases often work well (1989), while Curran and Blackburn believe that case studies for the research on business can be fewer than ten (2001). For this research, upon a prior assessment, I decided on five cases. My main goal is to relate the variables of these makerspaces and comprehend how they are designed, managed, and sustained for making. So as to achieve the best possible data to address my research objectives, the case studies will build up through a combination of methods, such as semi-structured interviews, observations and through spatial documentation.

I will now briefly outline my methods that I use to collect data during my interactions with field sites. Firstly, I gather from makers and makerspace directors through semi-structured interviews. The focus of these interviews is to understand the relationship of these actors with the makerspace through experiences

and insights. For the semi-structured interviews, I decided to make them as in the format of podcast interviews. I have been producing and hosting a podcast called Anylabtalks[13] Podcast, where I interview architects and makers. Relating this podcast with my research process, I plan to launch Season 3 of Anylabtalks Podcast, using my semi-structured interviews with makers.

The main reasons for this decision are as follows. Firstly, I invited makers and makerspace directors to participate in the semi-structured interviews, informing them that these interviews would be launched in a podcast, and used for my dissertation which was an incentive to join the data collection process. Secondly, this podcast idea resonated with my creative approach, where I was looking to combine academic research and everyday knowledge production, in an attempt to examine the potential of the podcast as a research tool by reflecting upon my research process. And thirdly, according to Llinares et al. (2018), podcasting's open source is a new way of exchanging ideas outside of the written form of the academic journal and publishing. Therefore, podcasts can empower researchers to engage in academic and public debates in new ways, providing a more accessible form of knowledge. That being said, using semi-structured interviews as podcast episodes raise methodological and ethical challenges. Creating a podcast episode can be highly time-consuming with the required technical expertise, as well as ethical issues of trust and privacy of interviewee data, which I will describe in the methodology section.

In addition to the semi-structured interview, for the observational data, I have been visiting makerspaces located in London several times. I had a chance to see them on their open days, public events or tours organised by their directors, community managers or makers. When meeting the makers in these makerspaces, I tried to understand their personal journeys, stories, how they are making and why

[13] Anylabtalks is a podcast talking with people from architecture, design, and creative environments. In every episode, conversation on ideas, interests, projects, and stories based on the guest's creative journey. Listen on https://open.spotify.com/show/2gbC9d9NRfP6ucKlnKVldt

they are in a makerspace. Furthermore, I exchanged ideas with members of the makerspaces as well as makerspace directors and community managers. By conducting these site visits, I was able to produce diagrams, and cognitive maps to spatially analyse the makerspaces. I also framed data from makerspaces' organisational documents, such as written yearly reports, so as to analyse a general scheme of their location, community, functional structures and purposes, projects, number of members and their local and global networks. I also gather digital data from their websites, social media accounts and the content they share on other online platforms. In this dissertation, I will also present the online visibility of makerspaces through photography, architectural plans, and spatial illustrations. I will link these data to the bigger scale of the physical environments of these study site neighbourhoods.

These data collection methods will be carried out in the following five field sites (See Figure 1), each representing a case study:

1. Makerversity in Central London
2. Blackhorse Workshop in North London
3. The Warehouse in East London
4. South London Makerspace in Southwest London
5. Sugarhouse Studios in South London

Figure 1: Selected cases located in the city of London map

Source: Drawing by the author, based London Plan[14]

The first site is named Makerversity[15] and is located in Somerset House Studios in central London. Makerversity founders are designers who have been working with community groups, organisations and institutions to explore ideas for social change. Makerversity has been supported by Somerset House[16] since 2013, allowing for low-cost rent, which allows Makerversity to operate as an affordable makerspace in central London. Therefore, Makerversity differs from the other cases as my practice also located in Somerset House Studios. As a designer, I have the Exchange[17] residency (since January 2020) in Somerset House Studios, which has

14 London Plan proposes a split between Inner and Outer London, with Inner London having a larger population and employment density. The Central Activities Zone (CAZ), which is located in the heart of Inner London, has the highest index values. These regions possess London's highest concentration of financial and globally oriented business services. Almost one-third of all occupations in London are located there. The CAZ is also the city's cultural and retail hub.

15 Makerversity is the most prominent resident of the Somerset House Studios. Makerversity is also one of the case studies I concentrate on in my research. See the website https://makerversity.org.

16 Somerset House is London's arts and culture centre and home to the UK's largest creative community. Somerset House is founded by Somerset House Trust which is an entirely self-funded registered charity that does not receive any regular public funding. See the website https://www.somersethouse.org.uk.

17 Exchange has been given bursaries for a residency, which aims to support a diverse community of creatives. This bursaries designed for underrepresented people in the creative and cultural sector or who have an impactful creative idea that needs a little support to get to the next level. See the website https://www.somersethouse.org.uk/exchange/somerset-house-exchange-bursaries

allowed me the opportunity to observe and be actively part of Somerset House projects and events.

The second study site is called Blackhorse Workshop, which defines itself as "a significant force in determining its neighbourhood's identity as a destination for creative industries" (Davey, 2019, p.9). An open-access community workshop with a focus on wood and metal technologies, Blackhorse Workshop is located in North London and offers regular access to tools, space, and on-site technical expertise. The Turner Prize-winning architecture firm Assemble[18] was charged with developing the workshop's initial concept, design, and physical development. The project was commissioned by the London Borough of Waltham Forest and funded by a group that included Create London, Arts Council England, and the London Legacy Corporation. The workshop's goal is to develop into a socially innovative, top-tier centre for making, building on the region's rich legacy of craft and industrial production.

The third makerspace is called The Warehouse. It is part of "The Every One Every Day"[19] initiative, accommodating people living or working in the Barking and Dagenham neighbourhoods in East London. The Warehouse provides machines and equipment for learning, prototyping and designing. The Warehouse's equipment and support are available for people to learn new skills, from digital manufacturing through hand-tooled and crafted products.

18 Assemble is a multi-disciplinary collective working across architecture, design and art. Assemble was founded in London in 2010 and since then the collective has produced a wide range of work while sticking to its original democratic and cooperative process, which allows for constructed, social, and research-based projects of varying sizes. Assemble is critical for this dissertation as I will mention them in two case studies: The Blackhorse Workshop and Sugarhouse Studios. Assemble work to design, build and manage the workspaces and, after that, share the workshop facilities to support collaboration across disciplines. At present, Assemble as a collective consists of twenty members. None of the members of Assemble are fully qualified architects, but share an interest in the topic (Moore, 2015). The multidisciplinary collective includes architectural creators, designers, researchers, and artists. See the website https://assemblestudio.co.uk/about

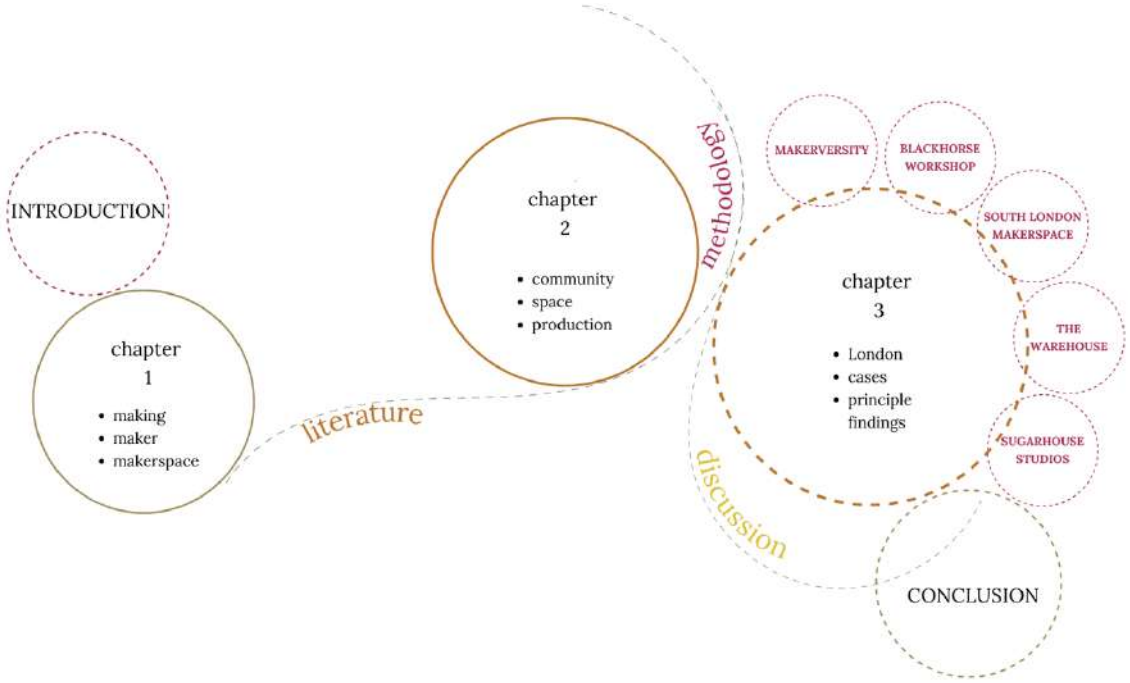
19 Every One Every Day is a network of 1000s of people living in London Neighbourhoods Barking and Dagenham working together on different neighbourhood projects around the borough to make everyday life better for everyone. See the website https://www.weareeveryone.org

The fourth study site is the South London Makerspace (SLMS), known as one of London's most significant community-based makerspaces. It is a non-profit community workshop in a Southern railroad arch in Herne Hill, London, that is open to everyone. Volunteers run SLMS, which has places for 3D printing, textiles, electronics, and woodworking, among other things. SLMS is a creative hub for its members, but it is also a great place to meet new people. They often host public events and let other community groups use the makerspace.

The last makerspace is Sugarhouse Studios, aiming to provide a space for artists, designers and manufacturers around a core of shared facilities that enable and support co-working and collaboration. In the same fashion as the Blackhorse Workshop, the architectural practice Assemble designed the Sugarhouse Studios, converting a former school's ground floor swimming pool and dance studios into a series of self-contained studio spaces. Sugarhouse is also open to the public via events, workshops and classes hosted by studio tenants and members.

Having introduced the research topic, research questions, methodology and the study sites, the rest of the thesis will be organised as follows (See Figure 2). First, building on this introduction, I will present the literature review and analysis of the core concepts of making and the makerspace in Chapter 1, which I will return to throughout the thesis. Accordingly, I will also review makerspace definitions. These definitions draw on seminal books, academic publications, conference papers, institutional reports, research and online publications. Alongside the main parameters, I will also analyse making related to open access, creativity, innovation, economic and social impact, and entrepreneurship. Afterwards, I will clarify the potential, critics, and future of makerspaces. Moreover, I will reflect on makerspaces' challenges and experiences related to the Covid-19 pandemic.

Figure 2: Structure of the research



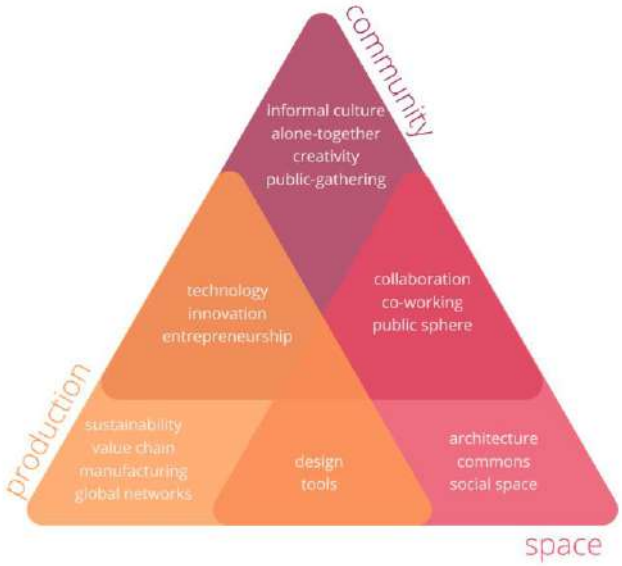
Source: Diagram by the author

In chapter 2, I will demonstrate the theoretical framework of makerspaces around the community, architectural space and production. Throughout this triad (see Figure 3 below), I will also conceptualise the positioning of makerspaces through parameters developed from different disciplines. I will outline the thesis' methodology with the philosophical theories and knowledge of inquiry regarding this structure.

In the first section of Chapter 2, I will explore the community aspect of makerspaces through social theories, urban studies, and organisational approaches to acknowledge that community is a significant foundation for a makerspace. Wang et al. (2015) have discussed grassroot makerspaces and their identity to determine if they are both a community space and space for communities. Therefore, exploring the community means also looking for collaborations and networking

between makers. In this part, I will also discuss related notions of community[20], such as the commons, creative class and creative cities, working alone-together and the sense of togetherness, establishing a connection between these notions and the makerspaces.

Figure 3: Theoretical framework



Source: Drawing by the author

In the second section of Chapter 2, I will assess the interpretations of space and spatial triads through spatial movements. With this framework, I will report the outcomes of the case studies I have realised data collection and analysis processes in the light of related literature on space. Undoubtedly, the scale of the (architectural) space is not limited to its physical structure, spatial layout and design, and it is crucial to relate the space to its relationship with people. I will analyse the socio-cultural factors describing the functional dimension of space with

[20] These aspects will be discussed through the ideas of scholars; for commons, see Bollier (2015) and Stavrides (2016); for creative class and creative cities, see Florida (2002, 2017), Glaeser (2003), Glaeser and Saiz (2003) and Landry (2008); for working alone together, see Spinuzzi (2012); for sense of togetherness, see Sennett (2008).

regard to Lefèbvre's spatial triad and Soja's thirdspace theory. Moreover, as urban studies play a role in supporting the community, this section aims to respond to the current challenge to gain insights into how and why place-based characteristics influence the community process.

In the third section of Chapter 2, I will discuss manufacturing and production in the context of makerspaces. In response to current debates, I will explore the literature relating to innovation and entrepreneurship in makerspaces based on the case studies. Moreover, I will ask the question of how makerspaces help to transform the creative value chain. The extensive literature on the new craft economy (Micelli, 2011), co-making economy (Gauntlett, 2011), democratised fabrication and circular economy (CE) (Ellen Macarthur Foundation, 2015) will help to elaborate the discussion further.

In the last section of Chapter 2, I will present and explore details of my dissertation's methodological perspective and methods. I will draw on relativist ontology and constructivist epistemology as my philosophical positioning. I will further define my reasons for choosing grounded theory - situational analysis and case study as the mixed research methodology. I will also review how my preferred methods and selected theories from cultural studies, communication studies, social sciences, arts and humanities are compatible with my epistemological stance. I will further examine the data collection methods and their limitations. Finally, I will discuss ethical considerations and methodological difficulties inherent to the research.

In Chapter 3, which is the empirical heart of this thesis, I will look at the multi-case study research carried out at each of the 5 cases of study. I will present the setting of the city of London, such as its history as an industrial city, the neoliberal policies, manufacturing, creative industries, and local production. I will attempt to assemble these factors so as to provide a general scene of makerspaces in London. Because each makerspace has emerged from unique circumstances such as cultural and physical opportunities, expectations and limits, location and

neighbourhood, I will provide some context on the particularities of each study site, before engaging with each selected makerspace.

To conclude Chapter 3, I will draw together the research literature to consider. I will also include a discussion of the various parameters arising from the analysis of the selected makerspaces. These parameters, which I will present in detail, will provide an overall understanding of London makerspaces. Additionally, the research questions will be addressed concerning architectural space, whereby the makerspace typology as a physical space of creativity will be assessed. I will end this chapter by thoroughly evaluating my findings.

In the Conclusion, I will criticise the research findings in light of my research questions, reflecting on the complexities between cases and the existing literature. I will then synthesise the commonalities across the case studies and suggest directions for further research in collaboration with makerspaces in other contexts. Finally, I will evaluate the research's overall limitations and the study's contribution to a broader understanding and practical engagement with makerspaces through their present and future formation.

CHAPTER 1: A FRAMEWORK FOR MAKERSPACES

1.1. MAKING

> "I think that through making things, you feel more of a participant in the world, and you feel more a part of it, more embedded - because you are contributing, not just consuming, so you're more actively engaged with the world, and so, more connected."
> (David Gauntlett, 2011, as cited in Jenkins, 2019)

In an interview, Jenkins[21] asks Gauntlett[22], "What do you mean by making?" and Gauntlett answers, "I simply mean people making things, this can be with new technologies, or ancient ones, and can be on the internet, or offline" (Jenkins, 2011, para.11). Gauntlett adds examples of people knitting a scarf, writing a poem, producing a blog, taking photographs and coding a videogame. In line with Gauntlett's thoughts, Dougherty believes the term making can refer to "creating, producing, crafting, shaping, tinkering, composing, and building", whereas he also figures 'making' sometimes overlaps many interests and other skills of people. Elaborating on this description, he argues that "making sits at the intersection of art and science, and at the crossroads of technology and design" (2012, p.11). Alongside Gauntlett, I will attempt to answer this question in this section.

Here for comparison, we should recall Sennett's expressions referring to making. Laurie Taylor moderated a conversation between Gauntlett and Sennett in

[21] Henry Jenkins (b.1958) is a professor at the University of Southern California in Los Angeles, United States. He is the Provost Professor of Communication, Journalism, Cinematic Arts, and Education. He has written many books about media and popular culture, such as *Convergence Culture: Where Old and New Media Collide*, *Spreadable Media: Creating Meaning and Value in a Networked Culture*, and *Participatory Culture: Interviews*. See his website http://henryjenkins.org

[22] David Gauntlett is a British sociologist and media theorist who has written several books, including *Making is Connecting.* In this book, Gauntlett says that making things is a way for people to connect with the world and with each other. See his website https://davidgauntlett.com

her radio show, "Thinking Allowed" [23], where Gauntlett emphasizes that he is interested in everyday creativity by anyone who makes and shares online or offline things because they want to (2011). In comparison, Sennett argues that making is more of a professional endeavour, and that makers are skilled in their type of craftsmanship. He believes,

> [c]raftsmanship may suggest a way of life that waned with the advent of industrial society, but this is misleading. Craftsmanship names an enduring, basic human impulse, the desire to do a job well for its own sake. Craftsmanship cuts a far wider swath than skilled manual labor; it serves the computer programmer, the doctor, and the artist; parenting improves when it is practised as a skilled craft, as does citizenship. In all these domains, craftsmanship focuses on objective standards, on the thing in itself. (Sennett, 2008, p.9)

Although Sennett and Gauntlett argue diverse perspectives on making, they both have the same idea of referring to personal motivation to make something. Regardless, it is critical to understand and also interpret the relationship between making, people and crafts. In an effort to specify the term craft, it is helpful first to explore some historical definitions.

1.1.1. History of Making

> "In early historical times, making stepped forward with the periodic discovery of new tools and materials—giving names to the Stone, Bronze, and Iron ages. In each of those eras, making was a local, personal, and skilled craft; it produced one object at a time, usually made uniquely for one person. That ended when the first industrial revolution arrived in the 18th century."
> (Wujec, 2017, p.30)

[23] "Thinking Allowed" is a radio show also listened to as a podcast produced by BBC Radio 4 and hosted by Laurie Taylor. In this episode, Taylor spoke with David Gauntlett and Richard Sennett on making and diving into their books. *Making is Connecting: The social meaning of creativity, from DIY and knitting to YouTube and Web 2.0* by David Gauntlett, Ryerson University Faculty of Communication and Design Research Chair and *The Craftsman* by Richard Sennett, who is a former London School of Economics professor.

There is a ceramic pot (see Figure 4) from Southwestern Anatolia, Hacilar [24], which reminds us that making is also part of history, where portraying human beings as homo faber formed stories of who we are as people. There is a long history of scholars, such as Gordon Childe (1951), Hannah Arendt (1958), and Henri Bergson (1912), who have focused on humans as tool makers. According to Ian Hodder [25], a British archaeologist and former director of the Çatalhoyük Research Project, the ability of tool making characterises humanity (2012). Hodder also references Clark (1997), that human intelligence is pulled out by tool making and Latour (2005), that human nature and civilization evolve from networks of people and things (2012).

Stoyanova (2017) positions homo faber as man the maker. Arendt differentiated homo faber from pure animals by their capability of creating instruments (1958/1998). For her, the purpose of the action of humans must be the freedom to act like a human; therefore, the true essence of humans is in their social being, in their cooperation with each other (Arendt, 1958/1998). From this standpoint, we can relate the needs of making instruments, tools and a community.

[24] Around 6900 years ago, during the "Pottery Neolithic" period, people in western Asia learned how to produce pottery. For several millennia, pottery was made by hand, since the potter's wheel was invented only in the fourth millennium B.C. Different cultures use different colours, sizes, and patterns on their pottery, and sherds—small, distinctive fragments of shattered pottery—often help archaeologists determine the dates and cultural affiliations of archaeological sites. See the website https://www.metmuseum.org/art/collection/search/325700

[25] Professor Ian Hodder a pioneer of postprocessualist theory in archaeology, was the guest speaker at the "CAMMA Thursday Talks" organised by the Istanbul Bilgi University Cultural Management Master Program (CAMMA) and the Cultural Policy and Management Research Center in June 2022. In his keynote entitled "Making Policy for Cultural Heritage: The Example of Çatalhoyük" he addressed the multiple attempts at cultural heritage management at the Çatalhoyük Excavations, which he directed from 1993 to 2018. The focus of this lecture was to show the policy aim of a heritage site which trying to support local communities with the help of different stakeholders. I believe it is very insightful to mention the community value of Çatalhöyük as well as it is the very rare example of a well-preserved Neolithic settlement, making has places in the region such as back-to-back houses with roof access, the wall paintings, reliefs representing the symbolic world of the inhabitants.

Figure 4: Ceramic painted jar from Middle Chalcolithic Period, ca. 5600–5400 B.C., Southwestern Anatolia, Hacilar

Source: https://www.metmuseum.org/art/collection/search/325700

From a historical view, Stoyanova (2017) also claims that homo faber's relationship to 'making' begins with the Greek philosophers Plato and Aristotle. Plato referenced the Greek word technê for craft, whereas Aristotle defined technê as the artistic or technical knowledge to do things. Therefore, technê is a disposition to produce and bring something into existence. Heidegger described technê as activities and skills of "the craftsman and the arts of the mind and the fine arts" (p.13). He wrote *The Question Concerning Technology*, which builds his thoughts on Plato's insights (Heidegger, 1954/1996). Heidegger also comes with the term "bringing-forth", a tendency shared by a continuum of activity, not only by "handcraft manufacture" but also "artistic and poetical bringing into appearance" (1954/1996, p.10). This is a fitting definition of making for our era as well. Adamson reviews Heidegger with these words: "there are ways of making that connect us to the existence, to the world we inhabit, and others that separate us; the former of these technologies, of course, are the crafts" (1996, p.404). And according

to Adamson (2013), the term craft is derived from the German word kraft, meaning power, whereby we can interpret making as a process, and that this process has power. Although terms and the meanings for making have been changing over time, history shows that the terms are related to process, production and even arts. Since medieval times, it has been possible to witness the history of making through manual production in small workshops, or mechanized production in large factories (Giedion, 1948/2013).

Similar to this, Wujec asserts that making is ageless because makers have be en making things from the earliest times (2017). He provides an example of our earliest ancestor makers as they envisioned an object with a function, planned the making process, worked with materials, and finally used the end result (Wujec, 2017). In an effort to identify the principal aspects of the term craft, it is helpful first to explore some definitions, both present and historical.

1.1.2. "Making is Connecting" and Beyond

Ingold describes making as a growing and weaving of things rather than producing objects related to Heidegger's poiesis (1996). We can see Heidegger's influence on Ingold, especially in his thoughts on the relationship between making and thinking. Ingold states that regarding the ways of making:

> [t]he process of making is not so much an assembly as a procession, not a building up from discrete parts into a hierarchically organised totality but a carrying on — a passage along a path in which every step grows from the one before and into the one following, on an itinerary that always overshoots its destinations (2013, p.45).

Ingold's attention to the process of making is related to the views of Bogers and Chiappini who claim that, "making is a process and a practice, not just an outcome." (2019, p.9). In addition to this view, making is an activity that encourages people to use their minds more holistically for creating, using, and

sharing (Canino-Fluit, 2014). Overall, these views focus on creating a journey or a mindset rather than a specific product. Similarly, apart from the outcome, we can recall Gauntlett's famous phrase “making is connecting” (2011). He considers this to be a simple sentence, but it is meaningful in terms of thinking about people making things and connecting with others (Gauntlett, 2011). Therefore, Gauntlett also states three reasons for the concept: firstly, connecting materials and ideas to make something new; secondly, the social dimension of connecting with other people; thirdly, increasing the engagement with social and physical environments through making things (2011). Indeed, there are other interpretations of making in this particular context. For instance, Carr and Gibson consider making a physical conversation with materials, tools, capacities, and performances (2016). The authors define making as “the composition and/or manipulation of materials that bring into being new or revised objects” (2016, p.302). Similarly, Miller considers making to involve “…integrated skills and familiarity, cognitive knowledge and an active role for tools and materials.” (2016, p.6). The character of making suggests new layers and boundaries while suggesting new juxtapositions among professional designers as well as amateurs. As Barba suggests, making is “a form of design rhetoric” with different understandings and goals (2015, p. 638). Following Vertesi (2014), making is like the ‘seams’ for identity. Thus, this identity represents the common ground between being a maker, an amateur or a designer.

Similarly, I found that democratising technology by digital fabrication as making is another layer of the term. It seems reasonable that there are other parameters in making, especially with emerging technologies. For example, the report Making in an Industry 4.0 World by Monitor-Deloitte stated that making is a general term and applies to creating products from a set of information (2015). Therefore, making can be defined as a naturally creative process in that people are motivated by a passion for solving a particular problem or creating something new. Notably, making involves physical products and a piece of downloadable software in a technological sense. Consequently, in this context, making refers to the process

of conceptualising and creating items, typically through the use of newly available technology.

Regarding this argument, the FairPhone[26] is a good example in this context. Developed at the future lab Waag[27], with the primary aim to find out what a smartphone contains, FairPhone founders expanded the research and scaled it up to a campaign for honest electronics and awareness of the consequences of current production methods. Bibi Bleekemolen, who is the impact and innovation officer of FairPhone, has stated that, "[i]t's all about longevity and DIY repair and product lifecycle, including making it easy to recycle. These were all key aspects of the design brief, which is not usually the case with mobile phones" (as cited in Phipps, 2016). Accordingly, Andrew Sleigh, co-founder of Maker Assembly[28] and host of the podcast *Looking Sideways*, reflected on ethical electronics in a panel called *Ethical Electronics* organised by Kickstarter to help makers establish a positive social and environmental impact with their work. Sleigh shares that, "the goal of the project is not to sell everyone a Fairphone, but rather to make every phone, and every other device, fair" (2018, 10:20). Sleigh believed that making a phone using an ethical mindset could be an approach to designing products which address the growing problem of electronic waste (Sleigh, 2018). In terms of thinking beyond the making process, there are other concerns, as Akemu et al. (2016) explore in their article, Social Enterprise Emergence from Social Movement Activism: The FairPhone Case (2016). These thoughtful notions behind making lead us to think about the makers' values and positioning. Likewise, Wujek clearly states that there is a search for meaning and the future of making:

> [t]he strongest of our superpowers is understanding why we should make things and how that will serve the people we do it for. We will understand this in ways that are

[26] Fairphone is known as the world's most sustainable smartphone. See the website https://www.fairphone.com/en/

[27] Waag is a Future Lab for technology and society that use public research techniques in the fields of technology and culture. Waag is made up of a trans-disciplinary team of designers, artists, and scientists. Waag has twelve research labs, including the Smart Citizens Lab, the Co-Creation Lab, and the Maker Education Lab. See the website https://waag.org/en

[28] Maker Assembly is a one-day gathering of makers. They want to make a place where people can talk about the meaning, politics, history, and future of maker culture. See the website https://makerassembly.org

> deeper and broader than we could have ever imagined before. Right here, right now, we are living in the earliest moments of an amazing new chapter in the history of making things (2017, p.314).

Moreover, there is personal motivation and feelings involved in making. According to Dissanaykae, there is a natural delight in making, such as the pure satisfaction of producing something or using one's agency, skill, awareness and knowledge for moulding forming or crafting materials, apart from their "beauty, uniqueness or usefulness" (2011, p.60). For the research process of my thesis, I have framed making as creating, innovating or modifying something using technological or craft tools for producing something in a physical location. I will explore this in terms of architectural space in the coming sections.

The social anthropologist Tim Ingold (2013) highlights the importance of growth between the process of making and the final created object. "I want to think of making, instead, as a process of growth. This is to place the maker from the outset as a participant in amongst a world of active materials" (Ingold, 2013, p.21). Ingold suggests that we put both thinking and making inside a process of evolution that yields a continuous beginning, rather than a conception of ends (2013). In a recent talk at Architecture Foundation 100 Day Studio[29], he also states:

> [of] course, words like making and growing can have ever so many shades of meaning, and there is not much point in trying to come up with exact definitions or legislate on their use of these very polysemic words. For example, one can make a bed, make love, make hay, and make fire, and each entails a different sense of making (Ingold, 2020, 15:29).

Ingold also makes an interesting point on making: "Making invites a kind of question: what are you making?" Ingold answers his question with insight from

[29] The Architecture Foundation designed the 100 Day Studio initiative. The 100 Day Studio created a series of online lectures, interviews, building tours, panel discussions, and quizzes for 100 weekdays from Monday, April 6, 2020 through Thursday, August 27, 2020. See the YouTube channel https://www.youtube.com/c/ArchitectureFoundation/featured.

Heidegger's seminal essay "Building, Dwelling, Thinking"[30], stating that "as the building is to dwell for Heidegger, making is to growing for me" (2009, p.xiii). Indeed, this view is relatively easy to understand by looking at making from an analogical standpoint. Ingold argues in addition that creativity emerges from an improvisational process between makers, materials and other non-human things such as tools and the physical environment (2013). This viewpoint suggests an interconnected network of relations in the making. At the same time, Ingold challenges creativity notion about making (2013), nonetheless, Stoyanova views making as a philosophical and artistic approach to humanity's connection with technology (2017).

1.1.3. Hacking

It is necessary to look at the definition of hacking when exploring making. The term hacking has been used since the 1960s, whereby hacker culture was associated with the Massachusetts Institute of Technology (MIT)[31]. However, with the rise of the Maker Movement and the questioning of the term making, the meanings of hacking are also being questioned. In the Digital Culture & Society Making and Hacking issue, the editors Annika Richterich and Karin Wenz shed light on the communities and spaces of hackers, makers, DIY enthusiasts, and fabbers (2017). Richterich and Wenz asked academics, artists, hackerspace and makerspace participants to study the philosophical, methodological, and empirical meanings and entanglements of making and hacking. As with the term hacking, the definitions of making and being a maker are debated. Making is frequently associated with the use of digital technology, but it is also used to refer to more traditional creative techniques such as knitting, sewing, woodwork, and metalwork.

[30] In Martin Heidegger's book *Poetry, Language, Thought,* which published in 1971, "Building, Dwelling, Thinking", is one of the texts that influenced architectural thinking.

[31] Hackers emerged from the artificial intelligence labs at MIT in the 1960s within the incubator of an MIT edifice, Building 26, a new subculture was created at the Department of Defense, DARPA.

Particularly concerning hacking, Gui Cavalcanti, founder of Artisan's Asylum [32], illustrated the different associations with practices of making and hacking:

> [no] amount of cajoling on my part will get a professional artist or craftsman unfamiliar with the terms to call themselves a 'hacker', or their vocation 'hacking'; in fact, if I were to say, 'I like how you hacked that lumber together into that table' to a professional woodworker at Artisan's Asylum, I would run the significant risk of insulting them (2013, para.5).

While Cavalcanti's passage indicates essential differences regarding the communities related to hacking and making, it remains to be explored how the actual practices of hacking and making may differ from or resemble one another. It is therefore first essential to look at the definition of hacking when exploring making. Deseriis describes hacking as, "[...] a material practice that involves making a difference in computers, communication and network technologies, which may well be illicit and be subject to seemingly technical criteria of excellence through which community relations are negotiated" (2015, p.3). I would argue that, just like the term making, the definitions of hacking are in permanent flux. Deseriis defines hacking as creating a portal into a virtual realm and, in turn, accessing data (2015). Richterich and Wenz claim that the use of the hacking term is used in symbolic ways, like being able to "hack your food, your furniture, your wearables, spaces (such as museums), biology and even your life" (2017, p.9). Morozov described the word hacking and its implications with the attribution to Stewart Brand's Spacewar article, stating that "to convince consumers that they were rebels, Brand first convinced them that they were "hackers," a slang term that was already in use in places like MIT but that Brand went on to popularize [...]" (2014, para.6).

According to Fallows, making has more positive meanings for technological creativity and imagination, whereas hacking provokes relationships with illegal activities or cyberattacks (2016). On the one hand, Dougherty argues that hacking is a wonderful lens through which to view the world; on the other hand, he asserts

[32] Artisan's Asylum is a makerspace dedicated to educating, learning, and practising fabrication. Their community shares tools and equipment, offers low-cost classes to the general public, has flexible membership and workspace, and hosts a variety of speakers and special events. See the website https://artisansasylum.com.

that making provides a more positive context for customising and improving the environment than hacking (2016). Referring to the views of Dougherty, hacking seems to combine expertise with creativity and a playful approach to technology. By comparison, Cavalcanti (2013) demonstrated the concept of making as material creativity. Following the definitions of making and hacking, we can argue there is a close relationship between the maker and hacker.

1.1.4. "Critical Making"

"Critical making", coined by Matt Ratto refers to design practices that critically engage with technology (2011). In his view, makerspaces, FabLabs, hacklabs and other public workshop facilities are points of departure for critical making, where their concept has become highly inclusive (Ratto, 2011). Ratto describes critical making, social media and DIY citizenship in an interview with Henry Jenkins:

> [w]hereas DIY citizenship emphasizes the dialectic between sovereign and structured self, the term critical making emphasizes the reflexive, praxis-oriented engagements and interventions that emerge from diverse indy or collective energies. Thus the 'critical making' is key to distinguishing the politics of culture as well as an extension of participatory culture (2014).

According to Ratto, critical making is intended to highlight the interwoven material and conceptual work involved (2011). He also describes this as critical thinking, typically understood as conceptually and linguistically based, and physical making, goal-based material work" (Ratto, 2011, p.253). Commenting on Ratto, Stoyanova argues,

> [m]aking becomes clearly defined as a specific mode of production and engagement with materials. However, this understanding of the process of making was not always obvious and has not only been challenged but has been alternatively described within historical philosophy of humanity as a producer (or maker) (2017, p.70).

Ratto further argues that critical making is positioned to reflect the maker's relationship to the produced object or the interplay of the creating process'

components (2011). This view has the potential to relate an individual to the collective. Ratto used critical making as a bridge between critical thinking and physical making (Stoyanova, 2017), whereby Ratto also distinguishes critical making from other essential practices by its focus on the process or the act of making as the site of discovery and learning instead of focusing on an outcome or object as a critical tool (2011). Therefore, the notions of critical making need to be explored with regard to the concepts such as open source, modes of production and intellectual property.

1.2. MAKER

In terms of the evolving maker definition, Dougherty describes the term's history from the concept of Homo Faber - man the maker, until the present day (2016). This historical journey can be linked to various social and cultural developments. Rodgers and Roslund contribute to the discussion, stating that, "[t]he desire to make stuff by hand hasn't gone away. Makers continue the long tradition of tinkering with, changing, and improving their inventions as well as things made by others" (2014, p.7). From the aspect of making and knowledge production, it is essential to ask who a maker is. When we look at makers today, described by Stoyanova (2017) as 'contemporary makers', they both make and produce knowledge for society. Menichinelli states that, "the term maker is very generic and universal; however, the many meanings of the term can be related together, directly or indirectly, to form a definition of who are the makers" (2020, p.22). According to Gollihue (2019), makers have a history that begins with the most traditional of materials: earth, metal, animal fiber, and food, which is far beyond the first computer. Menichinelli further states that the maker term is powerful, but is difficult to translate into other languages. For example, in Italy and Spanish-speaking countries, the term is translated as hacedores which is in Spanish (2020). The Chinese term for maker is 创客 was coined by China's makers themselves. They chose the term to distinguish their work from the world hacker and related

with the words such as innovation (创新), start-up (创业), and creativity (创意) (Lindtner, 2015). A contrasting example is in the academic literature in Turkey[33], where maker and the Maker Movement are not translated into Turkish, but generally used with the exact wording in English. Regarding the language and country context, the term maker has many dimensions, local modifications, and interpretations in-between contexts. Therefore, in answering the question of "how do we define a maker?" it is vital to note a person's identity who apparently shares the same essence with others.

Indeed, apart from the historical and contextual framing, there are other definitions of makers. So, when Dale Dougherty is asked who makers are, he often replies, "[w]e are all makers" (2016, p.6). Likewise, Anderson (2012, p. 13) famously claimed "[w]e are born Makers" (see above, p.5). Apart from them, Gollihue (2019) argues that the term maker has generally referred to people autonomously placed in the design and production of physical goods, from crafts to electronics. To end this part, I will also reflect on what a maker actually does.

1.2.1. Maker Identity

There is a difference between makers and their identities. We can define maker identities through their aims, backgrounds and knowledge. Stoyanova (2017), for example, positions making as a sort of creative practise at the junction of ideas related to the philosophy of technology. She examines the origins of a subculture[34]of artistic makers (Stoyanova, 2017). Whereas, Anderson claims that makers design, and prototype artefacts, produced by using digital manufacturing technologies, spaces, and services for their particular needs (2012). According to

[33] I examined the theses in Turkey on makers archived at the Turkey Database of National Thesis Center of the Council of Higher Education. See the website https://tez.yok.gov.tr/UlusalTezMerkezi/giris.jsp

[34] Stoyanova (2017) opens this subculture of makers in her article called *Reading Makers: Locating Criticality in DIY and "Maker" Approaches*. She positions making as a sort of creative practise at the intersection of concepts, art and technology. Making gives technologically oriented artists a way to negotiate the spectacular and the critical in their work by exposing the hidden technical (and social) login, while it also gives a method for performing criticality.

Vaage, the maker's identity depends on the context (2016). She also reasons that makers need acceptance by their audiences, or instead want to focus on their practice, for instance, she gives the example of biohackers who refer to themselves as practising bioart, biohacking, biofabbing or DIY science in their terminology, rather than as makers (Vaage, 2016). Although the term maker is useful for framing a certain context, as the culture, technology, or even the context changes, definitions will continue evolving

Indeed, there are counterarguments to the use of the term maker. For instance, Chachra argues that rather than the maker, he/she could be assumed to be someone who 'makes things' regarding the vulnerability of taking the entire identity of a person and rather expressing a facet of his own identity (2015). He also believes that if we only celebrate makers, we neglect people who repair, study, and teach (Chachra, 2015). Besides, in the context of Chachra's view, Buechley notes that women and minority groups are much less narrated in maker environments (2014). Furthermore, Buechley (2013) recalls Senneth's[35] craftsman's hand and body expressions, highlighting how the makers' body cannot be ignored in discussions on maker identity.

1.2.2. Types of Makers

> "But being efficient? That's the last thing that's on a maker's mind. Promote comfort and convenience?" Hugh laughed. "Have you actually visited my hackerspace or tried to use any of my inventions lately?" he said dramatically."
> (Cindy Kohtala, 2017, p.235)

[35] Richard Sennett, a sociologist, has re-popularised the concept of craftsman. His seminal book *The Craftsman*, examines craftsmanship and the urge to perform a task effectively for its own sake. Sennett contends in his book that "all talents, including the most abstract, begin as bodily practises" (2008, p.10). He sees the craftsman as a balanced individual with a continuous dialogue between manual and mental talents (2008). He argues that programming, open-source, and traditional crafts do not compete with one another. They rather establish a continuity. Additionally, he asserts that in the United States, earning a craft was usually connected with failure, i.e., not obtaining a university degree. Peter Korn's book *Why We Make Things and Why It Matters: The Education of a Craftsman* provides an empirical illustration of this connection (2017). Korn outlines his journey from earning a degree in history from the University of Pennsylvania to becoming one of the most well-known furniture manufacturers in the United States.

This imaginary dialogue between two makers emphasizes that being efficient means innovating something in a makerspace. Of course, makers can be considered innovative, and therefore they ask for new values and expectations when making (Unterfrauner & Voigt, 2017). Understanding these expectations, makers need to have space as well as communication. According to Nelson and Stolterman (2003), it is essential to assume that makers, just like designers, ought to communicate and work with people, as they need to deal with their work and be empathetic.

Alongside the creation and innovation context, we could see makers as also looking for fun, which integrates their practices and their communities. Makers are playful, resourceful, and experimental (Dougherty, 2016). Roslund and Rodgers believe makers mostly create with resources and play with the world (2014). In addition to the enjoyment side, Gutiérrez also suggests that makers give priority to being in a collaborative, critical and resilient community, where it is important to carry out collaborative projects (2018). This is a crucial definition beyond making; as Dougherty narrates, “makers not only help themselves, but they help others” (2016, p.17). Likewise, Hartmann and Mietznel (2017) suggest that makers are interested in creating and manufacturing things for themselves and hoping to create and exchange knowledge collectively. Regarding this collaboration idea, makers tend to be differentiated from entrepreneurs, where they relate to the innovative context. In this respect, Browder et al. (2017) believe makers share tools, expertise, and ideas more efficiently and collaboratively than typical entrepreneurs.

Concerning entrepreneurs, there are many names used in the literature to compare with a maker, such as a hacker, maker-entrepreneur, hobbyist or innovator. For example, in the Maker’s Manual, Aliverti and Maietta classify makers according to their degree of involvement, skill and knowledge (2015). The Maker’s Manual identifies the following groups of makers: DIYers, self-learners, educators, pro-makers and entrepreneurs (also Dougherty later represented makers, see p.5). This classification is critical for research makers. For instance, if we look deeply at

one of the research projects conducted by Browder et al. (2017), the authors define the term ‘maker-entrepreneur’ by excluding hobbyists and crafters from their case studies. Instead, they interviewed makers generating revenue from their production or operating a commercial enterprise (Browder et al., 2017). From this angle, in the upcoming sections of this research, especially in the data gathering part, I will explore makers through the parameters such as their boundaries between manufacturing, producing craft and/or physical products with creating software or digital media.

1.3. THE MAKER MOVEMENT

> “Make magazine, which I founded in 2005, harkens back to the magazines that hit their peak in the mid-20th century, such as Popular Mechanics, which had the attitude, ‘if it’s fun, why not do it?’. Such publications often helped people to start a hobby and learn new skills. Moreover, they helped the new hobbyist find a community of like-minded tinkerers to share ideas and experiences with. Maker Faire, which started in the San Francisco Bay Area in 2006, expanded this idea of learning and community and created a space where readers of the magazine could get together. At the faire, a maker could put an object they created up on a table and have people ask them about it. Having that kind of conversation with a range of people is the essence of the magazine, and of the whole movement.”
>
> (Dale Dougherty, 2012, p.12)

The official start of the Maker Movement is usually associated with the launch of Make Magazine to promote technology and creativity. The Make Magazine framed and published material about the Maker Movement, especially under innovation, by democratising technology, science, tools, and skills (Cavalcanti, 2013). As Dougherty (2012) emphasizes, launching Maker Faires also helped kick off the Maker Movement in a more global way. According to Richterich and Wenz (2017), these fairs still occur in cities worldwide and are based on

individuals and entrepreneurs presenting, sharing and selling their expertise and products. I can argue that Make Magazine can be considered a modern-day equivalent of the Whole Earth Catalog[36]. Contrary to this view, the founder of the magazine Dougherty, has stated that they took inspiration from Popular Mechanics, a science magazine (Reed, 2018). Reed also argues that Dougherty was inspired by different mediums, organisations and people, such as the garage PC building of Steve Jobs and Bill Gates, the development of the internet, and the World Wide Web (www) in academic labs (2018). Make Magazine celebrated making, and tinkering, where it positioned itself as the face of a self-proclaimed the Maker Movement (Bogers & Chiappini, 2019). Mark Hatch, previously a chief executive officer of the for-profit organisation TechShop Inc., documented the history of the Maker Movement by providing a manifesto. Hatch (2014) claims that makers outside of the academic realm also offer insights into the movement's birth and identify key individuals, companies, and organisations that advanced the Maker Movement. Anderson (2012, p.21) describes the characteristics of the Maker Movement with three clauses mainly concentrating on digital technologies related to the culture of the movement:

1. People using digital desktop tools to create designs for new products and prototype them.
2. A cultural norm to share those designs and collaborate with others in online communities.
3. The use of common design file standards that allow anyone, if they desire, to send their designs to commercial manufacturing services to be produced in any number. This radically shortens the path from idea to production, just as the Web did with information and software.

[36] Stewart Brand, a biologist educated at Stanford, published the first *Whole Earth Catalog* in 1968. The Catalog reached millions of readers and received the National Book Award between 1968 and 1972. The Catalog was essentially a paper-based database including thousands of life-enhancing hacks, tips, tools, suggestions, and opportunities. See the website of Whole Earth Catalog-1968 (https://monoskop.org/images/0/09/Brand_Stewart_Whole_Earth_Catalog_Fall_1968.pdf)

As the Maker Movement has been growing since early 2005, Hartmann and Mietznel argue that making has also been taking place in communications and in the world of commerce (2017). According to Willet, access to technology and knowledge for producing makers' media could be defined as the root of the Maker Movement (2016). He also argues that the 1960s and 1970s' DIY spirit promoted the ideals related to anti-consumerism, self-reliance, and self-actualisation (Willet, 2016). While Dellot believes that the Maker Movement has been beneficial for society and the economy (2015), the author notes that the term 'movement' can be problematic, although makers in this movement are all involved in the production of things, they do not necessarily have the same common goals (Dellot, 2015). Alternatively, the Maker Movement is defined by Ong and Collier (2005) as a worldwide network of hackers and makerspaces, characterised by collaborative design and grassroots innovation and brought to life by offline and online communities making use of the technologies found and produced in these spaces.

1.3.1. Social Movement, Cultural Phenomenon, or an Industrial Revolution?

There has always been an interest in the Maker Movement, also known as maker culture. Bogers and Chiappini argue that the Maker Movement took root in various cultural institutions and supported the notion of affording every individual access to the technology and knowledge needed to produce (2019). In that sense, Lang (2013) claims that the Maker Movement supports empowerment and entrepreneurship. However, Sarah Davies, in her book Hackerspaces: Making the Maker Movement, concentrates on the organisational structure, operational aspects, culture, and communities of makerspaces (2017). Furthermore, she emphasises the relationship between making and societal changes (Davies, 2017), as well as a chapter dedicated to the challenges of women and minority makers or hackers in these environments.

Hartmann and Mietzner (2017) believe that the Maker Movement emerged and attracted increasing attention since 2011, including the beginnings of its

institutionalisation. A small study by RSA[37] (2015) called "How makerspaces can help us master technology for a more human end?" suggested that the Maker Movement should be considered a cultural phenomenon. According to Dellot, the Maker Movement supports people using technology to produce something useful and helps people understand it and what technological tools are capable of (2015). As noted by Anderson (2012) business and entrepreneurial aspects of makerspaces and the Maker Movement have a strong potential to affect the economy, where he also characterises the Maker Movement as the next industrial revolution. I will also discuss this through Chapter 2, related with production and makerspaces.

1.3.2. Potentials and Challenges of the Maker Movement

As noted by Hartmann and Mietzner (2017), the Maker Movement is often associated with sustainability from a social point of view and does not pursue an elitist approach to design. The authors argue that the movement is empowering and inclusive, following a paradigm of participative design, focusing on altering, modifying and improving available resources in terms of both designs and products (Hartmann & Mietzner, 2017). According to this understanding, the Maker Movement generates a diverse network of people that develops new ideas and innovative thinking, where the movement lowers the costs of prototyping and makes early sales and funding more realistic (Holm, 2015). Bosse et al. (2019) argue that the Maker Movement is leading to a new culture of manufacturing, which leads many makers to combine technological interests with a societal mission. Therefore, there is the potential for an inclusive movement that connects people from underrepresented groups with maker communities and develops pathways for self-empowerment, for instance, through co-creating individualized assistive tools.

[37] RSA is the abbreviation for the Royal Society for the Encouragement of Arts, Manufactures and Commerce (https://www.thersa.org).

The global media outlines the Maker Movement, as a modern, democratic culture of innovation that creates the availability of several digital production technologies, such as specially developed software empowering the public to design new products or develop and manufacture existing designs (Hartmann & Mietzner, 2017). As such, one of the potentials of the Maker Movement is that makers are considered as entrepreneurs. As for this entrepreneurial standpoint, Holm implies that if the Maker Movement attracts more individuals into making such as product design, this may lead to more "accidental entrepreneurs" when they find both user solutions and a market to sell the products (2015, p.28). In a study by The Pop-Machina project[38], Metta and Bachus (2020) reported that making has a long-standing history in manufacturing, industries and crafts, and that the emergent the Maker Movement consists of various initiatives. These initiatives are part of the supply chain of making, with the goal to tackle social and environmental issues, and are often grassroots, collaborative, and led by communities (Metta & Bachus, 2020). Therefore, I believe understanding the Maker Movement from real-world experiences is essential.

According to Lande and Jordan, the innovative feature of the Maker Movement is the accessibility and the democratisation of tools (2014). Tierny claims that the Maker Movement allows diversity, such as bringing together makers from different social classes and educational backgrounds (2015). Therefore, the Maker Movement's growing popularity and influence have the potential to challenge global norms in industrial design, production, and funding. Increasing entrepreneurial endeavours, accelerated pace of innovation, and worldwide connectivity are all possible outcomes of the Maker Movement's rising profile and popularity.

[38] Pop-Machina is an EU-funded research programme that aims to determine how the Maker Movement may aid the transformation of cities to CE. A series of novel tools, such as a decision tree, a taxonomy, indicators, and maps of the Circular Maker Movement are developed to define it with a focus on the seven Pop-Machina pilot cities: Istanbul, Kaunas, Leuven, Piraeus, Thessaloniki, and Venlo. See the website https://pop-machina.eu

This perception tries to make the Maker Movement more open and resilient, but there is another view out there that aims for inclusiveness. One example of this is from urbanist Thomas Ermacora, who noted the following at the Maker Movement at the annual Fab Foundation meeting[39]:

> [o]ne of the opportunities of the Maker Movement, in association with cities, is to bring industries closer to inhabitants' needs, to be able to produce customized goods with local materials. The second reason is that there is a tremendous opportunity gap that needs to be addressed by cities in terms of capturing talent. Talent is the most expensive currency to any organisation, city, government, nation. It is the hardest thing to form and the hardest thing to keep. One of the beautiful things with makers is that it's a very self-learning and adaptive intelligentsia. It's a new class of people. (2018)

This comment has been criticised by Kohtala et al. (2020) for separating, instead of connecting, the residents of cities and makers, whom Ermacora described as a "new class of people". Accordingly, Boeva argued that Ermacora reproduces a new creative class definition of Florida. [40]

It seems logical that relating the Maker Movement with the ideas of reproducing sustainability, diversity, or inclusivity is globally powerful. Further, Hertz asserts that making and digital fabrication become isolated without the politics, activism, tactics, history, economics and social issues of the process (2012). In addition to these views, several academics and authors have vigorously challenged the Maker Movement in recent years. For example, in 2014, The Journal of Peer Production committed a whole issue to question the myths of the Maker

[39] 14th International Fab Lab Meeting "FAB14+"is a worldwide event organised by Fab Labs to share, discuss, collaborate and create communities around the different local and global interests regarding digital manufacturing, innovation, and technology. See more at http://fab14.fabevent.org/

[40] Richard Florida is an economist and theorist of Urban Studies. Florida focuses on economic and social theory. In 2002, he wrote *The Rise of the Creative Class.* This book advanced the creative class theory in which he argued that young, creative workers were the new engines of economic growth and that cities needed to court them in order to prosper. Following up on this book Florida published *The Flight of The Creative Class: The New Global Competition for Talent*, in which he devotes a significant portion of polemical analysis to defending his earlier book's argument regarding "technology, talent, and tolerance". In 2017 he wrote, *The New Urban Crisis*, where he explains that this incoming creative class tide has benefited some communities but divided others, creating a bifurcated. He called it "winner-take-all urbanism", charting the rise of "superstar cities" such as New York, London and Tokyo. In the same year, fifteen years after *The Rise of the Creative Class* Florida gave an interview and shared "mistakes were made – but he regrets nothing" as his blueprint for urban creativity blamed for gentrification and inequality.

Movement. In this issue, *Makerspaces and Institutions* (2018), contributing authors compiled a theoretically and empirically grounded analysis of the movement through presenting various tensions and contradictions alongside possibilities in the field. Furthermore, The Journal Digital Culture and Society also dedicated a special issue *Making and Hacking* (2017) and their co-constitutive practices. In this edition, academics, artists, and hackerspace members examined the meanings and entanglements of maker and hacker cultures from conceptual, methodological, and empirical standpoints. In particular, Troxler (2016) disputes the marketing attractiveness of the Maker Movement, arguing that shared machine shops play a minor role in creating wealth, knowledge, political consensus, and the social organisation of life.

Koehn (2015) discusses the evolving nature of the Maker Movement and analyses its ethical underpinnings in his article *The Ethics of the Maker Movement: The Potentially Good and the Possibly Terrible.* In addition to the ethical perspectives, Koehn (2015) criticises the Maker Movement's diversity, origins and future, meaning the maker culture not having an inclusive position for everyone. Stoyanova (2017) outlines the challenges of the movement under cultural codes, radicalism, and the Maker Movement's story (2017). Regarding the point of culture, she reminds the reader of the problems arising within the maker community, especially in the context of gender (Stoyanova, 2017). Similarly, Chachra (2015) believes an imbalanced gender dynamic exists in the maker industry (2015). Saari et al. (2021) ask in their recent article the extent to which the Maker Movement is open. The authors explore the multiple meanings of the concept of openness in the Maker Movement, arguing that it is a bricolage of diverse and situated practices and traditions. As noted by Saari et al. (2021), there is therefore, a need to critically reflect on the contested understandings of the Maker Movement's openness and its future by questioning current systems of consumption, production, and distribution.

Consistent with these criticisms, the Maker Movement has also been criticised for its rhetoric and process. In particular, Morozov [41] (2014) compares the Arts and Crafts Movement with the Maker Movement by what each movement does. According to Morozov, in the former, workers feel the factory's alienation, while in the latter, makers have to be entrepreneurs to become free of the system (Morozov, 2014). Although Stoyanova agrees with Morozov on this point, she elaborates that the Maker Movement's principles are less apparent in the popularised and corporatised version, but that these principles remain critical to many academic and artistic communities (Stoyanova, 2017).

In short, the Maker Movement can be seen as an integrative component of the local and global economy when considered in connection with entrepreneurship. Makers can find companies to market their ideas, prototypes and products, whereas established companies also show interest in the Maker Movement in terms of upscaling their products. These potentials and challenges of the Maker Movement include various parameters, whereby an integrative insight is required to describe and analyse the movement.

1.4. TIMELINE OF MOVEMENTS AFFECTING MAKERSPACES

"Fine art is that in which the hand, the head,
and the heart of man go together."
(John Ruskin, The Cestus of Aglaia,
the Queen of the Air, 1870)

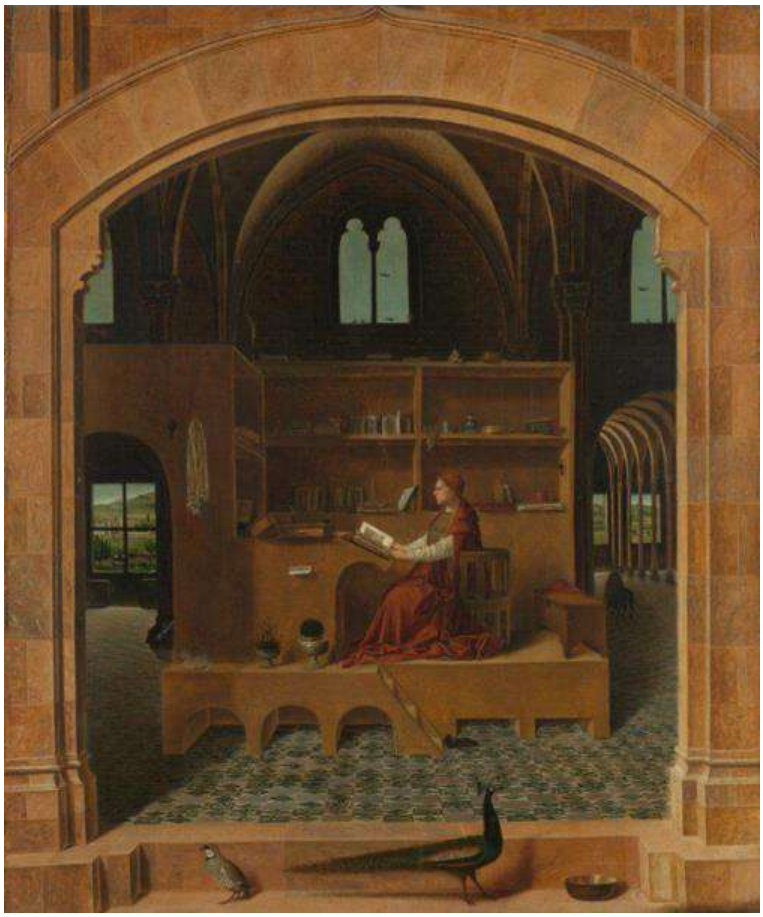
[41] Evgeny Morozov is *The New Republic* contributing editor and the author of *The Net Delusion: The Dark Side of Internet Freedom* and *To Save Everything, Click Here: The Folly of Technological Solutionism*. His article *Making It* received a great deal of reaction. The main ideas of the article is the theme of all of Morozov's writings: "we assign too much power to the magic of technology and not enough to concerns of ethics and politics" (2014).

Can we say that former historical movements contributed to the makerspaces of today? This includes the Arts and Crafts Movement, the Bauhaus school, Computer Clubs, Upcycling Movement and DIY Movement and maybe more. Forming the layers of every thought in making history, does it make sense to draw a linear historical timeline? The answer is complicated, which reminds me of Saint Jerome's (see Figure 5) environment through a stone wall pierced by a broad archway, as we're looking at a part of the whole world imposing spirituality and intellect. From the grid of green floor tiles to the vanishing point that corresponds with the book *the Word*, it is a very theatrical image that is framed, layered, receding, playing with light and shadow, and using methods to emphasise perspective (Heathcote, 2018). Accordingly, this image makes a statement about how we interact with architecture and how furniture can be reduced to a form of it (Heathcote, 2018). From an architectural view, this image always reminds me of the connection between disciplines, thoughts and movements.

When thinking about movements and technology, I would argue that linearity is not the best timeline display instead, the makerspace history can be seen as a comparative non-linear timeline[42], going back and forth between past and future events. As there are many inputs from making, crafting, hacking, and the spaces from past to present and into the future; the stories behind these spaces cannot be easily articulated.

[42] A linear timeline chronicles events chronologically as they occurred in a specific period of time, whereas a comparative timeline illustrates two or more subject areas that occurred simultaneously, and a non-linear timeline progresses and leaps between distinct time periods.

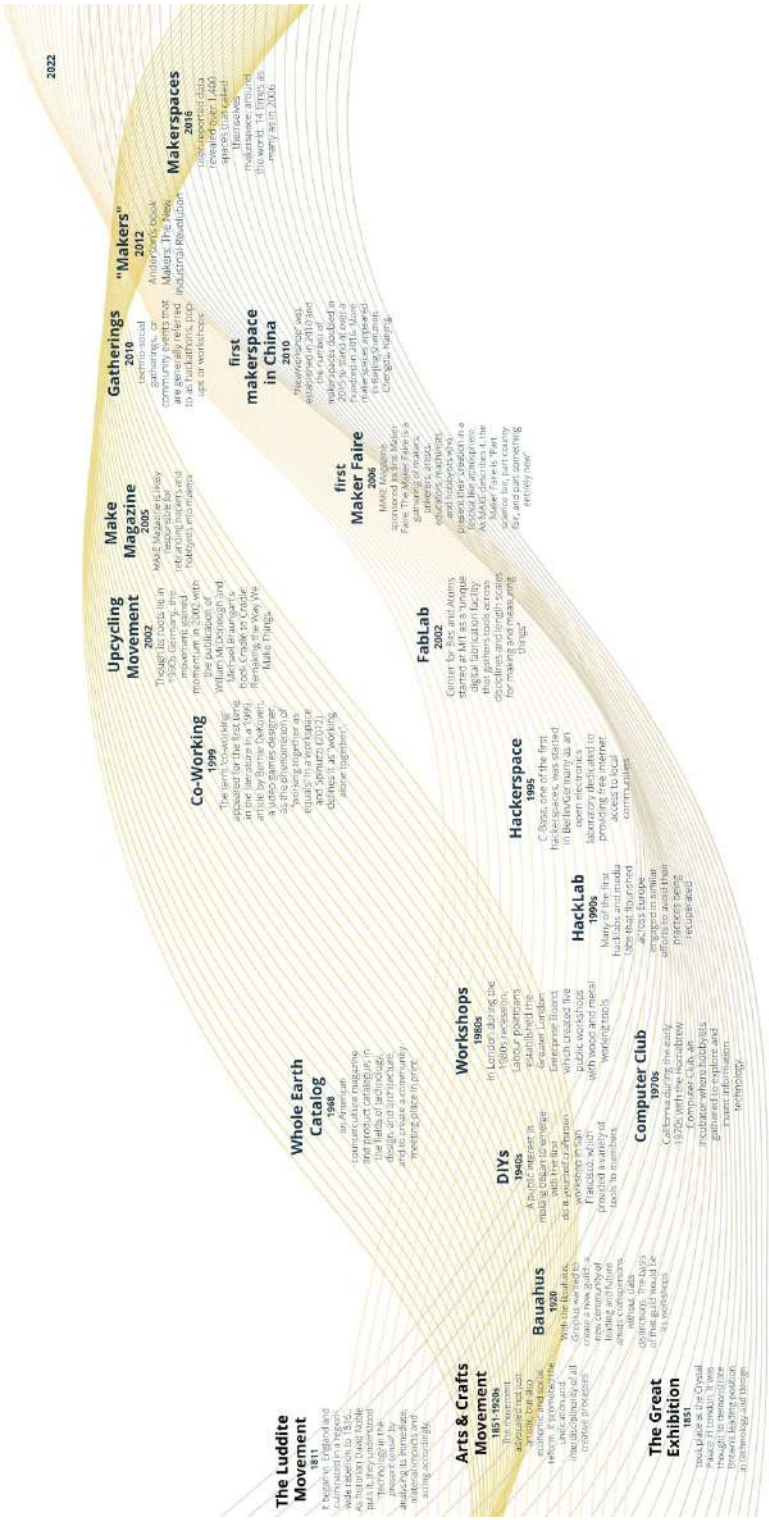
Figure 5: Saint Jerome in his Study by Antonello da Messina



Source: National Gallery

Undeniably, there are many contributing factors to consider. I will present a condensed version of the history of making and the layers of the movements or insights that have taken place from the 19th to 21st century (See Figure 6). As I quoted from Ruskin at the beginning of this section, this timeline, like "fine art" has to consist of the "hand, the head, and the heart".

Figure 6: A comparative non-linear timeline of movements related to making



Source: Drawing by the author

1.4.1. From the Great Exhibition to the Arts and Crafts Movement

Britain's social climate in the late 19th century was shaped largely by the Industrial Revolution and the public's enthusiasm with cutting-edge technologies. These developments impacted several facets of society, including manufacturing, commerce, and the craftsmanship. One important example is the Great Exhibition which took place at the in 1851 (See Figure 7). While the Great Exhibition was the first in a series of World Fairs, the exhibitions of culture and industry became popular in the 19th century. This event was the first to be international in scope, inspired by the French Industrial Exhibition of 1844, and was meant to demonstrate Britain's leading position in technology and design (Willette, 2018). In 1848, the exhibition's catalogue stated;

> [w]e are persuaded that if artistic manufacturers are not appreciated, it is because they are not widely enough known. We believe that when works of high merit, of British origin, are brought forward, they will be fully appreciated and thoroughly enjoyed. ... this exhibition, when thrown ... open to all will tend to improve the public taste (Ditto, p.193.).

Queen Victoria and Prince Albert organised the exhibition with the help of Henry Cole[43], who played an important role in reforming industrial design. Invited countries displayed their achievements in four categories: raw materials, machinery, manufacturers, and the fine arts. Peter Berlyn[44] described the effect of this exhibition,

> [i]n a world everyone may be able to see how cloth is made for clothes, leather for boots, linen for shirts, silk for gowns, ribbons, and handkerchiefs; how lace is made; how a pin and needle, a button, a knife, a sheet of paper, a ball of thread, a nail, a screw, a pair of stockings are made, how a carpet is woven (p.38, 1851).

[43] Henry Cole (1808–1882) was a designer and educator. Cole co-created the Great Exhibition of 1851 with Prince Albert and spent the rest of his life organising worldwide exhibitions. He was the founding Director of the Victoria and Albert Museum, which represents his desire to educate via the exhibition of artefacts.

[44] *A Popular Narrative of The Origin, History, Progress, and Prospects of The Great Industrial Exhibition* is the name of the book by Peter Berlyn. He talks about the history of the Great Exhibition, including how it was set up and other exhibitions of manufactured products that came before it, such as the Exhibition of Manufactures in Birmingham and the Paris Exposition in 1849.

This demonstrates the experiential nature of the fair, and the attention to the elaboration of how everyday objects were made.

Figure 7: "The Inauguration of the Great Exhibition: 1 May 1851", oil on canvas by David Roberts (1796-1864)

Source: Royal Collection Trust

According to King (2007), the Great Exhibition was the forerunner of a whole movement of national and international exhibitions staged worldwide. Today, EXPO (world's fair)[45] is derived from the Hyde Park Great Exhibition of 1851. Despite the Great Exhibition's critics, this journey gave rise to Britain's Arts and Crafts Movement in the nineteenth century. This was a reaction to the negative impacts of industrialisation and the comparatively low standing of the decorative arts, and it represented the beginning of a shift in social ideals towards how things were manufactured.

The Arts and Crafts Movement was a global design movement that challenged mass production, poor design quality, and unsafe manufacturing

[45] A world's fair, also known as an EXPO is an universal exhibition designed to showcase the achievements of nations. See more at https://www.britannica.com/topic/worlds-fair

circumstances. As we search through history, the present form of the makerspace traces its origin back to the Arts and Crafts Movement. The movement began in Britain and flourished over Europe and North America between 1880 and 1910, also emerging in Japan in the 1920s. The movement emerged when students of the decorative arts, consisting mainly of designers, architects, and craftsmen, began convening in order to exchange ideas on economic and social reform which were essentially anti-industrial in nature (Greenstead, 2010). This movement had a strong influence on the arts in Europe until Modernism displaced it in the 1930s, and its impact continued among craft makers, designers, and city planners long afterwards. According to Greenstead (2010), designers, architects and craftsmen, who were once the students of decorative art, began forming the purpose of exchanging ideas when the Arts and Crafts Movement emerged.

The Arts and Crafts Movement's ideology was derived from the critical thoughts of two influential figures, John Ruskin[46] and William Morris[47]. Ryan (2018) claims that Ruskin was influential in shaping the ideas behind the welfare state and the work of William Morris and the Arts and Crafts Movement. Jeremy Gilbert[48] argues that the most significant common ground between Ruskin and modern discourses rests in the possibility that, automation and the advent of technology will allow humans to devote their time and energy to pursuits of beauty.

[46] John Ruskin (1819 –1900) was an English writer, philosopher, and art critic of the Victorian era. He published on a wide range of topics, including geology, architecture, myth, ornithology, literature, education, botany and political economy. In the book *John Ruskin Social Reformer* by John Atkinson Hobson in 1898, he defined Ruskin "only those who are familiar with John Ruskin's estimate of the mercantile life and of the art of home-keeping can understand the full significance of the phrases in which he summed up the distinctive and essential virtues of his parentage."

[47] William Morris (1834 – 1896) was a revolutionary figure in Victorian Britain. His work as an artist, designer, craftsman, author, and socialist profoundly altered the era's ideologies. His friend Philip Webb designed Morris's family house, Red House in Kent, where he resided before moving to London. In 1861, Morris co-founded the firm *Morris, Marshall, Faulkner & Co* alongside Burne-Jones, Rossetti, and Webb, among others. They were a group of like-minded artists and craftsmen who reacted against the shoddy methods of the majority of Victorian industry (https://williammorrissociety.org/about-william-morris/).

[48] Jeremy Gilbert is a professor of cultural and political theory at the University of East London and a member of the founding national committee of Momentum. See more at https://www.jeremygilbert.org

Handcrafted production was highly valued by Ruskin and Morris, who thought that factory employment isolated employees from the products of their labour and deprived them of joy and fulfilment. They also criticised the rise of the consumer society, particularly the introduction of consumer goods of poor design and quality into the market and museums (Morris, 1882; Ruskin, 2004). The pioneers of this movement believed that objects created in degrading working environments such as factories lacked the soul and beauty of objects created by a contented craftsman. In short, Ruskin and Morris began promoting art education and craftsmanship, and attempted to demonstrate that they could create better products than those made by machines in factories. There were, however, significant drawbacks regarding the increased price of such goods, compared to the mass-produced ones. Therefore, the pieces created could only be afforded by wealthier people, which caused discontent among the creators of the pieces.

Morris's critical concepts influenced the Arts and Crafts Movement's philosophy, aesthetic, and emerging design trends (1882). He asserted that factory workers could not create excellent decorative art because they were unhappy or unsatisfied with their low-skilled jobs (Morris, 1882). He also criticised the notion that the relationship between the manufacturer and the designer was weakening, resulting in inferior products and adversely hurting the aesthetic appeal of the things made (Morris, 1882). It seems interesting how designers and makers are again today trying to close that gap by designing and making products themselves or co-creating such products to overcome the critical problems that have roots in the 19th century.

The main aim of the Arts and Crafts Movement was to transform society by making it more humanistic. Research funded by RSA (see Footnote 36, p.32) shows that the Arts and Crafts Movement was not just an economic movement but also a social one, with John Ruskin arguing that making and owning beautiful objects was essential to a man's character and thus a moral imperative (Dellot, 2015). Taken together, these findings illustrate that makerspaces can be seen as a continuation (or a new version) of the Arts and Crafts Movement. They share some similar goals,

such as giving people the freedom to reject monotonous industrial products (Morozov, 2014; Patokorpi, 2014). However, Morozov (2014) argues that the Arts and Crafts Movement failed because it lacked a broad-based appeal among the working class. While John Ruskin and William Morris were applauding handcrafted objects, the broader labour activity was battling with scientific techniques designed to deskill workers (Dellot, 2015). Clearly, makerspaces as contemporary craft workshops can be seen as a reaction against industrialism but also against post-industrialism by alienating tendencies of the knowledge economy (Berardi, 2009). Therefore, there needs to be discussed if makerspaces are efficient or not. In contrast to the early Arts and Crafts Movement, makerspaces embrace machine production, which is at the core of their patterns.

1.4.2. The Bauhaus School (1920s to1934)

> "Now, if one was founding a new Bauhaus—a new place where people build—for the early twenty-first century, [...] what might that look like? A place where art, craft and design can engage with the post-industrial age, and with educating a new kind of artist or craftsman or designer or all three who in turn can flourish within a post-modern society and culture [...]"
> (Christopher Frayling, 2011, p. 133

Like the Arts and Crafts Movement, the Bauhaus School stated that the fine and applied arts should be combined in the overall context of a new concept of architecture. Bauhaus was one of the first design schools and operated from 1919 to 1933 in Germany (based in Weimar until 1925, Dessau through 1932, and Berlin in its final months). In the Bauhaus manifesto, Walter Gropius [49], the founder of the Bauhaus, stated that "the ultimate aim of all visual arts is the complete building"

[49] Walter Gropius (1883 –1969) was a German - American architect and founder of the Bauhaus School. Gropius managed the Bauhaus as its director until 1928. See more at https://www.bauhauskooperation.com/magazine/knowledge/walter-gropius/

(1919). Gropius wanted to create a new community of leading and future artists and craftspeople without class distinctions.

Figure 8: Bauhaus student in the joinery of the Bauhaus, 1928–1929

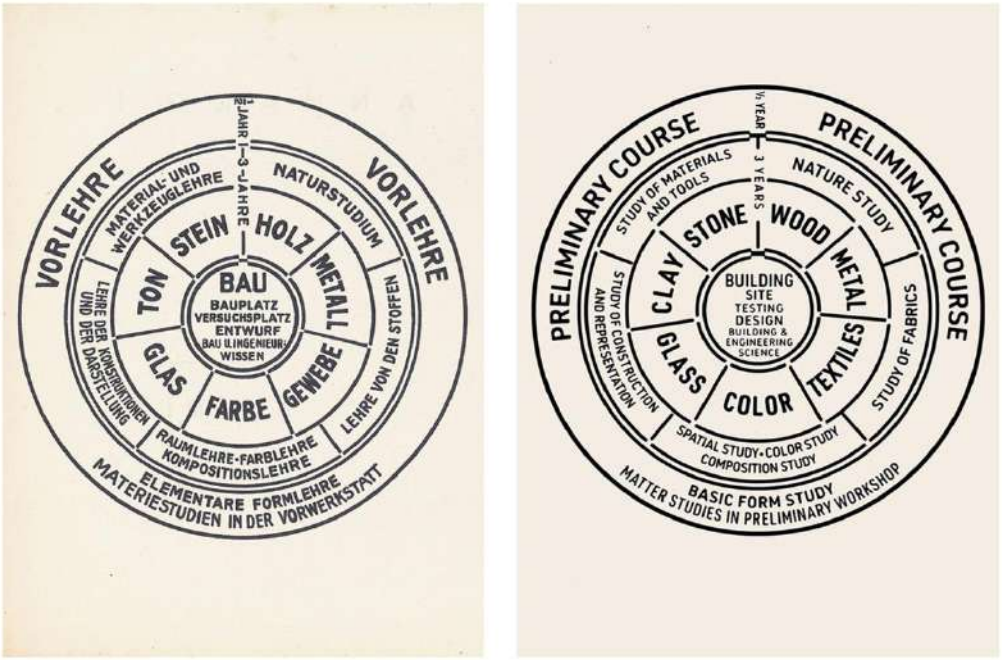
Source: Edmund Collein, bauhauskooperation.com

By pivoting from the crafts towards industrial design, the School eventually aimed to unite arts and technology, through form and function. Moreover, the school could be based in workshops, and not just in art studios. The Bauhaus School was influenced by the Arts and Crafts Movement as well as Modernism [50] and

[50] Modernism refers to a global movement in society and culture that sought a new alignment with the experience and values of contemporary industrial life beginning in the early 20th century. Using precedents from the late nineteenth century as a foundation, artists from throughout the world used new imagery, materials, and processes to produce works of art that they felt more accurately portrayed the reality and aspirations of contemporary civilizations. See more at https://www.tate.org.uk/art/art-terms/m/modernism

Constructivism[51]. Gropius preferred combining different and divergent influences within the Bauhaus Movement. At the Bauhaus School, teachers and students collaborated closely with public life and industry. The curriculum of the school of Bauhaus consisted of two core components: an introductory course and workshop training. The curriculum model, designed as a circular diagram (see Figure 9), became the structure until the school's closure.

Figure 9: Diagram of the Bauhaus curriculum (adapted, right), Walter Gropius, 1922



Source: The Getty Research Institute (https://www.getty.edu/research/exhibitions_events/exhibitions/bauhaus/new_artist/history/principles_curriculum/)

At that time, Bauhaus set a unique curriculum style, which has since influenced art and design education worldwide. The initial workshop training entitled students to pick their preferred workshop. The workshop practise was

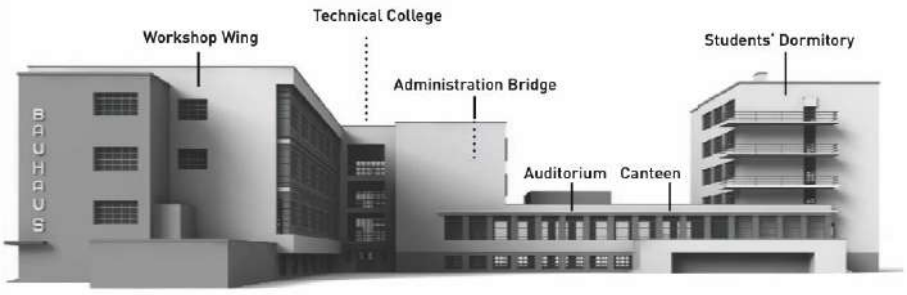
[51] Vladimir Tatlin and Alexander Rodchenko established Constructivism in Russia in 1915. It was a particularly austere form of abstract art. Constructivists thought that art should be a direct reflection of the modern industrial world. See more at https://www.tate.org.uk/art/art-terms/c/constructivism

reinforced with lectures on material and colour theory, tool theory, drawing, spatial construction, and the sciences. In addition, after finishing the workshop programme, students took an examination to become craft masters. The conclusion of this preparation course and workshop training would be Gropius's envisioned building theory (the inner circle of the picture), which is architecture.

When Gropius designed a new building for a design school, the Bauhaus in Dessau, Germany, he created a form of architecture to facilitate the design students' creative activities (McCarthy, 2019). Moreover, the building's integration of many spatial functions inside a single structure was a foresightful design choice (Siebenbrodt & Schöbe, 2015). The Werkstattflügel (workshop wing) housed the workshops, while the Bridge (administrative offices wing) was designated for its specific architectural function (Wilhelm & Gropius, 1983). In Dessau, the focus shifted toward industrialisation and mass production (Siebenbrodt & Schöbe, 2015). Importantly, this was one of the first art and design schools to open its doors to women. However, women were almost exclusively placed in the weaving workshop, one of the only financially viable workshops at the Bauhaus.

In 1923, the faculty introduced a type of intermediary shop floor work (werkarbeit) to connect the preliminary course to the workshops and encourage students to crafts (Stoeber, 2009). The workshops were then transformed from vocational shops to manufactories (produktivwerkstätte) to execute commissioned works. These transformations from shops to manufactories were critical as we relate towards today's maker culture regarding the economy.

Figure 10: The Bauhaus Building



Source: https://www.aboutgropius.com

During the Nazi period Bauhaus was seen as a centre of communist intellectualism, which led to the school's short-lived existence from 1919 to 1933. Nevertheless, the principles underpinning the Bauhaus continue to this day. The figures of Bauhaus [52], assured the survival of Bauhaus visions, such as craft-based workshop practice, connecting art to technology and industry, and specific design pedagogy in later art and design schools around the world. These principles also appeared in the aesthetic and manufacturing approach of, for instance, IKEA[53] (Smith, 2016). A recent research symposium, "Preliminary Course: From Bauhaus to Silicon Valley,"[54] echoes the reassessment of Bauhaus notions for today's

[52] Numerous individuals are associated with the Bauhaus, such as the architects Walter Gropius and Mies van der Rohe, the artists and educators Josef Albers and László Moholy-Nagy, as well as the students and later instructors Anni Albers, Gunta Stölzl, Herbert Bayer, and Marcel Breue.

[53] According to Poon (2019), IKEA seeks to implement the Bauhaus ideal in spirit, but its consumer-driven perspective distinguishes it from the later. While Bauhaus served as a cultural catalyst for change through depoliticization (Dyckhoff, 2002), IKEA prioritises efficiency in its operations through standardisation of designs and processes, sustainable and cost-effective production, and global chain-store retailing via supply chains and franchising (Burt et.al 2008; Edvarsson & Enquist, 2019; IKEA, n.d.).

[54] Preliminary Course: From Bauhaus to Silicon Valley was organised by Projekt Bauhaus, a worldwide project founded to engage in a dynamic discussion around the relevance of the Bauhaus. The year 2019 commemorated the 100th anniversary of the creation of the Bauhaus; Projekt Bauhaus envisioned a synthesis of knowledge in which technical, scientific, emotional, and artistic kinds of knowledge would be interconnected. The project asked these questions, which spaces encourage creativity and innovation, which sites of knowledge does society need today do advanced laboratories of computers, the internet, and media companies represent the Bauhaus of the 21st century. See the website https://projekt-bauhaus.de/en/

developments. The symposium claims that the advanced laboratories of computer, internet and media companies represent the Bauhaus of the twenty-first century.

1.4.3. Do-It-Yourself Movement

The DIY Movement began in the 1960s, with goals related to anti-consumerism, self-reliance, and self-actualisation (Willet, 2016). Atkinson defines the DIY Movement as "a leveller of class" or "a political force... facilitating the wider dissemination of subcultural views" (2006, p.1). Although there is a political side to the DIY Movement (Spencer, 2005), Goldstein states that there is also a social aspiration for DIY in the form of culture, being restricted to home improvement DIY projects (1998).

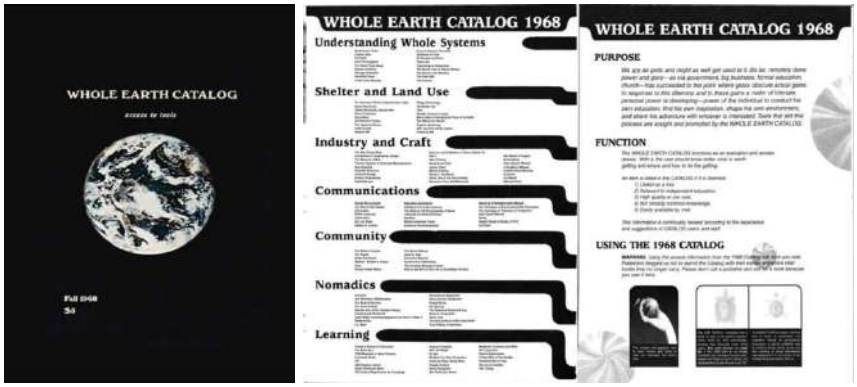
The movement has relations both with individualisation with the DIY as well as collaboration with the DIWO (Hartmann & Mietznel, 2017). Accordingly, these movements have manifestations which also assemble other manifestos[55] related to the Maker Movement. Reed (2016) links the early-twenty-first-century Maker Movement with the earlier artisanal movements such as DIY and zine culture. The DIY Movement can be associated with consumer capitalism and is particularly attractive to radical political collectives, while the Maker Movement promotes a depoliticized lifestyle and self-managerial branding (Reed, 2016; Chidgey, 2014). We can see this evaluation through the Great Exhibition, Arts and Crafts Movement, Bauhaus School, DIY Movement, and finally, Maker Movement. Consequently, it seems reasonable that there are parameters coming from each of them which will help make sense of how makerspaces form.

[55] For Maker Manifesto, see Hatch (2014), for Fixers Manifesto, see Sugru (n.d.), for Repairs Manifesto, see Price (2009) and Mok (2010), for Doers, see The Do Lectures, for Thinkerers, see Wilkonson & Pretich (2014), for Free Software, see Stallman (2002), for Open Source, see Perens (1999) and for Open Design, see Vallance et.al (2001) and Villum (2014).

1.4.4. Counterculture, Hackerspaces and Fablabs

Culture is one of the most used words in the English language (Nelson, 1989). Accordingly, Raymond Williams has suggested that culture is one of the "significant, binding words in certain activities and their interpretation; [and one of the] significant, indicative words in certain forms of thought" (1985, p.15). From this standpoint, English sociologist Bernice Martin (1981) defined counterculture as "an index to a whole new cultural style, a set of values, assumptions and ways of living and the period in which it flowered - the 1960s - was a transformation point" (p.15). It is also critical to mention Dick Hebdig's seminal book, titled *Subculture: The Meaning of Style* focused on the evolution of styles in subcultures such as Teddy boys, mods, rockers, skinheads and punks. Hebdige emphasizes each subculture's historical, socioeconomic, class, race, and mass media contexts, where he criticises some earlier accounts of subcultures that lacked, in his opinion, the inclusion of the broader social, political and economic aspects of these phenomena (1991). Based on subculture theory, Looper (2000) has created a typology of hackers, where he defines hacker subculture using media sources, self-identification procedures and historical information. On the other hand, according to Turner (2008), the counterculture of the 1960 and the 70s is one of the origins of hacking.

Figure 11: First issue cover and first two pages of the Whole Earth Catalog first issue - fall 1968



Source:

https://monoskop.org/images/0/09/Brand_Stewart_Whole_Earth_Catalog_Fall_1968.pdf

It is essential to mention again the Whole Earth Catalog (see Figure 11) which was one of the voices from the counterculture period (see Footnote 35, p.34 above). The term hacking[56] is widely used to describe the actions of digital activists who interact with computers. According to Moilanen (2012), there has been an evolution in hackerspaces, having been derived from this counterculture. Hackerspaces were associated mainly with adults who were computationally focused on making (Cavalcanti, 2013). Hackers came from volunteer groups of computer users who enjoyed exploring the limits of new technologies from both lab-based and informal locations (Coleman, 2013; Kelty, 2008). Therefore, the emergence of the first idea of a makerspace can be traced to the moment that hackerspaces appeared in the 1960s (Braybrooke, 2018).

In 1995, C-Base[57], one of the first hackerspaces, launched in Berlin as an open electronics laboratory committed to providing local communities with a free Internet connection. In 2018, C-Base had 550 active members hosting seminars on topics such as metalworking, 3D modelling, circuit-bending, wireless networking, and sound-hacking (C-Base). Today, C-Base still continue to work as a non-profit hackerspace. The hacker revolution had a greater impact than anyone anticipated. In the 1980s and 1990s, there were notable hacker communities such as the Chaos Computer Club (CCC) in Germany and the Electronic Frontier Foundation in the United States. In 2001, MIT established the Center for Bits and Atoms as a one-of-a-kind digital manufacturing facility that gathers technologies for making and measuring objects from several fields. Four years later, the Center inaugurated its first FabLab, a technical prototyping platform for innovation and creation that stimulated local entrepreneurship. The MIT class "How to Make (Almost) Anything?" taught by Niel Gernshenfeld has impacted the FabLab, which is regarded as a prominent example of a makerspace (Hartmann & Mietzner, 2017).

[56] See Best (2003), Coleman and Golub (2008), Musiani (2012), Bazzichelli (2013), Coleman (2013) and Adam (2003) for more on the widespread hacker identity; see Musiani (2012) for on how hackers differ from the governance of free software development; see Bazzichelli (2013) and Coleman (2013) for on the aesthetic and performative aspects of hacking.

[57] See the website: http://www.c-base.org

From this view, if we move back to the timeline (see Figure 6), the relations between the different movements have shaped the development of makerspaces, which will only continue evolving into the future with new ideas and attitudes.

1.5. TOWARDS A DEFINITION FOR MAKERSPACE

There are apparent normative questions that arise while looking at the makerspace. What is a makerspace? What kinds of definitions have been proposed? What does that term indicate for those who are a part of this? What will makerspaces become in the future? One might make the case that the term makerspace encompasses a wide range of activities and settings. However, the term makerspace does not have a broadly recognized definition. In the context of this study, I will refer to makerspaces as spaces with a variety of tools, as well as a community of makers with creating and doing at their core.

Regarding my observation on makerspaces, which I will describe further in Chapter 3, makerspaces can be designed to respond to many demands, such as management models, location and size, the communities around them, and their relations with innovation and technology. These demands vary from one makerspace to another due to their changing functions and aspirations. Therefore, the definition of makerspaces needs to be more specific with detailed examples. And for this research, in the case studies, there are various examples to make this ongoing definition of a makerspace. For example, Makerversity is a makerspace located in the heart of central London that serves as a collaborative workspace and offers a physical space equipped with various tools, equipment, and facilities for makers to produce their creations. Makerversity also offers support for those who want to start their businesses, which is the biggest challenge for a maker, and the makerspace provides access to resources such as funding, mentorship, and business development training. One example of members in this makerspace is Scaled, a company that develops custom-fit material solutions for flexible body armour, which is used in various fields, including sports protection, medical rehabilitation,

and industrial work safety. Therefore, as one of the makers, Scaled employs 3D printing technology to design for any body part and application area to deliver flexible impact protection and prevent hyperextension injuries in human joints through interlocking scales (Ellard, 2022). As a maker in a makerspace, Scaled embodies the spirit of innovation and collaboration, using cutting-edge technology and a multidisciplinary approach to develop solutions that address real-world problems.

When I entered Blackhorse Workshop, another makerspace in East London, a man was choosing a bunch of raw wood, and two guys were bent over a laser cutter, which was giving off a smell of burning wood. In another room, some of the makers were taking a class on how to use 3D printers. In the garden, people were sitting around and chatting (Blackhorse Workshop, fieldnotes, 2021). When observing a makerspace, you will see that many makers are frequently working in small groups. In a manner comparable to the workshops at the Bauhaus, makers utilise makerspaces to acquire skills and habits through hands-on manufacturing. However, makerspaces of today are more accessible to technologies, whereas the Bauhaus workshops frequently struggled to meet industrial requirements. For example, I interviewed Shruti Grover, a maker, researcher, and co-founder of Pattern Project,[58], a clothing micro-factory devoted to simplifying sustainable fashion. From these observations, it follows that a comprehensive perspective is required to define makerspaces.

Although makerspaces share a common set of cultural norms (Levy, 2010) and often the same types of equipment and operating methods (Gershenfeld, 2007), makerspaces are characterized differently depending on context. There are also different aspects of understanding makerspaces according to criteria of innovation,

[58] Pattern Project is a microfactory in South London. They make clean, urban, and cost-effective apparel production possible. While based at Makerversity, Shruti's roots in digital manufacturing came calling. The concept of a clothing micro-factory was conceived by a group of individuals who drew inspiration from their local community and newly discovered passion for sewing. See the website https://www.pattern-project.com/

technology, fabrication, urban context and social relations[59]. Mikkonen et al. (2007), for example, argue that the models of management, location, and the skills of the communities that live around them are important for defining a substantially unique profile for each space. Makerspace models may also differ significantly, from more business-oriented models, often sustained or partnered by corporations and foundations, to models sustained by the public (Niaros et.al, 2017). Therefore, we have to assess makerspaces in their own contexts and relate them to selected parameters. Furthermore, makerspaces have their own rules and thematic intentions, which may vary based on their unique history as well.

1.5.1. Do We Need a Definition?

It seems reasonable to say that makerspaces emerge in different shapes and sizes. However, there is a common point for all makerspaces in their spatial divergence of bringing makers, experts, ideas, tools, and knowledge together. Numerous research have been conducted to determine how makerspaces are structured, what types of communities support them, who is responsible for administering them, and what their professional engagement is (Bianchini et al., 2017). Therefore, to define what a makerspace is, I will group the definitions under the themes of the aim, perception of tools, spatial needs, administration style and members.

Firstly, makerspaces can be defined by their mission and vision. Basically, Smith (2017) believes that makerspaces are sites for democratising innovation activity and framing the flourishing of social innovations. Smith describes a makerspace as socially transformative, educationally useful and entrepreneurially promising (Smith, 2017). This definition highlights entrepreneurship, creativity,

[59] For makerspace definitions through innovation, see Cattabriga (2019), Smith et al. (2013), Lindtner et al (2014), Amabile (1988) and Laing and Bacevice (2013); for technology and fabrication in makerspaces, see Dellot (2015), Gershenfeld (2012); for public sphere and urban environments of makerspaces, see Taylor et al. (2016), Richardson et al. (2013).

and innovation. For instance, one of the case studies, Makerversity is singularly focused on supporting maker start-ups, while most other makerspaces are aimed towards hobbyists. Similarly, for scholars like Bagley (2014), a makerspace looks to be a community workshop, serving as an environment for knowledge exchange and entrepreneurial experimentation through making. Countering this view, Holman (2015) believes that the aim of makerspaces is not simply to become start-up boot camps or factories of the future, as they have a multi-faceted nature of making as well as a value proposition for their spaces. Therefore, Holman (2015) defines a makerspace as center of a new cottage industrial revolution by realizing their potential through a holistic approach.

Each makerspace is unique, and its managers, founders and members shape how it contributes to its community. For example, some makerspaces have a more entrepreneurial priority and offer services similar to incubators[60] with the additional benefit of technological and traditional tools. Alternatively, other makerspaces highlight their open access to space, tools and induction sessions for motivating makers and the local community to develop new skills.

Secondly, makerspaces can be defined by the making process. In other words, a makerspace's core is the various tools and the act of making (Davee et al., 2015). Accordingly, Burke (2015) defines the makerspace as anywhere making happens, where he emphasizes the act of making regardless of space. Conversely, Sheridan et al. (2014) suggests that makerspaces are physical locations where people use materials to create projects alongside other people. Indeed, this definition also covers the relations between makerspaces and innovation, technology, fabrication, as well as the physical space itself. Dellot defines a makerspace as an open access

[60] Incubator is a collaborative initiative meant to provide support and resources to start-ups and early-stage firms. In the early 1990s, incubators were ubiquitous (Hackett and Dilts, 2004), primarily supplying small businesses with physical and financial resources (Smilor and Gill 1986; Allen and McCluskey 1990). However, the incubator model has been criticised over time for its lack of an exit policy (Bruneel et al., 2012) and its reliance on long-term public investment for sustainability.

workshop hosting a variety of new and old tools, from 3D printers and laser cutters, through to sewing machines and potter's wheels (2015). Similarly, O'Donovan and Smith argue that "makerspaces are workshops where people can access a variety of digital design and fabrication technologies (DFTs), as well as traditional tools, and learn how to use them in personal and collaborative projects for making, hacking and repairing objects" (2019, p. 2). From this view, makerspaces can also be defined by their spatial divergence. For instance, Cavalcanti (2013) assumes that a makerspace can be different typologies, such as a classroom, a lab, a conference room, a library, a big warehouse, a workshop, and even a garden, as long as the spaces satisfy the makerspace requirements.

Lastly, makerspaces can be defined by their models of management, business models and economic layers. Specifically, a makerspace is a platform, "for creative expression that goes beyond traditional art forms and business models" (Dougherty et al., 2016, p.15). It has to be said that makerspaces are operated by various business models, such as volunteer-driven, non-profit, or for-profit models, where users pay fees to join as members (Cautela et al., 2014; Mortara & Parisot, 2016). We also see these management models in different makerspaces. Makerspaces can be a community-driven cooperative (autonomously managed and financed), an entrepreneurial initiative, a space supported by a company, or a dedicated space in an educational and cultural institution, such as universities, museums, libraries, and NGOs, which support and supervise makerspaces. These management models are very much related to the location, physical space, the communities around them, as well as economic models.

Kostakis et al. (2014) define four economic models for makerspaces: 1) institutional (free to the user); 2) for-profit (selling classes and memberships); 3) club (dues based on social contract membership); and 4) non-profit (combination of grants, public money and user fees). Unterfrauner et al. (2020), argue that makerspaces are open spaces aiming for democratic transformations, while adhering to traditional market-driven models. Makerspaces also offer capabilities

for participation, deliberation and community development, which constitute their transformational and democratic potential (Kieslinger et. al, 2021). However, makerspaces also reinforce the hegemonic values of the global economy and society at large, such as when they embrace an open innovation agenda that seeks to use the makers' creativity for global manufacturing in line with the dominant economic growth business models.

1.5.2. Layers of Challenges and Opportunities

In the last decade, makerspaces have supposedly experienced a renaissance. Popularized through the Maker Movement, they have been supported by various institutions, local authorities, NGOs and even companies. In connection to their rapid growth and hype, they have increased in popularity through rhetoric and evolution. However, none of this is to say that the success is guaranteed. There have been several intense criticisms of makerspaces, and ever-present challenges to their continued evolution. While some of these criticisms centre on cultural issues within the makerspace community, such as limited maker profiles, diversity concerns, and unequal gender dynamics in the maker industries, others challenge the makerspaces' economic stability and environmental consciousness. Some makerspaces, for instance, seek to extend their rooms or expand to new places, whereas others are minimizing their activities, such as Makerversity's Amsterdam branch, which closed its doors to the public in 2018. Many makerspaces struggle to balance the books, while others find it hard to engage with certain demographic groups, notably women. There are also production related challenges to grapple with, such as managing the intellectual property rights behind making, demands for expensive technology, work expectations, or lack of vision on environmental impact.

Perhaps the most obvious challenge of makerspaces leveraging the criticisms is the ethics, sustainability, and technological condition in makerspaces. For instance, Tierney shared in his article that futurist Jamais Cascio argued that moral and ethical framework has not kept pace with the Maker Movement, therefore

people not having "the wisdom to know what to make and what not to make" (2015, para.18). Accordigng to Tierney, Cascio also claimed that while makerspaces may empower people to master technology, there is no guarantee it will be used for benign purposes (2015). Kohtala, on the other hand, makes a similar critical point through an imaginary dialogue between makers:

> I thought makerspaces were supposed to be free and open and there to provide access to technologies to everyone. Yet you make good business from selling services and holding workshops, so everyone learns how to use a laser cutter and is no longer interested in actually doing anything with their hands," Harriet said, rather defensively. She straightened her shoulders and continued: "And then everyone prints out plastic Yodas and Medium Density Fiberboard (MDF) press-fit boxes and all the waste and off-cuts just go straight to landfill – along with those Yodas and boxes that no one actually needs. And as soon as the next version of the technology comes along, you ditch it and replace it with the newest and shiniest (2015, p. 231).

This quote highlights the importance of the vision and mission behind makerspace organisations, so as to ensure that the true creativity and innovation of makers go towards resisting consumerism, individualism and more collective actions. A challenge for achieving this mission is that alongside production challenges, manufacturing in a makerspace is also related to managing intellectual property rights. According to Dellot (2015), makerspaces must become extremely professional and formalised, which may necessitate greater corporate support. Then there are sustainability-related ethical problems. It is commonly believed that making one's own products has less environmental impact than acquiring new ones, and that small-scale local manufacturing is more sustainable than a system of mass production in which commodities are sent all over the world (Smith et al., 2013). This argument should be nuanced, however, as every makerspace is different in its approach to manufacturing. Smith et al. (2013), believe that there has to be a critical view, for example, crafting a single item of furniture may demand more energy and generate more waste than buying a mass-produced chair from a furniture company. Research by Incite Focus[61] provides an excellent example of how makerspaces can

[61] Incite Focus is a production and training lab focused on the relationships between digital fabrication, permaculture, experiential learning, and appropriate technology. The Michigan State University Extension Partnership identifies Incite Focus as a project partner for Food Plus Detroit, a sustainable food incubator

focus not simply on ‘making stuff’ but on the kind of community-based production that can support a sustainable local economy. This group uses old technologies and revises them with agile new technologies, creating a local market for local products which are generated in makerspaces or FabLabs.

Besides ethical concerns, Gollihue criticises makerspaces for limiting people for becoming a certain kind of maker (2019). This can result in highly technological makerspace communities relegating other more traditional makerspace communities to crafters. This also relates to the profile of a maker. For instance, Langley (2016) remarked on his visit to the Maker Faire Rome, which had over 110,000 participants who wanted to make innovative new things that most visitors walked away from a stand after learning about a project. As a result, technically oriented decision-makers appeared to be blind to the potential contribution of visitors (Langley, 2016). This example is not directly related to makerspaces, but the attention of maker fairs, whereby the movement and makerspaces are inevitable points in common.

Makerspaces can be conceived as spaces that disrupt existing institutions of production and consumption (Smith, 2017). However, as Retsin (2017) notes, Paul Mason and others have argued digital production is forming the basis for a new post-capitalist society, so it is important not only to make nicely crafted chairs, for example, but also to consider production as a more comprehensive cultural and political project. Although it is important to be attentive to the manufacturing critics on makerspaces; I believe, as Smith (2017) does, that responsibilities for social development cannot be held by makerspaces alone and needs avoiding disempowering good endeavours with unrealistic expectations (Cohen, 2017). Moreover, there is another challenge to the economic viability of making. According to Unterfrauner and Voigt (2017), maker products are mostly customised

initiative administered by the Michigan State University Extension Partnership. See Susan Berfield's June 16, 2014, Bloomberg Business article *Fab Lab: The DIY Factory That Can Make Anyone a Maker* for more details on the zero-net-energy home project. See the website https://www.incite-focus.org

and made on-demand, whereby cost becomes the dominant factor over ecological and socio-political considerations.

As I mentioned earlier, there is an awareness of makerspaces' values such as openness, environmentalism, and inclusion. In fact, Neil Gershenfield in his keynote at the maker faire in Rome, argued that makerspaces would play an important role in addressing the United Nations Sustainable Development Goals (SDGs)[62], especially in sustainable cities and communities, climate action, quality education, clean water. Accordingly, Unterfrauner and Voigt (2017) believe that the makerspaces will flourish (like Gershenfield believes) if social innovation momentum would be acknowledged on a macro-level.

Some researchers agree on there being an imbalanced gender dynamic in the maker industry, with fewer narratives of women and minorities in the Maker Movement, and some makerspaces engaging in a limited fashion with particular demographic groups, notably women (Chachra, 2015; Buechley, 2014, Dellot, 2015). Holbert claims that maker communities, companies, and flagship projects tend to revolve around conventionally masculine projects (2016). Chachra also points out the sexism ingrained in making and maker's values, suggesting a more pervasive value system within the maker community - those who make things are better than those who do not (2015). Besides, there are some observations on how the Maker Movement does not include minority communities such as women, people of colour, and people with disabilities (Seo, 2019, Siu et al., 2018). Alternatively, Unterfrauner and Voigt (2017) give illustrative examples[63] showing

[62] The Sustainable Development Goals (SDGs) or Global Goals are a collection of 17 interlinked global goals designed to be a shared blueprint for peace and prosperity for people and the planet, now and into the future (https://www.globalgoals.org/goals/).

[63] Makerspaces and Fablabs were built in refugee camps to solve immediate necessities, and other projects were developed for "Doctors Without Borders". Another example is "Fieldready.org", which makes humanitarian supplies in the field. Maker spaces are also used by parents seeking technical solutions for children with special needs. For example, one makerspace organised a "makerthon", similar to a hackathon, to develop a wheelchair that adapts to a growing body. Interviewed makers described their projects as aimed at contributing to assistive technologies and designs for people with disabilities, such as prostheses, a customised spoon for people with

how some makerspaces value the democratised access given to them. These spaces open their doors to various social segments and groups, from young to old, and from educational backgrounds and communities that are traditionally hard to reach and rarely engage in maker activities such as refugees.

It is also clear that makerspaces are taken seriously as a resource for communities, and not only as a preserve of technologists. Numerous manufacturing methods facilitate personal-scale fabrication, empowering individuals with disabilities to design assistive technology (Hurst &Tobias, 2011; Meissner et al., 2017). However, makerspaces can also play a role in changing broader worldviews. In other words, makerspaces are not only workshops for crafting goods, but also places to prototype a new way of life - one that answers to the potential and problems of a technologically pervasive world. Wolf-Powers and Levers (2016) stated that makerspaces function within urban and entrepreneurial ecosystems to assist makers in tackling manufacturing, finance, marketing, and distribution obstacles. For illustrate, according to Dellot (2015), the ZB45 makerspace in Amsterdam offers monthly meetups to debate technology and surveillance, Fab Lab London runs workshops introducing individuals to the principles of circularity and MadLab Manchester hosts sessions on how to eco-retrofit houses.

It is also essential to be aware of and consider the challenges of makerspaces. Many problems, such as economic instability, and increasing demand for new technologies trigger increasing costs and struggles to balance the book for operations. Moreover, these challenges also affect the quality of makerspaces, requiring more training, collaboration, and better usage of sources. In spite of these challenges and concerns, makerspaces have many potential civic roles, like offering workshops for children and hosting community-wide educational programmes for

partial paralysis, or a golf tee for people in wheelchairs. Alternatively, the “Senior-Design-Lab” had a more social perspective, for instance, supporting an independent life at a mature age.

adults. This variety of functions demonstrates the tremendous potential for makerspaces to improve the lives of their local communities.

1.5.3. Covid-19 Response

As my research timeline covered Covid-19, it is essential to add this standpoint to the writing. According to Ranney et al. (2020), the rapid spread of Covid-19 worldwide placed national health systems under unprecedented pressure, and close to collapse in some countries. The maker community was instrumental in the rapid response to the lack of medical hardware supplies. Makerspaces used digital fabrication tools for life-saving Coronavirus treatments as well as the production of face shields to offer some protective equipment for doctors worldwide (Diez & Baeck, 2020). Across the world, makerspace initiatives appeared to use their digital fabrication tools, such as 3D print valves for life-saving Coronavirus treatments (Diez & Baeck, 2020).

As such, we observe different forms of solidarity appearing all over the world by makers and makerspaces building open-sourced, low-cost medical supplies. According to the Healthcare Workers Foundation's (HWF) report, during the initial lockdown in March 2020, the HWF partnered with a number of companies and organisations to rapidly upscale the production and distribution of Personal Protective Equipment (PPE) to hospitals that were lacking adequate protective equipment with which to work with Covid-19 patients (2021). Richterich (2020) analysed the maker response to Covid-19 in the United Kingdom, and proposed a link between national politics and the strained healthcare system. Richterich argued that there was a political dimension to the situation when volunteers in makerspaces reacted to the governmental failure in healthcare supplies (2020). The makers' Covid-19 response initiatives relied strongly on the sharing of open designs and a self-organised production and dispatching of DIY equipment, via online and social media (Corsini et al., 2020; Zastrow, 2020).

Richterich (2020) also argued that the local production of hardware products by using open source was the core characteristic of the maker communities' Covid-19 response.

To address this special need, Makerversity member Nate Petre [64] came up with the PPE 3D print farm idea. The mission of Petre and the Makerversity's community centred on the pioneering creative and technological exploration of products with a positive social impact. Interestingly, Fabfoundation carried out a survey on the products made by the fablabs in response to Covid-19. More than half of these products were approved or medically reviewed by an agency or organisation. The authors of the study concluded that "a locally sourced, globally distributed manufacturing process could continue to fill an immensely important role in the months (and years) to come" (Fabfoundation, 2020, p.13). Overall, Kinnula et al. (2021) support makerspaces in their publication *the show must go on! Strategies for making and makerspaces during the pandemic*, arguing that the pandemic increases the significance of the skills and competencies in design and technology.

[64] Makerversity member Nate Petre, who came up with the idea for the PPE 3D print farm, was previously a researcher at Imperial College's Dyson School of Design Engineering specialising in Digital Disruptive Manufacturing. Backed by funding from NASA, he developed the world's first fully compostable 3D-printed surfboard. I will further describe his journey in more detail in Chapter 3.

CHAPTER 2: THEORIES ON MAKERSPACES

This dissertation on makerspaces relates to notions of community, space and production. This chapter will describe and discuss these notions in a theoretical context, using cultural theory, design theory, and phenomenology as vectors. This theoretical view provides the foundation for the analysis and interpretation of the empirical material in Chapter 3 and influences the choice of the data gathering methods. In addition, I will describe how a makerspace is part of a broader context and how it can be experienced and understood concerning its outcomes.

To begin with, I will discuss the idea of community and navigate the community-relevant notions for makerspaces. Thereafter, I will examine space - how it can be understood from a theoretical viewpoint, such as constituting the design of physical spaces related to function, and how space interacts with makers from a phenomenological aspect. Afterwards, I'll focus on production and its significance for makers, makerspaces, neighbourhoods, and cities.

At last, I will describe my methodology and research design that have shaped the viewpoints in this thesis and the criteria for what constitutes knowledge. I will explain why I chose to employ a case study approach to investigate the concerns expressed in the thesis's introduction. This is followed by a discussion of the data collection methods that I employed during my fieldwork.

2.1. UNDERSTANDING COMMUNITY

"No man is an island entire of itself;
every man is a piece of the continent, a part of the main;
if a clod be washed away by the sea,
Europe is the less, as well as if a promontory were,
as well as any manner of thy friends or of thine own were;
any man's death diminishes me,
because I am involved in mankind.
And therefore, never send to know for whom the bell tolls;
it tolls for thee."
John Donne[65]

Community as a term is widespread in academic and everyday usage. To provide the term with relevant meaning, the definition of community has to be enriched by an interdisciplinary approach from social theories, urban studies, and organisational approaches. German sociologist Ferdinand Tönnies considered the term community primarily as related to social integration and face-to-face communication involving a feeling of membership and shared emotional connection (1957). In his seminal work *Gemeinschaft und Gesellschaft*,[66] Tönnies characterized community by a natural will, whereby society, or rather modern society is characterized by rational will (1957). According to Tönnies, community is represented by individuals' strong social links (i.e., family, friends, and neighbours), whereas society refers to abstract associations among individuals who do not necessarily share feelings, location or time (1957). As Tönnies argues,

> [t]he true cement of unity and, consequently, of the possibility of a community lays, firstly, on the narrowness of the consanguineous relation and blood mixing; secondly, on the physical proximity and lastly – to human beings – on the

[65] John Donne's poetry *No Man Is an Island* (1988) refers to the connection between all humans. Because every person is a component of humanity, Donne argues that individuals are better off together than separately.

[66] *Gemeinschaft und Gesellschaft* by Ferdinand Tönnies is a classic work of late-modern social and political theory. It emphasises the universally inherent tension between small-scale, kinship and community-based cultures and with large-scale, market-based, competitive civilizations. Gemeinschaft und Gesellschaft, initially published in 1887, is accessible in an edited and translated English translation by Charles P. Loomis as *Community and Society* (1957).

> intellectual proximity. One must seek the sources of all kind of understanding in this gradation (1957, p.47).

Therefore, according to Tönnie's theory, a community can be defined as a group of people that share common bonds around traditions, beliefs, or objectives (1957). Tönnies used community to describe people that actively worked together to maintain their bond and further their goals, rather than as a town or group that was loosely associated. Based on Tönnie's definition, we can frame a community by its aims to come together, which I relate to the maker communities in the following sections. Similarly, Charles Abrams gives credit to cooperation which covers the process of groups working or acting together for a common benefit (1971). Abrams defines community as "that mythical state of social wholeness in which each member has his place and in which life is regulated by cooperation rather than by competition and conflict" (1971, p.60). Similarly, Durkheim (1964) believes that modern society develops community around interests and skills more than their locality.

Alongside these definitions, some scholars highlight the importance of space and people to define community. For instance, Bell and Newby (1974/2012) argue that a community needs a place and a configuration as a way of life. From a similar view, Zibechi (2010) underlines that a community is made up of links between people, so it is not a ready-made concept. In my view, this link between people - makers – in my case, is essential to define a community. On the other hand, this could also be linked with Gusfield's emphasis on "relational" notions of community, which concern "the quality of character of human relationship, without reference to location" (1975, p.16). Indeed, this definition can vary depending on the aims, relating to Tönnies' earlier thoughts. Gläser refers to a community of any collection of participants that have "a perception of having something in common with others" (2001, p. 7), while Djelic and Quack (2010) note that there has seen a shift in usage of the term community in a more minimalist fashion.

Patrick and Wickizer explore the community in the following ways: as a place, particularly a geographically constrained area; as social interaction, where social networks and social supports are essential; and as political and social responsibility, considering political and social incentives in the formation of communal groups (1995). I believe their views are critical as they make an integrated definition of community. According to Bartle (2011), these interactions can be tied to not only behaviours but also acts based on mutually held expectations, values, beliefs, and interpretations.

Widely varying definitions of community have emerged in many subfields of organisational theory (O'Mahony & Lakhani, 2011). For example, it is possible to list community types as open-source communities, scientific communities, occupational communities, communities of practice, technical communities, and online communities (O'Mahony & Lakhani, 2011). Based on these elaborations, a community is a set of interactions between human behaviours. Lately, the theme of community has become increasingly prominent, particularly in discussions in the literature on communities of practice, open-source communities, and supplier communities (Adler, 2015; O'Mahony & Lakhani, 2011). For instance, Castells (2011) claims that these forms of community are dramatically reshaping the industrial landscape, which I expand upon in the production and makerspaces relationships later in this chapter. The different aspects above highlight elements related to physical proximity, shared or bounded interactions and belongings in community definitions. The following table (Table 1) summarises these themes and definitions.

Table 1: Themes and definitions that are used for the community

Author, Year	Theme	Community Definition
Abrams, 1971	Cooperation	Communty is a mythical state of social wholeness in which each member has his place and in which life is regulated by cooperation rather than by competition and conflict
Bellah et al., 1985	Participation	A group of people who are socially interdependent, who participate together in discussion and decision making, and who share certain practices that both define the community and are nurtured by it
MacQueen, 2002	Diversity	A group of people with diverse characteristics who are linked by social ties
Theodori, 2005	Process	The community—defined as a place-oriented process of interrelated actions
Goodings, Locke, & Brown, 2007	Sustained	We will use the term 'community' to refer to any group which is able to maintain itself in this way.
Lehavot, Balsam, & Ibrahim-Wells, 2009	Group	Community was defined by a small group of friends
Zibechi, 2010	Links between people	Community does not merely exist, it is made. It is not an institution, not even an organisation, but a way to make links between people
Mcclellan, 2011	Tangible	Community is therefore at once a lived experience and a tangible entity
Bettez, 2013	Shared beliefs	Communities are comprised of those with whom we share the same values, beliefs, and worldviews
Capece and Costa, 2013	Physical proximity	There are communities that are defined primarily by the territorial dimension, as in the case of neighbourhoods

Source: Arranged by the author

Connecting these definitions to this dissertation, it is essential to consider the context when defining a community, as communities are re-invented and re-created (Zibechi, 2010). Then, findings will contribute to understanding the cooperation, physical proximity and relations between members of makerspaces. It is, however, hard to emphasize how the idea of community is defined through making context. Moreover, there are also critical views on comprehending the meaning of a community. For example, in *Against the Romance of Community*, Joseph (2002) states that community is used as a tagline to create a sense of social cohesion. Moreover, Joseph questions the term community in terms of it invoking an unquestionable good with romantic or nostalgic purposes (2002). Another significant contrasting view is that communities are not necessarily always organised and cohesive; they sometimes lack a sense of community and social

identity (Hamdi, 2010). Davies argues that community is “one of the two main aspects of what maker culture is all about and, thus, suggests this is a core concept: Community, community, community.” (2017, p.157). Before going to explore relations and understanding themes related to the community, it is critical to highlight how I will define community from a makerspace perspective through this dissertation. It is important to note that there are various definitions of community, and one of these definitions pertains specifically to makerspaces. In this dissertation, I will define community in the makerspace as consisting of various groups, including makers themselves, daily users, workshop participants, makerspace directors, community managers, and technicians. This definition encompasses those who are actively involved in the makerspace environment in some capacity. Additionally, there is another community related to makerspaces, which is the local community or the community within the makerspace's neighbourhood. This community is composed of individuals who have a relationship with the neighbourhood and who may engage with the makerspace in different ways. For example, some individuals within the local community may utilize the resources offered by the makerspace or participate in events and activities organized by the makerspace. Others may not actively engage with the makerspace, but they may still have an interest in its operations or benefit indirectly from its presence, such as through increased economic activity or the availability of new resources. I will now explore what the “sense of community” means.

2.1.1. Sense of Community

Sense of community (SoC), also known as “psychological sense of community”, is a concept that focuses on the experience of the community and is used in the fields of community psychology, social psychology, and community social work, as well as in a number of other scientific fields, such as sociology, anthropology, political science, and urban planning. For this research, I would like to understand how communities methodically move through a sense of community.

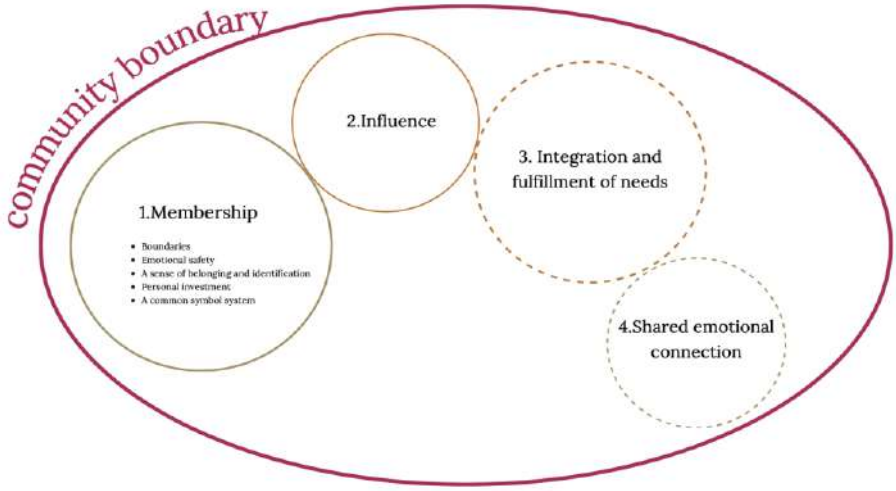
SoC generally refers to how an individual perceives their bond to a community and the intensity of these ties (Doolittle & MacDonald, 1978). In 1974, Seymour Sarason[67] introduced the concept of a psychological SoC where he emphasised the experience in the community rather than the physical setting. McMillan and Chavis (1986) shaped the sense of community as a theory for the first time. Their seminal work claims that SoC could be a model used among locality-based and relational communities[68]. The authors emphasise community as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" (McMillan & Chavis, 1986, p.9). These supportive networks can be defined through makerspaces and their communities, which I will explore in Chapter 3.

McMillan and Chavis also proposed a framework called the four-factor model of SoC to create a psychologically meaningful community, they suggested membership (related to the feeling of belonging to a group), influence (a sense of matter to a group and individual mutually), reinforcement (integration and fulfilment of needs,) and shared emotional connection (belief that members share similar past, places, or experiences) needed (1986). This framework (see Figure 2) remains a contemporary discussion topic among researchers.

[67] Seymour Bernard Sarason was a Professor of Psychology Emeritus at Yale University. Sarason is credited with inventing the discipline of community psychology and he utilised in the social psychology with a variety of duties, such as changing the way schools run, educating teachers, and caring for the elderly.

[68] In sociology and community psychology, the term community has two distinct meanings. Community as the locality is the first, whereas community as a relational group is the second (Bernard, 1973; Bess et al., 2002). Accordingly, the usual definition of a community is "locality-based community", which encompasses city blocks, neighbourhoods, small towns, cities, and rural regions. There exist interpersonal ties between geographically proximate community members, known as inhabitants, although not always by choice. "Relational communities" are marked by interpersonal connections and a sense of community, but they are not geographically bound. Internet discussion groups, for example, are communities without geographic bounds.

Figure 12: The four-factor model of SoC



Source: Drawing by the author, based on McMillan and Chavis (1986)

The above model still constitutes the main theoretical framework for studying SoC, almost four decades after it was established (Mannarini & Fedi, 2009). There are, however, some alternative angles to this model. For instance, Nowell and Boyd investigated the theoretical roots and improvement of the sense of community, designing an alternative model where they considered the sense of community as a responsibility in addition to resources (2010). Relatedly, Boyd and Angelique (2002) focused primarily on connections among individuals within neighbourhoods or workplaces.

Regarding these approaches, a sense of community will be defined as reflecting a community's social environment and integration of factors such as neighbourhood, membership, shared values, and attachment to place (McMillan & Chavis, 1986; Nassar & Julian, 1995; Brower & Dettinger, 1998). Moreover, there will be factors reflecting the makers' environment that will be considered, such as social networking (Wellman, 2005), resident satisfaction, social interaction (Weiss, 1982), social wellbeing and community participation (Chavis & Wandersman, 1990; Hughey et al., 1999).

2.1.2. Community Engagement, Solidarity and Participation

Taylor et al. (2016), believe that makerspaces have much to offer the communities in which they are located. This assumption relates to community engagement, as their study showed that community engagement was either a core activity or an aspiration in makerspaces (Taylor et al., 2016). The question raised is how we can witness community engagement in everyday life. As a recent example, during Covid-19 when local communities helped each other, we witnessed people shopping for the elderly who were not allowed outside or clapping hours for the health workers on neighbourhood balconies.

Indeed, there are many activities that define both community and community engagement (Bellah, 1996). Tekeli (2020) suggests alternative ways to increase community engagement. Firstly, some of the solidarity economies[69] such as mobile technologies, 3D printers, the Maker Movement or DIY Movements, platform economies, cooperatives and local development; secondly, with social innovation labs; thirdly, with participatory cultural and arts events; and finally, with health and sports organisations (Tekeli, 2020). Regarding Tekeli's first alternative, Mason (2000) states that solidarity is the binding of individuals into a cohesive collectivity based on normative obligations and is also an emergent attribute of groups that facilitate collective action and social order.

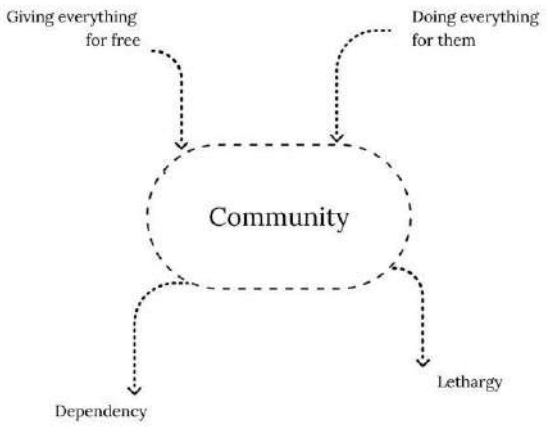
Participation can be described as being involved in something, or an active involvement of people with the purpose of influencing decisions that affect their lives in civic and developmental organisations, political parties and local government (Wates, 2000; Roodt, 2001). Indeed, participation has connections with the community. Participation, according to Rahman (1993), is the exercise of people's power in thinking and doing, as well as in managing their action within a

[69] Solidarity Economy or Social and Solidarity Economy refers to a wide range of economic activities that prioritise social profitability over financial profitability alone. Solidarity economy refers to a vast array of organisations, including cooperatives, mutual associations, non-governmental organisations (NGOs) engaged in income-generating activities, women's self-help groups, community forestry, associations of informal sector workers, social enterprise and fair-trade organisations and networks.

collective framework. Within the context of this study, I would like to discuss the models of participation as they relate to community makerspaces. In *Empowering Communities through Participatory Methods* Reddy (2002) describes a top-down model of participation (see Figure 13). This model is based on governments'[70] decisions on communities, which develop a sense of dependency among the people. Reddy (2002) also presents a 'partnership model' (see Figure 14) as an alternative to the top-down model where communities and governments collaborate.

I will consider this model in the case studies section, where the concept of participation was defined through maker communities in makerspaces. Therefore, participation is interpreted as a process in which the outcome is community engagement.

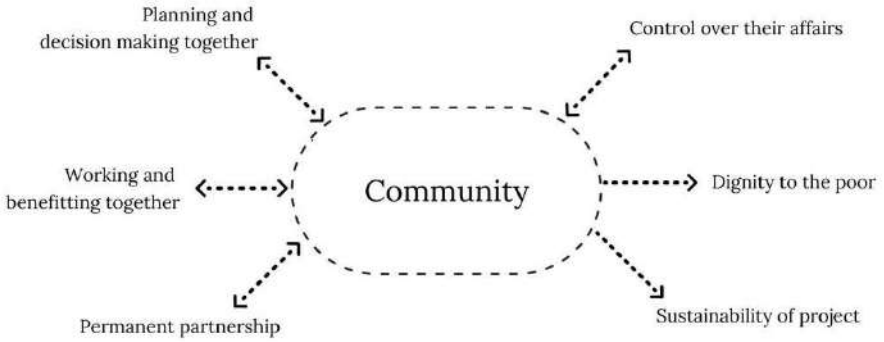
Figure 13: Top-Down Model of Participation



Source: Drawing by the author, based on Reddy (2002)

[70] It is necessary to discuss the concept of government here. According to Keman (2011) the concept of government is not self-evident and is in fact a pretty complex process. He argues that governing is the exercise of control over a community through the application of ordered rule; government is simultaneously a set of institutions and a group of players that dictate how and to what extent public affairs within society are shaped and directed.

Figure 14: Partnership Model of Participation



Source: Drawing by the author, based on Reddy (2002)

It is critical look at the concept of participation through communication and media studies, which is related to the concept of participatory culture[71]. Jenkins (2008) has emphasised that a participatory culture shifts the focus from individual expression to community involvement, whereby the significance of participatory culture is not entirely an ingredient for new media, but also an entity for the community. In other words, participatory culture opens space for creativity to represent maker culture and to encounter future modes of making in communities.

[71] Henry Jenkins and co-authors published *Confronting the Challenges of Participatory Culture: Media Education for the Twenty-First Century* in 2006. This paper defines a participatory culture as one being:

- With relatively low barriers to artistic expression and civic engagement
- With strong support for creating and sharing one's creations with others
- With some type of informal mentorship whereby what is known by the most experienced is passed along to novices
- Where members believe that their contributions matter
- Where members feel some degree of social connection with one another (at the least they care what other people think about what they have created

See the website http://henryjenkins.org.

2.1.3. The Commons

Exploring the community structure further, understanding commons and relating the commons narrative with the makerspaces is essential for the purpose this dissertation. Stavrides (2016) defines the commons as a social space, suggesting that common areas emerge in the contemporary city which is open to public use. Like Tekeli (2020), I argue that we have to give reference to the community when we talk about the commons.

Similar to the commons, producing relations between people and spaces in the context of internal and outer connections of public space is also critical for makerspaces. Hardt and Negri (2005) define the commons as the natural environment, its resources, and the products they generate, in addition to the products of social interaction, such as codes, languages, effects, information, and other types of knowledge. Hardt and Negri's definition of the commons is highly pertinent to Stavrides' definition in terms of seeing the commons as a social space, which I believe is important when considering makerspaces as potential places for the emergence of commoning. Additionally, Stavrides emphasises the following:

> understood as distinct from public as well as from private spaces, 'common spaces' emerge in the contemporary metropolis as sites open to public use in which, however, rules and forms of use do not depend upon and are not controlled by a prevailing authority. It is through practices of commoning, practices which define and produce goods and services to be shared, that certain city spaces are created as common spaces (2016, p. 2).

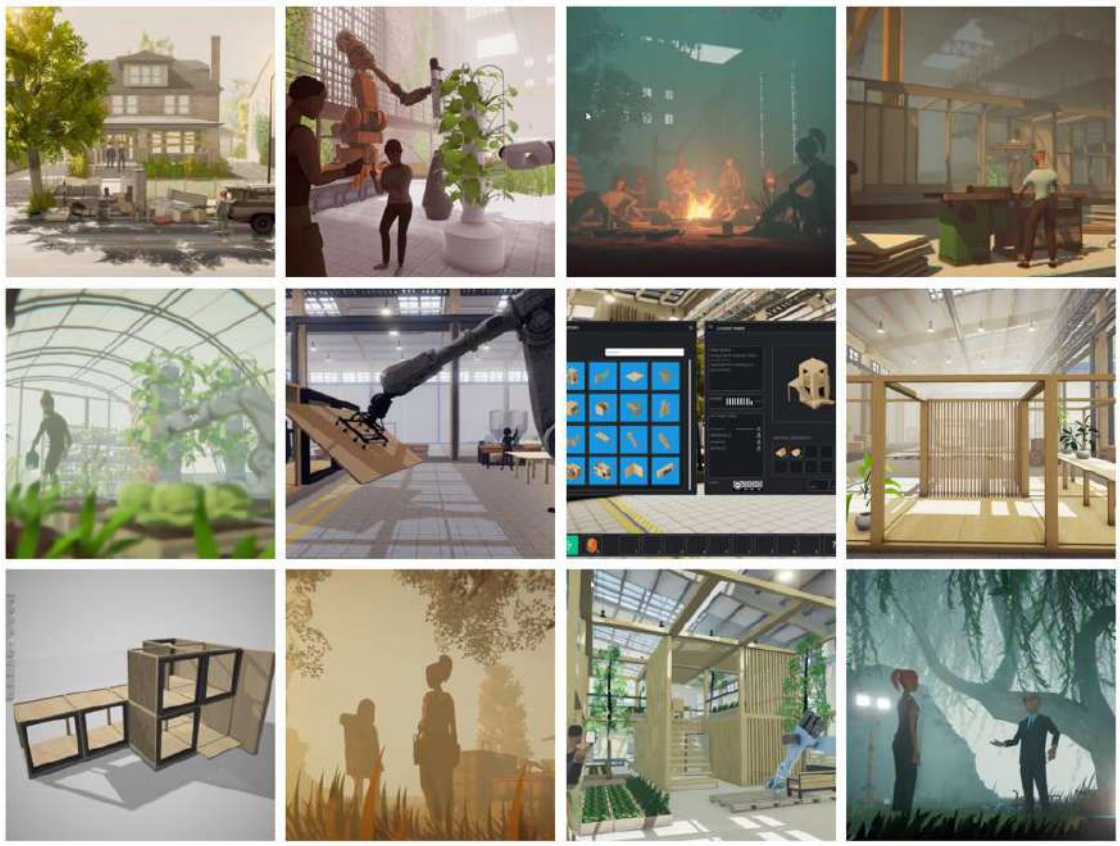
Accordingly, common space can best be described when it is compared to private and public areas, although common space is essentially incommensurable with the public and private (Stavrides, 2016). Accordingly, Taylor et al. (2016), emphasize the social values in communal makerspaces which they define as the hubs of the community, where people come together for working, for mutual learning or only to socialise. Respectively, it is crucial to discuss the commons under the context of the public sphere and the architectural space, which I address in the next section through the case studies of the research.

Rather than only describing the physical notion of communities, we should also mention the virtual territories for communities. In this sense, I would like to share an example of a virtual game called Common'hood's[72] which imagines a post-scarcity world, where the players grow their economy and community. This world is created using digital fabrication tools similar to the ones in makerspace and fablab environments, such as CNC machines, platforms for communication, and online marketplaces. In Common'hood's world (see below, Figure 15) players are engaged and empowered with agency to use tools to construct environments according to their needs.

In this sense, we can argue what the necessities of a community are. As discussed previously, communities are formed through demands or obligations. Therefore, community engagement in a makerspace does not happen by itself; there are ways or processes to be witnessed. For instance, makerspaces organise events such as networking meetings, 1:1 mentoring sessions, accelerator programmes or maker-in-training courses. Martin characterised community infrastructure of makerspaces to support engagement with events, yearly or monthly magazines, and online platforms (2015).

[72] Common'hood is a game created by Jose Sanchez for the Plethora-Project, an initiative to advance computational literacy within the context of architecture and design. It conforms to the "show me your screens" philosophy of the TopLap live-coding organisation that seeks to remove Obscurantism in digital design. The objective of Common'hood is to create a new habitat for gamers and their community. As a result of the economic downturn, many members of the players' neighbourhoods are now homeless. Consequently, they occupy the abandoned factory and determine how they will live. See the website https://www.common-hood.com

Figure 15: Visuals from Common'hood game



Source: Plethora-Project

2.1.4. Makerspace Community or a Community's Makerspace?

Makerspace is about community, but what defines a makerspace community? To answer this question, it is essential to acknowledge that makers are the core subject of a makerspace. In McKown's (2015) interview with Molly Rubenstein[73] and Kofi Taha[74], Rubenstein shared her standpoint on communities as:

[73] Molly Rubenstein is the coordinator of IDIN Innovation Center. which is a part of the International Development Innovation Network led by MIT's D-Lab; implemented by a global consortium of academic, institutional, and innovation centre partners. See the website: https://www.idin.org/

[74] Kofi Taha is Associate Director at MIT D-Lab which works with people around the world to develop and advance collaborative approaches and practical solutions to global poverty challenges (https://d-lab.mit.edu/).

> one of the things I learned when working at Artisan's Asylum[75] is that the most effective thing I could do for a maker who came to us for help connected them to other makers trying to do similar things. Far beyond what I or our staff could offer, the most remarkable developments came from their interactions with a dynamic and diverse network of like-minded people. My job was simply to enable and provoke those interactions. That's what we're trying to do with this network of innovation center partners.

Accordingly, we can frame a makerspace community with members who are like-minded people searching for innovative ways to make. In this sense, in the report *Makerspaces: Supporting an Entrepreneurial System*[76], it is assumed that makerspaces are creating an entrepreneurial ecosystem based on skills, innovation, and creativity that fosters a dynamic community (Benton et al., 2013). On the other hand, I would argue that makerspace communities have the potential to generate space itself. These communities are often born when like-minded tinkerers come together to make, create, and hack. Barniskis (2014) claims that the tools and equipment of makerspaces are essential, but the community's knowledge pool is more vital than the former. Indeed, there are considerable motivations for makerspaces to relate to the community, such as knowledge exchange, networking, the role of managers and also makers' backgrounds. Sennett, for his part, argues that a craftsperson's potential value is realised only within a community of like-minded practitioners (2008). Roschelle and Teasley define these collaborations in a makerspace as a "mutual engagement of participants in a coordinated effort to solve a problem" (1995, p. 2). Therefore, collaboration can be thought to be an exercise in convergence or the development of shared meanings that enable participants to reach an intersection through the development, monitoring, and repair of shared knowledge (Lai, 2011). According to Browder et al. (2017), makers are more collaborative than typical entrepreneurs and gather to share tools,

[75] Artisan's Asylum is a non-profit makerspace devoted to the teaching, learning and practice of fabrication (https://artisansasylum.com).

[76] The report Makerspaces: Supporting an Entrepreneurial System was created by the Michigan State University Center for Community and Economic Development and the EDA University Center for Regional Economic Innovation (REI). REI aspires to identify and develop new economic development tools, models, policies, and practises to support the innovative economic development of high-growth firms and the creation of jobs in economically depressed regions throughout the state (http://www.reicenter.org).

expertise and ideas in an efficient way. Many makerspaces therefore build around the notion of collaboration and community. I will discuss this frame in the case studies part of the Third Chapter. The frame I introduced above is also connected to the spatial qualities of makerspace relationships. Butcher (2013) investigated these connections by looking at the position of physical attributes within spaces when constructing and maintaining community symbols and rituals. Likewise, Unterfrauner et al. (2018) emphasises that stimulating the exchange of knowledge and experiences within makerspace communities is crucial for creating a trustful virtual and physical environment. Likewise, when we look at the knowledge introduced in makerspace and community relations, we also narrate cultural environments with makerspaces. I would like to take a critical look at this aspect in the following section on architectural space.

According to Hustić (2021), while museums, for example, are public, private or hybrid legal bodies and top-down based institutions with collections, staff and facilities at their core, makerspaces, on the other hand, are bottom-up based self-organised communities and organisations having at their centre people, tools and skills. Indeed, this perception of makerspaces also varies from one to another; so we could say that the community is not a fixed entity, and neither are makerspaces. In this sense, makerspaces, workshops, and other community-led organisations could be a starting point for comprehending the role of communities. According to Menichinelli (2020), a community emerges from the interactions and connections of local makerspaces. As the community parameter is relevant to understanding makerspaces, their impact on the community needs to be analysed. Also, some barriers may exist between the community and the makerspaces, which cause complex issues that deserve further attention. It could be difficult to bring people together to maintain a common goal or the same knowledge when it comes to making. For instance, Schultz (2015) asks, how have people never been into the technology welcomed?

In the research by Nesta, it is argued that makerspaces should be well connected with their local communities and other makerspaces (Sleigh et al., 2015). Varna and Tiesdell (2010) suggest that makerspaces are usually accessible to a specific community, and thus be seen as semi-public places. I would also argue that their accessibility is for public use, as some makerspaces have open days policies. For instance, some makerspaces organise workshops to attract people from the neighbourhood.

As Taylor et al. indicate, makerspaces serve the communities by addressing local needs and issues (2016). From this view, makerspaces can connect the local community with their maker community and projects, but there are different patterns in every makerspace depending on their context. As we have witnessed through Covid-19 since March 2020, there are distinctive examples[77] of makers, designers, volunteers and hackers acting to help their local communities and the public (see Chapter 1 above). Bar-El et al. (2016) emphasise that makerspaces create a sense of social responsibility by introducing new members and welcoming them into their community. Undoubtedly, the location of the makerspace has to be linked to the portrayal of the space, whereas exploring the community is essential. To conclude this part on community, I want to provide a last sociological insight from Bartle who claims that,

> we cannot see a whole community, we cannot touch it, and we cannot directly experience it. Like the words 'hill' or 'snowflake', a community may come in one of many shapes, sizes, colours and locations, no two of which are alike (2011, p.1).

[77] Field Ready and Emergency Designer Network are two examples that I will provide here. Field Ready is a non-governmental organisation that works in challenging circumstances, such as conflict zones in Syria, refugee camps in Bangladesh, and vulnerable communities in the United States. Faced with Covid-19 pandemic, the organisation swiftly redirected its programmes and developed a variety of goods to prevent the rapid transmission of coronavirus, including face masks, visors, and taps that do not require the use of hands. Accordingly, Field Ready shared its designs freely, allowing them to be manufactured in many locations and adapted to local requirements (https://www.fieldready.org). Another example is the Emergency Designer Network, a collaboration of ten small-scale UK manufacturers, designers, and makers. Through local production, scrubs for National Health Service (NHS) employees have been manufactured to supplement hospital stockpiles of vital clothes like as scrubs in the fight against Covid-19.

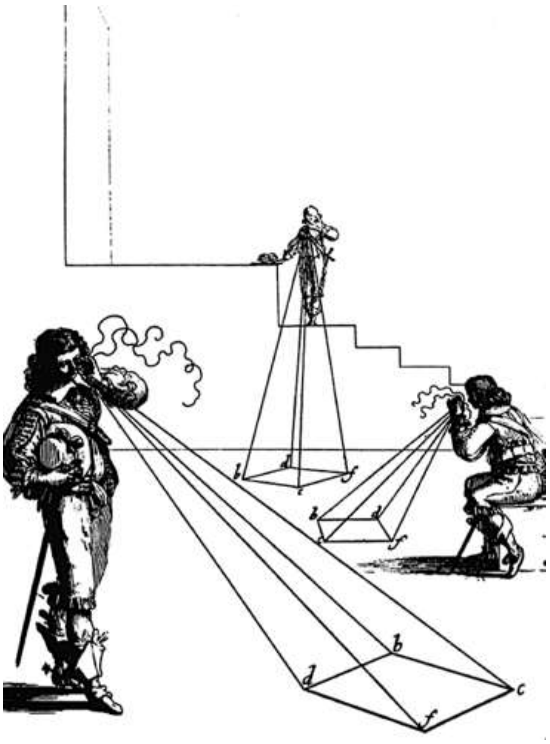
2.2. ARCHITECTURAL SPACE

In today's world, many initiatives, companies, entrepreneurs and especially architects are attempting to create spaces that are more than merely walls and a ceiling. Especially designers constantly look for increasingly innovative ways to create architectural spaces. In this respect, space is one of the most important components of architecture as well as the built environment and is mainly associated with the volume of a particular structure. To understand what space means for makerspaces, it is substantial to examine the definitions of space throughout the literature of various disciplines. This includes not only how space is defined as physical, but also as social context and as a conceptual space within which production occurs, and how all these interpretations can contribute to makerspaces.

The importance of space in social and cultural theories[78] is growing. The notions of space and spatial narratives, which I will present in the following paragraphs, have assisted me in developing a tentative outline of space regarding the makerspace context. Peterson's thoughts on anti-space and space are indeed a crucial addition to the space debate (1980). The first paragraph of his article is illustrated by Abraham Bosse naming Les Perspecteurs on the experience of space as volume, which is inherent with geometry and shape (see Figure 16). In this image, Peterson asserts, "space, as an idea, is the intangible qualifier of our view of shape, of position, and of dimension, determining the relative size of real objects" (1980, p.89). In this dissertation, I will relate this idea with the parameters of architectural space.

[78] See references include Bourdieu, 1991; Gregory and Urry, 1985; Hess, 1988; Hubbard et.al, 2004; Keith and Pile, 1993; Knowles and Sweetman, 2004; Thrift, 1996 and Zieleniec, 2007.

Figure 16: Les Perspecteurs by Abraham Bosse, 1648



Source: Peterson, 1980

Frampton (2001) suggests that the concept of space was introduced in the architectural discourse in 1893, to be exact, by August Schmarsow[79] in his inaugural lecture as professor of art history at Leipzig University. In formal terms, architectural space is defined of designing and transforming inhabited environments into creative outer spaces through the utilization and in-depth understanding of the concepts of the built environment. Frampton (2001) presents four key types of architectural space: physical, i.e., the volume of the inhabited structure; perceptual, i.e., the space occupied by an inhabited structure; non-directional, i.e., open movement in the structure; and interwoven, i.e., a space or structural area that leads

[79] August Schmarsow was the first architectural theorist to advocate a spatial approach to the study of architecture. His lecture titled "The Essence of Architectural Creation", in Mallgrave and Ikonomou, Empathy, Form, and Space (a translation of the lecture *Das Wesen der architektonischen Schöpfung* given in Leipzig, 8 November 1893.

to the other. An architect should have a comprehensive knowledge of the concept of space to understand its emotions and connect with users.

As makerspaces are usually considered living social contexts or conceptual statements, they are also defined through their members, tools and spaces. Makerspaces could be related to the community, the public sphere and, indeed, the built environment. Therefore, I will try to discuss how space related theories can be applied or translated into makerspaces and how makerspaces can themselves alter or recalibrate the perception of the space-place relationship, be it public or private.

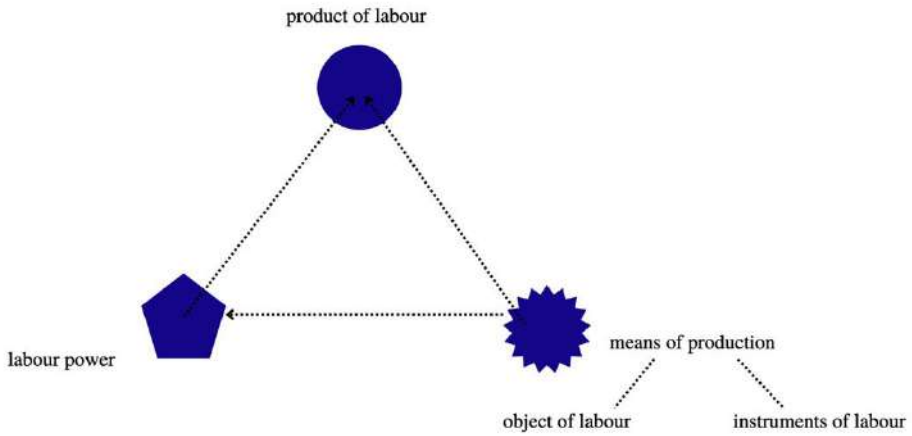
2.2.1. Understanding Space and Spatial Triad

In this research, space refers both to the spatial inputs, representations, and lived experiences and simultaneously to the dialectical configuration of those activities that produce it. From a social standpoint, I have to inevitably involve parameters for the space, so it follows that it must also involve consciousness and experience of space. In this way, providing a comprehensive view of the concept of space and spatial triads through spatial movements will help me to develop a critical understanding of various elements of spaces. This leads to the conceptualisation of social, physical and visual aspects of a spatial structure of space as they relate to makerspaces.

According to Lefèbvre, Karl Marx viewed social space “as the sum of the sites of production, as the territory of various markets” (2009, p. 211). Lefèbvre argues that a materialistic theory of social space can be constructed based on Marx's concepts, such as “abstract labor” and “commodity” (1991, pp. 26, 32-33, 49). Marx’s conception of space is based on three main characteristics (see Figure 17): conceptualisation of spatial elements on the basis of production, regulation of spatial elements in a production framework, specifically a factory where specialisation and allocation of roles serve as a way of increasing workers’ alienation, and the exploration and development of new structural spaces with the

aim to promote capitalist expansion. The first component of space in the Marxist triad is focused on the historical aspect of production. According to Marx (1887/1992), the production serves as an effective spatial element as it not only determines the historical context but also enables humans to develop and modify a space by transforming its structure in accordance with their needs. The alteration and modification of spatial elements are equivalent to how humans shape and perceive their own existence (Marx, 1887/1992).

Figure 17: Marx's triad



Source: Drawing by the author, adapted from Fuchs, 2013

The second component is associated with the division of labour in the production context. It is mainly focused on the control and regulation of workers' space in the factory. In such a regulated production space, workers mainly perform restrictive and repetitive tasks. In addition, the early division of production labour facilitates manufacturer's growth in that the craft, which is clearly and concisely separated from the process. The third and final component is mainly concerned with the spatial expansion of capitalism facilitated by the discovery of new spaces as well as their restructuring in accordance with capitalist needs and requirements. Therefore, when we look for space, production and labour are the first parameters to explore according to the Marxist view.

In addition to early reflections by Walter Benjamin, there are many major pioneering works around Marxism, starting with Henri Lefèbvre, who was followed by his pupils David Harvey and Manuel Castells in the 1970s. Let us now focus on Lefèbvre's ideas on the production of space. Lefèbvre assumes space is a historical production in which the social being is the medium and outcome (1991). Lefèbvre's idea of space has been extensively explored in the literature[80], particularly his conception of space as a social production rather than a stage or setting (1991). According to Lefèbvre's theory, the production of space is composed of two main frameworks that are structurally tied to one another: the first framework refers to the periodisation of space and consists of absolute space, sacred space, historical space, abstract space, contradictory space, and differential space; the second framework refers to the spatial triad framework and comprises spatial practises (perceived space), representations of space (conceived space), and representational space (lived space) (1991). I will mainly discuss the spatial triad of Lefèbvre (see below, Figure 18) as well as social space in this part.

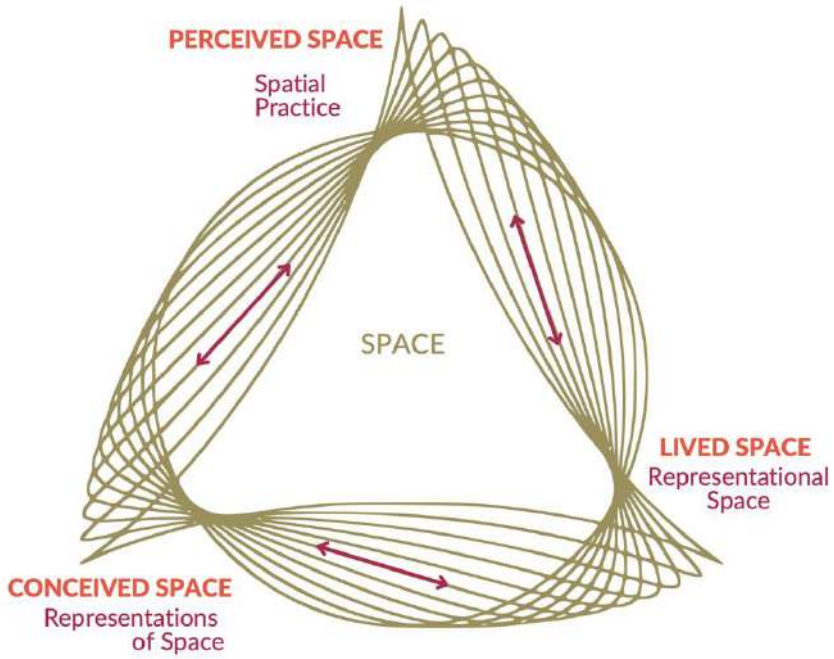
In the spatial triad, the first force is perceived space; the way in which dwellers actually use space. In this respect, Lefèbvre characterizes space[81] as a continuous social dynamism (1991). This requires an interpretation of the spatial elements as well as how dwellers actually use a particular space. The second force is what Lefèbvre calls conceived space: the power play of capital and state, mainly referring to the investments of bankers, the rules of bureaucrats, and the blueprints of architects (1991). Conceived space, in this sense, provides a concrete framework through which architects consider space as a system and its association with specialised knowledge. The third and final force is the lived space: the desires of the dwellers, their dreams and memories. Accordingly, lived space involves the

[80] See Brenner, 2000; Butler, 2012; Elden, 2004; Martins, 1982; Merrifield, 2006; Soja, 1989; Stanek, 2011; Urry, 1995 and Zieleniec, 2007.

[81] Similar to Marx's dialectic forces continuously flow into one another in Lefèbvre's picture of space, engaging in conflict, subjugating one another, and ultimately transforming struggle into synthesis.

comprehension of space on the basis of the everyday experiences of users. In light of this, this concept is mainly associated with the symbolic view of space or the imagination of users.

Figure 18: Spatial Triad of Lefèbvre



Source: Drawing by the author, adapted from Lefèbvre, 1991

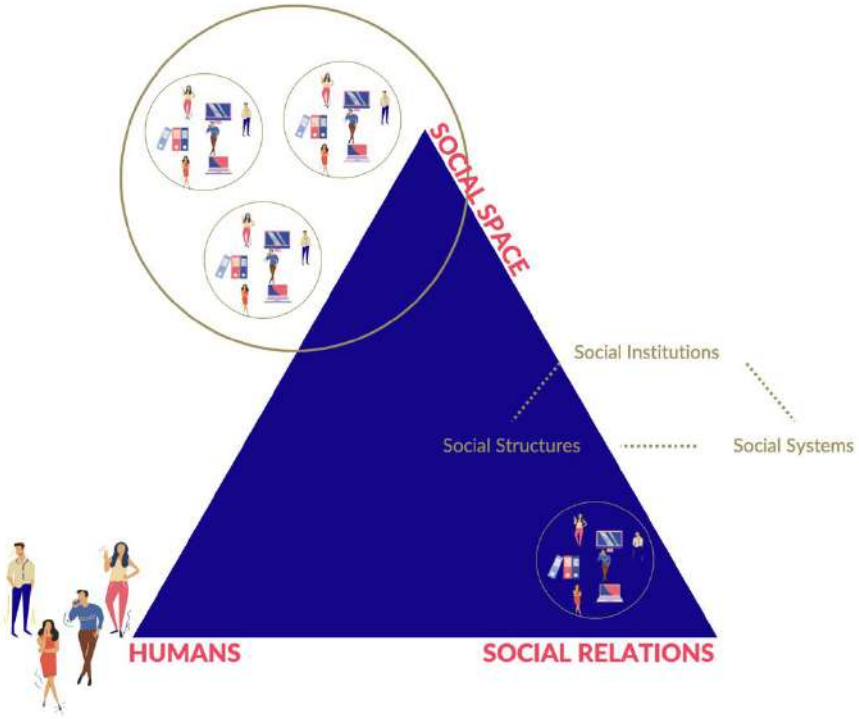
Lefèbvre is concerned with the interaction of these three forces of spatial production, as they are not isolated or indeed isolatable (1991). The forces are in a perpetual dialectic relationship with each other, cooperating and competing. A comprehensive view of the spatial triad of Lefèbvre, discussed above, thus provides a concrete definition and insight of spatial practices, which leads to the formation of the concept of social space. As Lefèbvre stated, social space consists of social construction and representation of spatial elements that are not usually visible or apparent (1991). He claims that social space is based on three main concepts: form, consisting of fundamental spatial aspects, structure, comprising actual spatial experiments, and function, consisting of the sociocultural conception of spatial

elements (Lefèbvre, 1991). Lefèbvre asks, "[i]s that space natural or cultural? Is it immediate or mediated – and, if the latter, mediated by whom and to what purpose? Is it a given or is it artificial?" (1991, p.83). He claims that social spaces, which are objectively situated in a physical world and normatively restrained by actors, live "between nature and culture" (Lefèbvre, 1991, p.84).

To recap, social spaces are human spaces dependent on the practices of those who inhabit them. When Lefèbvre frames these as social relations, he acknowledges that humans re-create various social spaces in everyday life (1991). In the diagram of social space (see below, Figure 19), form (spatial aspects), structure (spatial elements), and function (sociocultural conception of spatial elements) come together to connect people and social relations. For instance, if we articulate a makerspace as a social space, it also has certain political rules of behaviour and a specific culture. Consequently, a makerspace is a bounded collection of several concepts, items, and their relationships. In line with this view, Doreen Massey claims that "[s]pace concerns our relations with each other, and in fact, social space, I would say, is a product of our relations with each other, our connections with each other." (5:37).

Considering these interrelationships in social space, I will also discuss the significance of physical space and its connectivity with social, urban, and virtual aspects in Chapter 3. Inspired by Lefèbvre's approach, David Harvey has long been interested in the social production of space, although anthropologists have held that space is culturally formed; as an integral component of material culture, space is intricately entangled with daily social activity.

Figure 19: Lefèbvre's Dialectic of Humans-Social Relations-Social Space

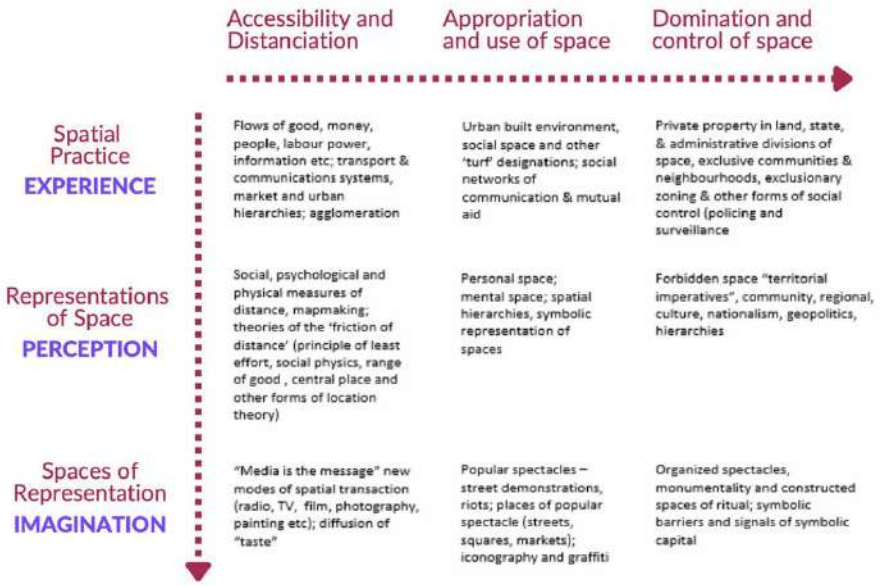


Source: Drawing by the author, adapted from Lefèbvre, 1991

Lefèbvre's conception of spatial practice affected Harvey, who developed them into a grid of spatial practices (see Figure 20). Harvey aims "to capture the complexities of spatial practice in an urban setting" (1990, p.256). Along the top line of this grid, Harvey outlines three dimensions that he believes are essential for investigating the complexity and nuances of spatial practice in urban environments. Lefèbvre's triad, in contrast, is given on the left side of the grid. These ideas have also affected architecture historians[82], who have criticised the privileged standing of architecture and the role of the architect, arguing that architecture is continuously reproduced through daily life.

[82] See Anthony King, ed., Buildings and Society (1980); Anthony King, The Bungalow (1995); Amos Rapoport, House Form and Culture (1969); and Amos Rapoport, Human Aspects of Urban Form (1977).

Figure 20: David Harvey's Grid of Spatial Practices



Source: Drawing by the author, adapted from Harvey, 1990

Harvey has exhibited impatience[83] with Lefèbvre's open-ended, three-dimensional notion of the production of space, privileging the production of material perceived over conceived and experienced space (1990). As Schmid puts it, "while Lefèbvre promoted the development of a comprehensive theory of the production of space, Harvey pursued a narrower project: a political economy of space" (p.38, 2008). Contemporary discussions of space also take their roots in these discussions, as well as Michel de Certeau's post-structuralist theories of space[84] as a practised place. By this, he meant that officially designated, sanctioned, and valued places are transformed into spaces through tactical consumption.

[83] Harvey contends that even while Lefèbvre's triad of the production of space was finally qualified from his previous determinist perspective, lived space never took front stage in his writing. For references, see *Justice, Nature, and the Geography of Difference* (1996, p.322) and "Space as a Keyword" in *David Harvey: A Critical Reader* (2006, p.279).

[84] Michel de Certeau asserted that space is "like a tapestry whose horizons encompass historic revolutions, economic changes and demographic mixtures, on which lie customs, rituals and practices" (2011, p. 294). For de Certeau, space is a product of subject which is a notion that is confused and radically heterologous.

The contemporary understanding of space in architecture has its roots in two major schools of thought: Lefèbvre's triad and de Certeau's theory of space resulting in the materialistic aspect of space as a component in and of space. The particular conceptualisation of space deployed by de Certeau (1984/2011) is a useful distinction between place and space[85]. De Certeau's view is a scripted view of space, like a word when it is uttered. For example, he emphasizes that the plan of a city consists of the visualization of places, locations, nodes, and points on a grid, similar to the use of grammar in a language. In other words, practiced space critically refers to spatialisation, i.e., space is a static, idealised, and stable structure based on a hierarchical context exhibiting an anarchic movement.

According to de Certeau (2011), while the place is the positioning of objects to each other, space is the experience between them. Another symbol of space is the pavement on which pedestrians walk (Buchanan and Lambert, 2005). With an in-depth understanding of the socially dynamic and situational conception of space, we can describe the distinct ways in which the spatial context as a practised or materialistic phenomenon associated with social appropriation is used to portray users' connectivity with spaces. De Certeau delicately separated space, a territory of daily life, from the place, an institutional territory, which has its own stability and confers a sort of authority to activities (2011). According to him, only a practised place might have the basic attribute of stories of space (De Certeau, 2011). Merrifield (1993) defined what place is to space, what solid is to fluid, what form to process, and what an anchor to a grounding. Space is, therefore, constantly changing and developing as a social dynamic and manifests itself through the place. According to Tuan (1977) place is a concrete object or a point/area in space, often defined as stable and permanent, whereas space is experienced directly as having room in which to move.

[85] See also Ahearne, 1995, pp.179-182; Buchanan, 1996.

French anthropologist Marc Augé claimed that a large number of 'non-places' are being formed in the modern urban landscape (1995). Augé defines a non-place as an area that cannot be classified as relational, historical, or identity-based (1995). These non-places are anonymous and interchangeable places to which people have no emotional connection (Augé, 1995). According to Augé,

> [t]he word 'non-place' designates two complementary but distinct realities: spaces formed in relation to certain ends (transport, transit, commerce, leisure) and the relations that individuals have with these spaces. (1995, p.94)

Furthermore, Augé believes there is a dichotomy between places and non-places originates from the contradiction between place and space. Therefore, he asserted that de Certeau's consideration of the notions of place and space is an essential prerequisite for his thoughts on non-places, where de Certeau not opposing 'place' and 'space' in the same way that 'place' opposes 'non-place'. For him, space is 'an intersection of moving bodies' where pedestrians transform a street into a space (Augé, 1995).

Following de Certeau who sets out to articulate what might be called an auto-governmental zone, Augé (1995) suggests that there are certain places that, not yet being spaces in de Certeau's terms, nevertheless are not places either. Auge's hypothesis is this: if a place can be defined as relational, historical and or concerned with the identity will be a non-place. Buchanan (1999) reviewed Augé's article and argued that he has never mentioned the late capitalism but non-places result from transformations in the mode of production, where he asked, "to what extent is the experience of a space tied directly to the objective conditions of that space? And, by the same token, to what extent can the objective conditions of space be separated from the subjective experience of space?" (Buchanan, 1999, p.397). Passengers on an aeroplane, as an example of Augé's view of non-place, share no necessary relationship with one another beyond an accidental situation, "micro-historical" (Buchanan, 1999, p.395), and they have been only together for a few hours. This also raises a question on working environments such as hot-desking in co-working spaces or makerspaces. This can be indeed discovered through if these spaces are

generic spaces such as airports, hotels, and train stations, and as Augé suggested, we can argue if these spaces are non-relational, unhistorical, and unconcerned with identity.

Doreen Massey[86] shares her understanding of space between spatial and artistic research to architectural experiments. She argues that conceptualising space matters in intellectual work, in social life, in political practice, and has three characteristics (Massey, 2005). According to her, the first one is that the space can be considered a product of interrelations from an entire structure down to the minuteness of facilitated interactions (2005). Secondly, space can be recognized as a polymorphic phenomenon, or, in the meaning of contemporary plurality, as a structure in which various paths co-exist (Massey, 2005). Thirdly, space can be conceived as a structure that is always under formation, "it is something that is never completed, not even closed" (Massey, 2005, p.9). As Massey argues, space is an "ongoing production" (2005, p.55). Her portrayals of space have influenced how we identify space, particularly of becoming through functions. In light of this, I argue that makerspaces are products of interrelations, whereby the case studies will present how this understanding of space informs makerspace phenomena. On the other hand, Massey, among other scholars, has argued that as social relations are gendered, so is space (2005). Men and women inhabit space differently, but gendered space is also defined through representations. Making connections between space and gender relations resonates with the earlier research of anthropologists[87] on public and private notions of space, social relations and power

These views on space were further engaged with by noteworthy intellectual scholars of the late 20th century, who began to interpret the spatiality of human life

[86] Doreen Massey is one of the geographers who re-conceptualised the concept of place and provoked a theoretical shift in the literature (1994). She draws a clear distinction between what she calls an idealised notion, namely understanding place (Massey, 1994).

[87] See *Defining Females: The Nature of Women in Society* by Ardener,1978; *The Public and the Private* by Gamamikow et al.,1983 and *Woman, Culture, and Society* by Rosaldo and Lamphere, 1974.

with the same critical insight. In the 1980s, Edward Soja[88] explored the role of space in critical social theory promising a broader engagement with Lefèbvre. Nevertheless, Soja recognised Lefèbvre 's intellectual heritage, such as everyday life and lived space, even though these terms were ultimately deployed very differently in Soja's works.

Figure 21: Soja's three aspects of being

Source: Gregory, D. et al. 2009, p.776

Soja (1996, p.71) further points out that space and spatiality (see below, Figure 21) have been overlooked in previous reviews on the subject of "being" over-emphasis on "historicality" and "sociality". Soja states that, "Spatiality tends to be peripheralised into the background as a reflection, container, stage, environment, or external constraint upon human behaviour and social action" (1996, p. 71). The spatiality of makerspaces - where makers reside, make, and create - is essential to this research's case studies. I argue that Soja's theories are relevant

[88] Edward William Soja (1940-2015) was a cultural theorist, postmodern political geographer, and urban planner. Soja became one of the most perceptive thinkers of space and location after the publication of his seminal work *Postmodern Geographies* in 1989. Other notable works by Soja include *Thirdspace: Journeys to Los Angeles and Other Real-and-Imagined Places* (1996) and *Postmetropolis: Critical Studies of Cities and Regions* (2000).

in analysing the makerspaces and their form to begin seeing space through various standpoints and with the possibility for new and exciting space-making methods.

2.2.2. Third Place, Thirdspace and Beyond?

> "…we must understand space as an open process, and place as the moment we can intervene in its unfolding. To be honest, I think that deep down, in our hearts, we have always felt Lefèbvre was right."
> (Vermeulen, 2015, para. 10)

As I have mentioned previous part, the notion of place and space have varied throughout the fields of architecture and geography; therefore the clarification is also defined differently. I would like to add a layer to the discussion in the form of Oldenburg's "third place", Bhabha's "third space", and Soja's "thirdspace". Place and space are terms that have meanings based on their context. I believe the discrepancy between place and space is useful for the enquiry of looking at makerspaces. After all, becoming a "third place" or a "thirdspace" has different perceptions, definitions and, indeed, their parameters.

There are also many scholars who wrote about the concept of "third place". One of them is Ray Oldenburg[89] argues about the significance of informal public gatherings. Oldenburg (1989/1999) states that the first place is the home where a person lives and feels the most comfortable; the second place involves the work environment, the organisation where a person works and the convenience of which depends on its environmental spirit; and the third place comprises a realm that is removed from the concerns of home and work and where individuals meet and interact with one another for enjoyment and liveliness. In this respect, he assumes that the third place can be considered as the heart of social processes and a key

[89] Ray Oldenburg is an urban sociologist, and his seminal book *The Great Good Place* examines the significance of gathering spaces for society and public life. According to him "third places" are essential to local democracy and a community's social vitality, in contrast to the first and second places i.e., home and work.

component of community building, which separates individuals from the two usual environments of work and home (Oldenburg, 2001). Oldenburg also asserts that third places foster social equality by equating the status of visitors, offering a venue for grassroots politics, encouraging habits of public association, and providing emotional support to people and communities (2001). We can argue that he realisation of working environments such as co-working spaces can cover various needs of work, socialize, and rest[90]. At some point, a makerspace itself has aspects of third place which accommodates interaction between people and the economy.

Alongside Oldenburg, Carmona (2001) presents a comprehensive view of the "third place" as the heart of social processes, and with a democratic spirit which explains the key values associated with places, classified into four major types:

1. Character, which focuses on habitation determined by response and reinforcement of native communal patterns of development, culture, and environment

2. Ease of movement, which defines effective integration and utilisation of land so that it facilitates connectivity, accessibility, and effective permeability of habitants

3. Public realm, which mainly involves public spaces that are secure, attractive and perform effectively for all individuals of a community

4. Continuity and enclosure, which are dimensions that provide a clear and accurate distinction between public and private spaces.

To make sense of such complex definitions, Bhabha's "third space" presents itself as a useful term (curiously resembling in form, though not meaning, the "third

[90] In 2016, WeWork, the $20 billion "coworking" start-up, expanded into "co-living" with its dorm-like WeLive apartments that offer communal facilities and daily activities. See the announcement on the website: https://www.wework.com/newsroom/announcing-the-official-launch-of-welive

place"). Bhabha[91] uses the term "third space" for describing a hybrid cultural identity that emerges from the interweaving elements of different cultures (1994). In Bhabha's words, "a third space is usually defined based on sociocultural elements triggered by significant elements in a particular society" (1994, p.56). This theory requires the actual conceptualisation of the term to understand and interpret literary and cultural products, such as the lifestyle of immigrants in today's multicultural world.

In 1996, Edward Soja published his seminal book *Thirdspace: Journeys to Los Angeles and Other Real-and-Imagined Places*, where he suggests that space and spatiality have been neglected in previous thinking on the subject of "being" in favour of an overt focus on "historicality" and "sociality" (p. 71). I see the relevance of Bhabha and Soja when analysing the conceptions of space. On the other hand, Soja has been influenced by writers; Gloria Anzaldua (the borderlands), Gayatri Spivak (the reworldings), and Edward Said (the imaginative geographies). According to Soja, where reality and imaginings come together and allow us to understand space in new ways,

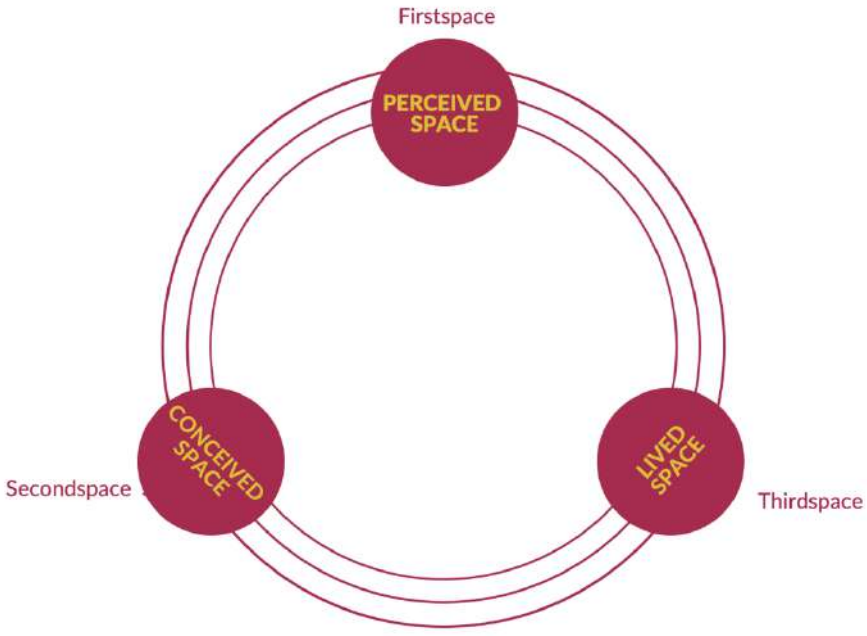
> [e]verything comes together… subjectivity and objectivity, the abstract and the concrete, the real and the imagined, the knowable and the unimaginable, the repetitive and the differential, structure and agency, mind and body, consciousness and the unconscious, the disciplined and the transdisciplinary, everyday life and unending history (Soja, 1996, p.57).

Soja specifically mentions Lefèbvre's *the Production of Space* as an influence in his work and asserts his goal to "purpose-fully reappropriate" (1996, p.53) it. It can be hard to comprehend Soja's own theorization of the concept of "thirdspace" because he criticizes Lefèbvre's work and then interprets and reinterprets it throughout the book. But this is not a coincidence; as Lefèbvre himself already rearranges and reorders elements of his work in an effort to avoid 'systems'. Soja

[91] Homi Bhabha (b.1949) is a leading voice in postcolonial studies. He is currently Professor of English and Afro-American Studies at Harvard University. Bhabha proposes a cultural hybridity theory that rethinks identity, social agency, and national identification concerns. In his book *The Location of Culture* (1994), Bhabha explores terms such as mimicry, interstice, hybridity, and liminality to argue that cultural production is always the most productive where it is most uncertain.

points out that one of the central views of "thirding", the making of an expanding chain of heuristic disruptions, strengthening defences against totalizing closure and all "permanent constructions" (1996, p. 61). According to Bhabha, Soja's epistemological trialectic of space entails being both open to and involved in everything while also being disabled, otherness and hybrid. For Soja, the "firstspace" is the actual built environment and physical buildings, which he relates to Lefèbvre's "spatial practice" (1996). Soja relates the "secondspace" with "representations of space" termed as "conceived' space" (1996, p. 67). Finally, he describes the "thirdspace" (see Figure 22) as combining the firstspace and secondspace to form "a fully lived space, a simultaneously real-and-imagined, actual-and-virtual locus of structured individuality and collective experience and agency" (Soja, 1996, p.67). This suggests that within thirdspace there are many potentials for reimaginings of existing structures and conceptions of spaces that attempt to disrupt existing power structures and dynamics.

Figure 22: Soja's trialectics of space



Source: Drawing by the author, adapted from Soja, 1968

At this point, I discuss that by considering notions of space through the lens of first, second and thirdspace, makerspaces are dissected in ways that empower the researcher to cultivate a different view. Hence, conceptualising makerspaces as a thirdspace provides a unique framework for spatial context, moving away from everyday life activities (Lefèbvre, 1991) for which such spaces are usually utilised. Most importantly, it is crucial to consider these spaces in a flexible manner so as to promote their interconnected and interdependent nature (Soja, 1996). I argue that Soja's ideas provide a valuable and progressive framework for trying to view space and place differently and with the promise of novel and exciting new approaches to place-making. In order to interpret a makerspace using his theory, one must interact with the makers and community because the act of making culminates with them in the space. In this dissertation, I will look at how the concept of thirdspace provides a deeper understanding of the relationship between the makerspaces and the makers' experience. At this point, I will reflect on the discussion part on makerspaces concerning thirdspace.

2.2.3. Conceptualising Makerspaces

As I have discussed previously, the concept of space is common to architecture obviously and the social sciences, as it not only depicts social structure but also focuses on and defines associated manifestations. In this respect, space reflects the power structure of a society, specifically the distance between individuals and the way they define the intensity of social cohesion, as well as a symbolisation of different types of social proximity. Hence, using space as a means of depicting the interconnections in the social system is the most effective way to shed light on the strength of social relations, the structure of society and its dynamics (Stavrides, 2016). Therefore, I argue that every makerspace has been planned or executed by spatial arrangements according to mission, values, needs, and physical limitations. Regardless, space in architectural terms, is a much broader concept.

In addition to a physical structure, it can be considered a form of interrelations between social aspects. For instance, Franck and Schneekloth conceive a doorway as a space in the wall comprising a passage of the human body for the purpose of exit or entry, which is based on its universal attributes. This is contrary to the doorway of a church which will carry a distinct generalization (1994). This shows that a similar architectural space can have different meanings and conceptualisations depending on locations and contexts and, most importantly, the way they are perceived and considered by users based on their lived experiences.

Accordingly, makerspaces are usually present in the form of not-for-profit organisations that are largely funded by donations, grants, or membership fees, which thus enable them to generate funding and value through their own facilities and service provision. Therefore, a conceptual framework for makerspaces can be associated with the evaluation of spatial elements with the aim of promoting them in different contexts. With the passage of time, makerspaces continually evolve and develop within and beyond their social contexts. Considering this point, makerspaces can be considered physical spaces that are flexible and in a continuous production process. However, by generalising the concept of makerspaces from merely a physical space to a source of innovation, there needs to be a consideration of the spatial design for a particular makerspace.

A broad generalisation of the concept of makerspace promotes it as an effective medium in which the collective and innovative performance of individuals is highly dependent on internal dynamics and the environment (Eaves & Harwood, 2018). This view promotes the significance of makerspaces precisely that shapes the learning and development of individuals associated with a particular physical space. In addition, makerspaces have evolved and spread to a variety of public and private settings (Boyle et al., 2016; Blikstein, 2013), such as institutions, organisations, and museums with the key aim of promoting the professional development of individuals through effective knowledge transfer and co-creation practices (Neves & Mazzilli, 2013; Paganelli et al., 2016). Most importantly, makerspaces have emerged both in physical and virtual environments. For the latter,

makerspaces are based on platforms such as websites, Wikipedia, and social media pages (Davies, 2017; Eaves & Harwood, 2018), events like online hackathons to promote interactions (Johnson & Robinson, 2014; Komssi et al., 2015; Criado & Otarola, 2016). Accordingly, some makerspaces can be more focused on their spatial design and facilitates than others to engage their community in different settings.

Depending on the uniqueness of their context, makerspaces can adopt different forms and spatial needs. For instance, these can either be present in the form of a stand-alone organisation, a co-working space, an entrepreneurial setting, a social venue, or as a component of a technology park. Indeed, a makerspace, along with its physical space, provides its members and makers with an environment within which they can make interactively and efficiently. Oldenburg (2001) claims a coffee shop is a third place with its location, environment and the quality of interaction in this environment. Consequently, it is possible to define makerspaces as third places while they are acting as collaborative and collective workspaces. This view is one of the criteria which I will examine in the selected case studies.

Space, in architectural terms, carries within it several possibilities and is made up of much more than just its physical structure, providing a view of the strength of social relations and power dynamics associated with a spatial structure. Accordingly, there are many aspects, such as the functional structure or relations of spatial design, that can be considered as a co-constitutive process, which provides a relation with the users; in our case with the makers. Therefore, there are factors including variety and flexibility, proximity to others, visual access, personalisation and territoriality, and auditory privacy as well as distraction in a makerspace.

Architectural space can be regarded as a physical space created by an architect in a structured and orderly manner, based on the process of composition used for various purposes due to its extensive and variable character. Considering this, a working space, i.e., makerspace, co-working space, hackerspace etc., is a physical space designed to give users an appealing working experience. It entails the use of

creative and inventive concepts. Even so, a deeper understanding of the working space is much more than just a physical structure, including socio-cultural aspects, lived experiences, perceived ideas, and imaginations. As a result, the experiencer typically bases their evaluations of the knowledge on their own reflections (Ingold, 2013). Additionally, it is essential to examine makerspaces from the view of collaborative spaces, which are made up of many networks that assist in forming and assembling new types of spatial production, reproduction, and representation. This stance offers makerspaces goes beyond simply the physical characteristics and advocates them as communal places that let people interact with one another and with the physical and social environment around them.

2.3. THE DIMENSION OF PRODUCTION IN MAKERSPACES

Members of makerspaces work with common tools to make their own products to meet others' or their own needs. Due to the increase in availability and affordability of many sophisticated and intricate technologies, such as 3D printers, laser cutters, open-access hardware and software, there is a higher interest in making (Moos et al., 2017). Moreover, these technologies have developed possibilities for makers to produce speciality goods, as well as consumer products. Therefore, makerspaces give them the opportunity to simplify the process of making, prototyping, and manufacturing. These methods can be considered complementary, but they are still distinct, whereby making converts an idea into a prototype, and manufacturing makes a product from a prototype (McGuffin-Cawley & Wilczynski, 2021). According to a study, experimentation and prototyping are very critical, especially in the early stages of developing an idea (Thomke, 2003). Therefore, a prototype is thought to accurately characterise a project's idea phase in the conventional journey of product development. This also depicts activities in a makerspace, where makers can make samples before starting the manufacturing process. Based on this, reviewing production in a makerspace is critical in the context of economic factors and (creative) value chain.

Marx deals with the question of time through production and consumption during capitalism. His arguments justify production by stating that the "first historical act is the production of the means to satisfy basic human needs" (Marx & Frederick, 2001). The term manufacturing defines the process of converting physical material into a product of a certain value using human labour, tools, or machines. Lewis Mumford, in his book *Technics and Civilisation*, argues that small or local producers can deliver what is needed and when in a more efficient manner than big manufacturing unit assembly lines (1934/2010). He further explains that as the production of everyday items becomes more routine, subsidiary production may become more personalized and experimental (Mumford, 1934/2010).

In commercial or professional contexts, making is distinctive from manufacturing; on the other hand, makers and manufacturers mainly require similar tools and technology. As an example, approximately 50% of Americans identify themselves as makers (Lou & Peek, 2016), but only 1 in 10 works in proper manufacturing jobs (Helper et al., 2012). In present times, the interest in making is ever-growing and persistent because de-industrialized economies are focussing on advanced onshore manufacturing. Anderson (2012) argues that the future of manufacturing lies in the distribution of design and production in non-traditional models. He frames these models as the revival of the workshop system, which will be driven by digital fabrication and a decentralised workforce (Anderson, 2012). Ritzer criticizes Anderson in his article called "makers are better seen as prosumers":

> [m]y focus is on Anderson's single-minded concern with production and the ways in which that distorts his analysis. The fact is that Anderson should have known better since all of the technologies and processes of concern to him also involve consumption. Indeed, they involve more-or-less simultaneous production and consumption, or presumption (2012, para.2).

Makerspaces also provide a prototype product, and the manufacturer converts these ideas into everyday-use items. While there are many opportunities in a makerspace to create a product, there are barriers to the manufacturing of that

product in larger volumes, whereby manufacturing sometimes involves production volumes ranging from single digits to millions of parts (Kalpakjian & Schmid, 2020). The products created in makerspaces may include a spectrum of small and simple things like traditional handicrafts that can develop into more complex electronic devices and robots. Therefore, we can say that makerspaces have become representatives of small-scale and place-embedded manufacturing units.

Accordingly, we can discuss that this process is related to redistributed manufacturing and mass production. Hennelly et al. (2019) argue that makerspaces have the potential for scalable forms of redistributed manufacturing on the other hand, they discuss that the role of makerspaces in local production systems is limited. In this regard, there are concepts "design global-manufacture local" (DGML) (Niaros et al., 2017), covering production methods in which design is created, shared, and refined as a global digital common, yet local manufacturing typically occurs through shared infrastructures. Through a network of distributed makerspaces, the manufacturing paradigm DGML focuses on localised production settings (Niaros et al., 2015).

Makerspaces may be of advantage to historically marginalised communities in these models, by using their insightful expertise and prowess for rebirthing manufacturing sectors (Monitor-Deloitte, 2015). As an example, Anderson's company 3D Robotics (3DR) is a model of what regular people can make when they get hold of extraordinary tools. 3DR was conceived in an online forum called DIY Drones, in 2009, which has grown with free expertise contributions of participants all around the world and with the help of the creator's connections in Silicon Valley. The company makes drones and drone kits for consumer markets and employs several hundred employees and has received $50 million in venture capital (Holman, 2015). Accordingly, Aldrich (2014) claims there will be implications of the Maker Movement on crowdfunding platforms such as Indiegogo, Kickstarter, and Crowdcube, for supporting product development costs and fostering communities around the products.

In the *Made in China: Makerspaces and the search for mass innovation* report by Nesta, Saunders and Kingsley (2016) analysed 100 makerspaces in China. They found out that Chinese government has an interest in makerspaces, because they are not satisfied with "made in China, designed elsewhere", and makerspaces can assist in fostering grassroots innovation (Saunders & Kingsley, 2016). Moreover, the economy of making needs to change from low-cost, labour-intensive manufacturing to design-led production therefore, makerspaces help for companies to release this process for their employees (Saunders & Kingsley, 2016). Today, there is also enhanced digital literacy and connectivity, and the consumer-producer relationship has caused changes in the expectations and experiences of both parties. This trend has been further promoted by makerspaces as they support the production advantages of digital connectivity as information on how things are made travel worldwide, while physical production takes place locally. This has also considerably increased the speed of production, as in the past, "the process of coming up with an idea for a product, designing its form, imagining a method to create it, gathering materials and tools, and finally ending up with a finished product used to take a lot of time" (Burke, 2015, p.10). Makerspaces have either remained as local economic players or evolved into internationally competitive businesses. Accordingly, there is a chance when local manufacturing technologies in makerspaces (i.e., 3D printing, computerised numerical control machines) are combined with digital commons of knowledge, software, and design.

2.3.1. Paradigm Shifts, Making and Industrial Revolutions

> "Those that embrace Fourth Industrial Revolution technologies; such as digitization, artificial intelligence, robotics, and additive manufacturing, stand to boost performance, shape new business models, and drive sustainable growth."
> (Klaus Schwab, 2016)

Industrial revolutions have transformed manufacturing into mass production, and industry 4.0 as a paradigm holds the potential to overturn the world's economy.

Thomas S. Kuhn, a well-respected philosopher of science, coined the term paradigm shift as a fundamental swing in the underlying theories of scientific fields. When a paradigm shift happens, new methods, arrangements, and ways of measuring performance are implemented (Kuhn, 1962/1996). Therefore, when the industrial revolutions are discussed, the references used for a paradigm change or multiple paradigm shifts occur concurrently. According to Gray (2016), each industrial revolution era is innovative. The basis of industrial revolutions was launched in the mid-18th century in Britain, progressed from 1760 to 1830 and was powered by the invention of mechanical production systems that used water and steam power.

The second industrial revolution began in the 19th century is characterized by the mass manufacturing of products and the replacement of steam with chemical and electrical energy. According to Anderson (2012), this period lasted from 1850 to around the end of World War I (1918), including Henry Ford's Model T production and assembly line. Machines took over the industry, and these mechanising technologies were further improved to meet the increased consumer demands by enhancing the production potential of these technologies (Youssef Abdelmajied, 2022). The fabrication of integrated circuits and microchips marked the beginning of industry 3.0 began in the late 1900s. According to Anderson (2012), the Maker Movement's industrialisation best characterises the third industrial revolution, which combines digital production and personal manufacturing. For instance, Anderson's Makers: The New Industrial Revolution has given both industrial revolutions 1.0 and 2.0. as a backdrop for the makers. As he mentioned in the book's title, he predicts a transformation in personal production systems (i.e., computers, the Internet, CAD, laser cutter, and 3D printer) (Anderson, 2012). Anderson believes that these technologies will allow us to make more things from the bottom up by ourselves, or in shared makerspaces, than relying on large-scale organisations to produce them for us (2012). What Anderson (2012) sees as a dramatic shift away from enormous organisations devoted to production and toward small, even one-person, arrangements capable of producing

a wide range of things on their own. From the second half of the 20th century, we are currently living in the fourth industrial revolution, characterised by the application of information and communication technologies. Klaus Schwab, founder and executive chairman of the World Economic Forum, conceived the phrase 'fourth industrial revolution' (2016) and envisioned a world where individuals move between digital domains and offline reality to enable and manage their lives (Xu et al., 2018). The fourth industrial revolution differs from the previous industrial revolutions as it does not promise manufacturing jobs like the factory lines of the past decades. Instead, its progression depends on the democratisation of fabrication technologies such as Computer Numerical Control (CNC) machines and 3D printers. In previous industrial eras, consumers accepted the recommendations of creators, designers, engineers, and developers of the product, and only these people were labelled as producers.

To that end, digital technologies are being integrated into the manufacturing supply chain as part of industry 4.0. London Economics report[92] describes the technologies of industry 4.0, such as additive manufacturing and 3D printing, robots, cobots, cloud robotics, smart manufacturing, and smart factory. In this sense, Kreiger and Pearce highlight (2013) that technologies like 3D printing make it possible to manufacture customised products on a small scale, minimise waste, and have a smaller environmental impact due to less transportation. The use of information and communication technology in industries is the trademark of this revolution, whereby industry 4.0 represents the most significant disruptive shift in manufacturing due to technological advancements (Pereira and Romero, 2017). Industry 4.0 also connects ideas like crowdsourcing (Vianna et.al, 2020) and CE (Rajput and Singh, 2019), which I will relate with makerspaces in the coming sections.

Consequently, can we witness the fourth revolution through makerspaces? Makerspaces aim to democratise technology and encourage people to use these

[92] Innovate UK, the UK's Innovation Agency, commissioned the *London Economics* report to investigate the potential benefits and drawbacks of adopting Industry 4.0 technologies.

technologies and produce their own goods locally. Yet, according to Hielscher and Smith (2014), there is a lack of research on the role makerspaces can play in using these technologies for society and the environment. In order to establish a larger maker community, all different kinds of makerspaces are connected to one another through internet networks and share a shared spirit of openness and collaboration (Corsini, 2021; Jones-Carey, 2019). Vones (2019) also argues that makerspaces can act as a lynchpin for encouraging social and environmental reform within the context of the fourth industrial revolution by building local communities focusing on fostering sustainability, inclusivity and ethical working practices. From these standpoints, as Garside (2018) discusses, if technological knowledge and skills mastered, makerspaces will become intellectual grounds where people can make with accessibility of technology, alongside constructive collaboration. Accordingly, we see making things is less about rote manual labour, and more about value being created by designing products that can be tailor-made for the people who use them (Birkelo, 2017) in this latest industrial revolution, which relates with the next part, democratisation of design and manufacturing.

2.3.2. Democratisation of Technology and Entrepreneurship for Makers

Rafael Dias and Adrian Smith (2018) observe that developing societies do not pay heed to the complex technologies behind the art and engineering products surrounding us and tend to overlook technological progress. This keeps such societies from evolving into a technological milieu (Dias & Smith, 2018). Scholars have been stressing that we, as inhabitants of this ever-changing earth, should acknowledge how the technical nuances of our times will help society become a technological marvel (Ellul, 1990). But in parallel, how our perceptions are shaped and influenced by technological progress is also a concern. We have become attached to the decisions made by technology and tend to follow the lead of the artefacts (Ellul, 1990). When people choose this route, they often fail to consider

the social factors involved in the design, development, and ultimate use of technology.

In addition to this, Winner argues that politics infiltrate all aspects of technology (2010). Thus, we should understand that technology is never neutral, as "technology is different from a tool that is consciously chosen to achieve a predetermined end" (Goldberg & Strain, 1987, p. 7). For example, a hammer's use and effect are already decided by the user (Wasilewski, 2020). But technology, on the other hand, is a complex system that "can delimit the field of possibilities for thought and action" (Goldberg & Strain, 1987, p. 7). Due to this reason, social responses to technology and technological progress largely depend on the values, attitudes, and beliefs of designers and consumers.

Such beliefs and values also choose the desired and undesired political, economic, social, and cultural changes in society, and indirectly also determine the progress of technology. Today, probably more than ever before, politics, economy, culture, as well as social relations are embedded within technology (Wasilewski, 2020). In terms of technology, there are factors such as manufacturing methods, materials, storage and distribution types which are affecting the whole supply chain while thinking about the design and the function of products. As a result, production is aided by manufacturing techniques like 3D printing, CNC milling, sensor networks, programming, and interactive hardware, which are linked to democratising technology and encouraging individual production. Gilder (1989) also claim that technologies are essentially liberating information. On the other hand, this relationship between technology and society is crucial to some social scholars. They contend that advancements in technology limit the variety of human behaviours (Marcuse, 1941/1998, 1964/2002), which leads us to explore more the connection between society and the democratisation of technology in the makerspace context.

In a framework with such a complex amalgamation of society and technology, makerspaces provide access to digital manufacturing tools that allow for producing, designing prototypes, and repairing all kinds of objects. The democratisation of digital manufacturing technology has been translated into entrepreneurship and acted as a source of knowledge generation, mobilising citizens, and transforming perceptions (Diaz et al., 2021). Makerspaces are believed to empower and help people experience an expansion in capabilities as makers experiment and try to balance and mix technology and various cultural values and beliefs (Smith & Stirling, 2018). Moreover, there is an accessibility issue, as Mumford (1934/2010) stressed that accessing tools and technology by the public is related to the pleasure of making. In this respect, public organisations and activists are trying their best to promote makerspaces as these spaces are dubbed as sites of production, incubators of sustainable prototyping, and promoters of citizen innovation. However, participants and makers need careful consideration (O'Donovan and Smith, 2020). Despite the many advantages of personalised fabrication through the democratisation of technology and tools, conventional manufacturing techniques and plants have also been discussed through the quality of making and mass-customised products.

Holman (2015) believes that these open-source makerspaces are as yet unable to produce complex consumer machines and thus are not ready to overtake the legacy of traditional factories. According to Stangler and Maxwell, democratising technology may not necessarily yield state-of-the-art consumer products (2012). However, it is still a wonder to look at the sheer variety of things an amateur can make by engaging with advanced technology (Stangler & Maxwell, 2012). Electronic projects and coding are frequently seen as cutting-edge and sophisticated. On the other hand, a piece of furniture created with a laser cutter, or a CNC milling machine might not look as complex or well-crafted as its equivalent created using more conventional methods.

Makerspaces are framed as significant mediators supporting entrepreneurship and the development of new ventures in addition to contributing to makers' technological knowledge and skill development. Maker communities are seen as suitable environments for supporting budding entrepreneurs and providing a foundation for the growth of new businesses, practices, and products with modern technology. As mentioned in the previous section, I argue that by reforming the setting of makerspaces with technology, we acknowledge that production methods are related to the community through their needs, perceptions, and use.

In the Maker Movement Manifesto, Hatch (2014) points out that there is little infrastructure available for start-up companies to become smooth-running businesses, which causes a halt in the creative thinking process, whereby markets continue to be monopolised by bigger companies as start-ups misplace their innovations. He also notes that if we want to base our economies on manufacturing, then it is necessary that easy-to-use, powerful, yet cheap tools are diffused and distributed in the right way, which will aid in leveraging upcoming technological advances across many industries (Hatch, 2014). Nowadays, new trends are coupled with patterns of social innovation which are novel ideas and products that are explicitly designed for the public good. For instance, a group of makers based in Makerversity founded the Tyre Collective (see more at Chapter 3, p.137), in which they designed and manufactured the first device to capture tyre pollution. The main idea is to reach zero emissions with technology.

It is innovation, either in the form of consumer goods or technological progress generated to fulfil community needs that remain unaddressed by the local government or the state (Murray et al., 2010). Makerspaces are equated to open facilities where all community members are included and empowered to solve local problems and achieve local economic development by enhancing inclusivity and economic redistribution (Chalmers, 2013, Thompson, 2019). An imminent example of such a socially empowering makerspace can be that of Barcelona's Ateneus de

Fabricació[93]. This makerspace allowed citizens to shape the country socially, politically, and economically by the engagement in public places "where people of different backgrounds, training, stories, learning abilities, experiment, jointly creating, carrying out activities and projects related to digital fabrication that involve them throughout the process" (Diaz et al., 2021).

2.3.3. Alternative Economies

In recent years, scholars have regarded makerspaces as having the potential to foreshadow more socially and ecologically integrated manufacturing. To illustrate, Mazzilli-Daechsel (2019, p.248) claims that makerspaces illustrate how "the formation of a new relationship between technology and humans is hindered by an economic system that restricts leisure time and promotes professional and educational specialisation". While Smith (2017) provides a case study of a Hacklab in Edinburgh to demonstrate that alternative economies could be performed alongside capitalist ways of making, as he describes a kind of activism. Therefore, it is essential to define the makerspaces from capitalism or sustainable capitalism standpoint. The origins of sustainable capitalism may be traced back to 1999 when Hawken et al. invented the term 'natural capitalism'[94] to characterise the reconnection of ecological and economic aims together into a business. According to Mitra et al, sustainable capitalism is a conceptual type of capitalism based on sustainable approaches that aim to preserve the world while minimising inefficiencies (2011). And to survive, similar to a capitalist economy, sustainable capitalism has to grow and find new markets to fund its progress (Mitra et al., 2011). Accordingly, in his book *Sustainable Capitalism*, Ikerd (2005) also states that all economic value originates

[93] https://ajuntament.barcelona.cat/ateneusdefabricacio/en/

[94] *Natural Capitalism: Creating the Next Industrial Revolution* is published in 1999, and mainly concentrates on environmental economics co-authored by Paul Hawken, Amory Lovins and Hunter Lovins. Paul Hawken described their motivation behind the title, that it was intended to be a pun on "natural capital" a term originally coined by Schumacher in 1973.

either from the earth or from society; therefore, the economy enables our particular relationships with one another and the earth rather than producing value on its own. It is critical to remind Ikerd's standpoint to look for the relationship between makers and the economy.

In 1974, Schumacher's book *Small is Beautiful: Economics as if People Mattered* introduced the concept of simple production in economics, highlighting the significance of maintaining the flow of resources within a community. Schumacher's economic philosophy was followed in the mid-1980s by an optimistic narrative on new economics[95] (Ekins, 1986/1990). Starting from 2008, the global financial crisis affected new economy ideas as to emerge, such as a no-growth economy (Jackson, 2009), a de-growth economy (Latouche, 2009), and alternative exchange economies (Hirscher & Fuad-Luke, 2013). Such models are alternatives to well-known or neo-liberal global economies and can take the form of the co-making economy, the new craft economy and the CE.

The system of a co-making economy relies on the input of people present at the consumer end and recognizes the potential of people rather than just considering them to be passive beneficiaries or burdens on the system. Accordingly, co-creation can be used to induce and enhance both the core and supporting services in a production chain (Ozment & Morash, 1994). Furthermore, co-creation can be used to collaboratively generate new ideas, which is called co-ideation, where service providers host open contests and crowdsourcing events (Verrinder, 2012).

The phrase "co-creation" which is described as a method of collaborative development for designing, making, and producing novel concepts, solutions, products, and services, is more frequently used in literature (Hatch & Schultz, 2010). This takes place in collaboration with experts and stakeholders, including customers and suppliers. Therefore, ideas are shared and improved between creators, experts, and customers (Fronteer, n.d.). This trend has become common

[95] The phrase "new economy" refers to components or sub-sectors of an economy that are either actively developing innovative or newly developed technologies or making extensive use of these technologies.

over the past few decades and has changed the way businesses innovate and operate. This is because of the availability and accessibility to the vast amount of information online, and educated consumers want to become more informed about the products they buy and use. Thus, enterprises are increasingly collaborating with their customers to improve service experiences. Customers are also invited to co-design with producers, which can help identify customer needs and generate feasible solutions (Russo-Spena & Mele, 2012). These two-way reciprocal relationships seem to blur the lines between service providers and users as more people get involved in production and making.

Alongside co-making, co-creating and even co-design, there is a bigger area called crafts. Today, crafts are only referred to as old-fashioned domestic leisure or as DIY activities. With alternative angles and methods of crafting, these crafts have re-branded themselves as activities of emancipation, individualisation, sub-culture identification, and anti-commercialism, resulting in crafts re-emerging as an industry (Jakob, 2013). The history of crafting is as old as humanity itself; some people have only seen it as a set of hand skills, while others see it as the alignment of hands with a creative thinking process. Crafting utilises raw materials and makes eye-catching creations by using knowledge learned through teaching and personal experience, as well as skills of co-operation and collaboration to find and solve problems in the making process (Jakob, 2013).

It may come as a surprise to learn that in the modern world, which is known for its rapid pace and advanced technology, an increasing number of people are quitting their employment to pursue their interests in the craft industry. The Craft Organisation Development Association (CODA) reported that about five million Americans earned a part of their income from selling crafts, which is an approximately 4000% increase in their self-product sales as compared with the period of the 1999 survey. In the UK, part-time professional crafting, together with individual sales, has been on the rise (CODA, 2011). The government has also made policies that help revitalise crafts to spur recession recovery (Jakob, 2013). Current

online platforms, of which Etsy is one of the biggest and most well-known, earn all their revenue from online selling and buying these handmade crafts.

However, it may be argued that rather than only craft forms of economic growth, there are also supportive areas, including supplies, retail, marketing, and craft-making training. Thus, individual crafters face economic difficulties as it is difficult to earn a sustainable wage. Some of these handcrafters engage in entrepreneurial activities that do not follow the ideals of unique handmade production, i.e., employing mechanised production (Jakob, 2013). The Maker's Manual, a joint publication of PSFK Labs and Intel, has pointed out the economic, societal, and technological forces influencing the future of the Maker Movement (PSFK Labs, 2014). Economic forces describe the possibilities in which a community can be integrated in the economy. For example, new services and marketspaces can be provided to buy, sell, and promote products. Small businesses can be stimulated through the implementation of government policies. For example, governmental policies can be designed to encourage makers to become entrepreneurs, which could help their country gain financial advantages in the global economy.

2.3.4. Making in the Circular Economy

There were various studies on the CE, which is an economic system that tries to add value to products and supply chains while minimising the use of raw and virgin materials, waste, and pollution (Metta & Bachus, 2020). CE tries to envision a reformed industrial system that will promote resource efficiency by adding value through closed-loop resource approaches, and helps with the circular flow of resources (MacArthur, 2013a, 2013b; MacArthur et al., 2015). This can be achieved by slowing resource loops (Stahel, 1984), by designing products that have a longer life by providing suitable maintenance, repairing, refurbishing, remanufacturing, and recycling (Bakker et al., 2014).

In recent years, maker initiatives have grown and become more widely known through their connection to CE. Accordingly, some of the activities (such as

workshops for selling crafts or founding a business) can already be observed within the makerspaces, which encourage scholars to speculate on the potential of makerspaces in contexts with the distributed manufacturing systems of CE. According to Kohtala (2015), makerspaces engage society in a bottom-up effort to promote CE and maker activities increase civic engagement towards consumption (Unterfrauner et al., 2019). Metta and Bachus (2020) also argue that the maker mindset offers a platform to accelerate public acceptance of the CE. They relate CE to the Maker Movement since makers can support the three economic levels that CE primarily focuses on the resource, producer, and consumer. Customers can choose CE with the help of the Maker Movement, which also offers additional information (Kohtala, 2015). A research study by Prendeville et al. (2017) states that makerspaces have the potential to emerge as successful manufacturing units in future CE. Makerspaces serve as educational nodes, spaces for creativity, and provide solutions for circular design in mainstream fields (Prendeville et al., 2017).

At present, makerspaces are not geared towards manufacturing. Instead, they are knowledge centres or centres for experimentation that are trying to understand and develop feasible approaches for the implementation of CE principles in makerspaces. But many questions still remain to be answered: will businesses be ready to collaborate with makerspaces? or how far are makerspaces in the race to compete with or give something similar to the manufacturing factories of the present day? After all, consumers are used to the wide variety and standardised manufacture of billions of everyday products. In “Circular Makerspaces: the founder’s view”, a study by Prendeville et al. (2017) on CE and makerspace relation, the authors assert that makerspaces can play a critical role in a future CE. They also discovered that the makerspaces they visited might have the sustainability values for CE, although none of them was entirely positioned around a circular vision (Prendeville et al., 2017). A point to note is that many makerspaces are not financially self-sustainable, and government subsidies are necessary to guarantee their sustainability. Therefore, there is a need to address factors like consumer

behaviour, market forces, policies and government legislation that hinder the capacity of makerspaces to grow and act through CE.

2.3.5. The (Creative) Value Chain of Makers

The value chain idea was initially put forth by Michael Porter in his book *Competitive Advantage* in 1985. Porter claimed that a value chain breaks down significant tasks: design, produce, market, deliver, and support (1985). Accordingly, Kaplinsky and Morris (2001) highlight the series of events in the value chain, which comes from the idea of manufacturing, delivery to users, and disposal after usage. Therefore, a value chain represents a preliminary creative idea usually developed by utilizing various other inputs to formulate a product and undergo a sequence of catenated stages, ultimately reaching the final consumer (Commission et al., 2017).

Makerspaces have profoundly affected the (creative) value chain over the last decade as makers strongly emphasise the process around the act of making. Therefore, the maker mindset often links the substantial act of creating tangible goods to the formation of mental objects (Tabarés-Gutiérrez, 2016). While some makers use making for solving social and environmental problems, others engage in more conceptual ideas. Ratto (2011) suggests that there needs to be an emphasis on the mental process of the idea stage and the physical outcome.

The (creative) value chain has evolved with the ubiquity of makerspaces at each of the following levels (Masnick & Ho, 2014): at the foundation level, makerspaces have facilitated the formation of unique and innovative products and services (such as augmented or virtual reality-based products and services); at the production level, makerspaces have helped to formulate a more refined and cost-effective process (such as fast prototyping solutions, and new testing solutions); at the distribution and dissemination level, they have revolutionised the development

of streaming services and added new products each day to enhance the distribution experience; at the marketing level, social media and other interactive tools by makerspaces have increased the audience as well as consumers for products and services; last, at the consumption level, makerspaces have redefined the accessibility.

On the other hand, progress in the value chain is unbound and allows free, complete, and easy access to information that supports reusing, revising, remixing, and redistributing (Hatch, 2014). Makerspaces also add a culture of cohesion and collaboration in the value chain by encouraging peer-learning (Moilanen, 2012). The goals identified by makerspaces for communities and regions directly correlate with the creative value chain systems. Makerspaces try to invite local communities to the idea development and then generate open and easy access to resources and technologies. The mushrooming of makerspaces in communities and regions brings about transformation and integration in the fields of business, science and technology.

2.3.6. A Conceptual Frame through Production

Makerspaces inspire individuals to become ‘entrepreneurs’ by infusing them with the spirit of making by introducing their creations to the world (Anderson, 2012). Anderson believes that makers can take the path of entrepreneurs from the basement workbench to the marketplace, where makers’ passion also helps makerspaces evolve from their embryonic stage to their present breakthrough stage as business owners (2012). Entrepreneurship is a concept which relates mainly to innovation, technological developments and economic growth (Schumpeter, 1934). Entrepreneurs, small-business owners, and hobbyists who follow this passion for making are dubbed makers, which also defines their lifestyles and personal identities (Toombs et al., 2014). As I have repeatedly mentioned, makers would be accidental entrepreneurs (Holm, 2015; William Barrett et al., 2015; Browder et al., 2017); it is critical to consider the interaction between the entrepreneur and the

accidental entrepreneur in this context. Accordingly, Moore said, “there is such a thing as a natural-born entrepreneur. But the accidental entrepreneur like me has to fall into the opportunity or be pushed into it” (1994, p.23). According to Shah and Tripsas (2007), accidental entrepreneurs discover an idea through their own use and then share it with others; and also engage in collaborative creative activities prior to business frequently within the social context offered by communities, which leads to the enhancement of ideas.

In this sense, makerspaces might have been contributors to innovations and entrepreneurship. Makerspaces can motivate makers to establish start-ups (Halbinger, 2018) and may function as a tool for combining different peoples’ talents for making (Stock et al., 2016). Bercovitz and Feldman argue that producing novel ideas has to be done with the team (2011); therefore, in a makerspace, it depends on the community whether members work together or individually. Central to any makerspace is the ability for individuals and organisations to have unrestricted access to blueprints, prototypes, manufacturing, and the exchange of experience and knowledge that guides the manufacturing of objects. These elements also represent how makerspaces assist the formation of new start-ups (Friessnig et al., 2020), thus helping individuals add value to their novel products and services through schematic procedures and activities (Thestrup & Sandvik, 2017). Makerspaces can be considered pots of resources that either address the needs of society or the local community, thus helping to bring the maker’s thoughts to the world. Moreover, I have also argued that makerspaces, as part of the entrepreneurial eco-system, contribute to the (creative) value chain, not only adapting but also transforming the value chain. Connecting these ideas to how manufacturing be democratised through technology, it is essential to look for examples in makerspaces as to the extent that this is really working. I will further examine makerspaces through their creative value chain definitions in Chapter 3.

2.4. METHODOLOGY

In this section, I will discuss the methodological approach I have chosen to take in my research. I begin by discussing the reasoning behind the interdisciplinary[96] epistemological stance I have chosen and then discuss its link to the case study methodology I employed to investigate the research questions indicated in the Introduction to this dissertation. I will then offer a visual summary of the research design and conclude by evaluating the process of collecting and analysing data with the highlight of the ethical concerns developed during the dissertation. According to *Facilitating Interdisciplinary Research* (2004), interdisciplinary research refers to a research approach where individuals or teams combine information, techniques, tools, theories, concepts, and/or perspectives from two or more specialized fields to enhance the basic understanding that exceeds the scope of a single discipline or research area. Therefore, I argue that interdisciplinary brings various parts of knowledge through a designed system by the researcher.

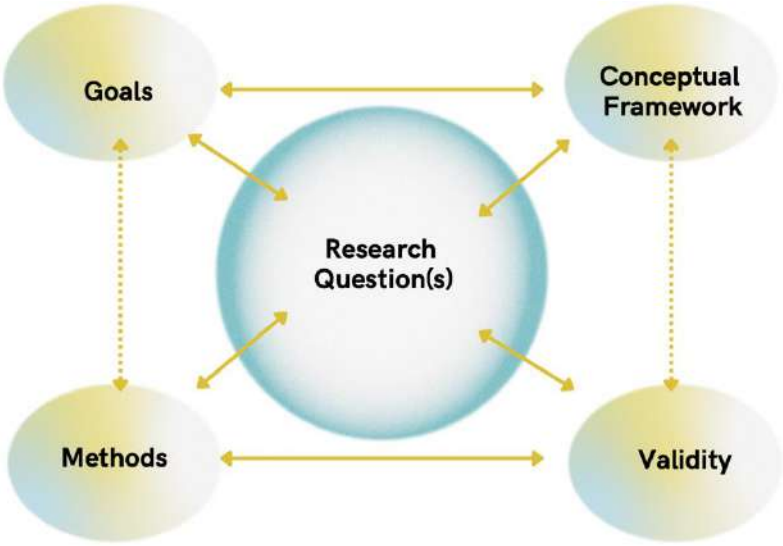
2.4.1. Research Design

Conducting a study requires good research design. As noted by Maxwell, "A good design, is one in which the components work harmoniously together, promoting efficient and successful functioning; a flawed design leads to poor operation or failure" (2013, p. 2). A research design unfolds how the research will be conducted to answer specific research questions and to what specific purpose. Now that the main literature surrounding the makerspaces has been assessed and the research gaps identified, I will expand the scope of this study and present the research design to achieve these objectives and to answer the main research question(s). Accordingly, Maxwell (2013) suggests a model for research design (See Figure 23), which consists of the components of the research study and the ways in which these components affect one another. In this paradigm, rather than being linked in a linear or cyclical order, the various components of a design

[96] Interdisciplinary means integrating disciplines to a new level, implying component barriers are breaking down. Interdisciplinary research blends disciplinary viewpoints into a more holistic view (Newell, 2013).

form an integrated and interacting entire model, with each component being closely linked to multiple others. The model also depicts the most significant interactions between these five components, including aims, conceptual framework, research questions, methods, and validity (Maxwell, 2013).

Figure 23: An Interactive Model of Research Design

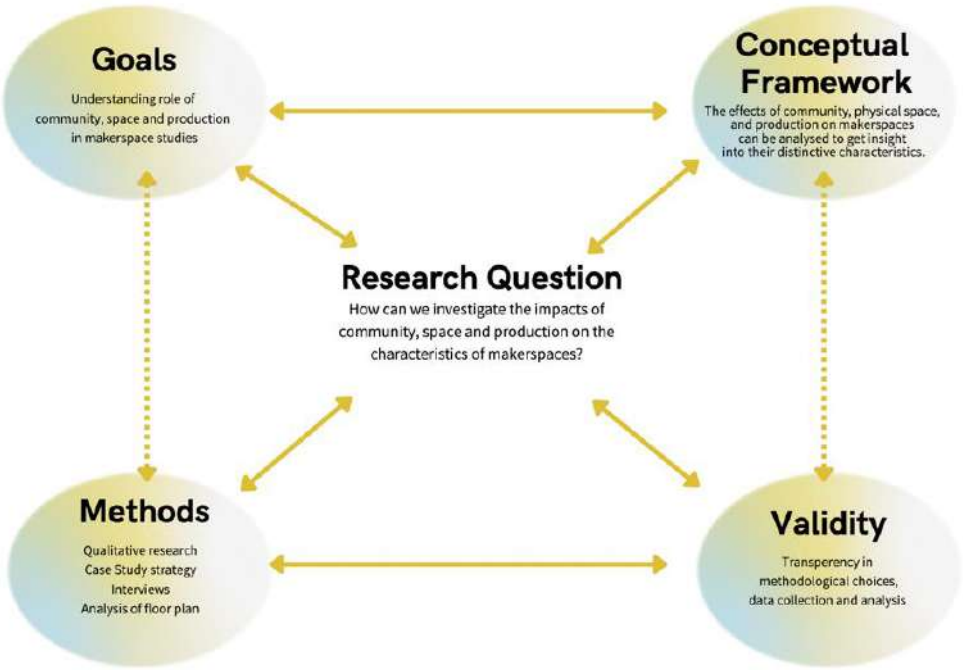


Source: Drawing by the author, based on Maxwell (2013)

Maxwell defines the figure as two parts, the upper and lower, whereby the upper one presents the research questions in an integrated relationship with the goals of the study, as the goals should be informed by relevant theory and knowledge. Maxwell argues that "the research questions are the heart, or hub, of the model; they connect all the other components of the design and should inform, and be sensitive to, these components" (2009, p.217). On the other side of the diagram, the lower part defines the methods in the research for answering the research questions, where these questions need to be framed in terms of the applicability of the methods, as well as the plausibility and relevance of validity threats (Maxwell, 2013). The relationships among the closely linked components are unique in this model. The model is accessible as it specifies the different

components of a research project and the critical points based on which decisions are made. Therefore, the model helps frame the research, and I have used this model as a guide for developing the research design for my research (See Figure 24).

Figure 24: Thesis' Interactive Model for Research Design



Source: Drawing by the author, inspired by Maxwell (2013)

I attempt to highlight the various stages of the research process in order to handle the necessities of my research question, which is to confront the complexities of studying making and makers in space and production in their social setting and urban environment.

2.4.2. Communication and Architectural Studies Through Research Design

Epistemology is defined as how we know and is an important part of the research process. Thus, I will begin by elucidating the epistemological premises of my research methodology. In social sciences, methods significantly impact the research project's success, validity, and durability. For instance, social scientists

conduct qualitative research to comprehensively understand human behaviours and attitudes within their respective contexts (Rubin & Rubin, 2005).

I have used the case study methodology for guiding the data collection and leading their analysis. As Merriam (1985) states, case studies give insights which are grounded in a real-life context. Therefore, considering different makerspaces with the case-study approach methodology felt most appropriate. According to Yin (2014), a case study is an empirical inquiry investigating cases while the borders between phenomenon and context are unclear. Thus, to promote the richness, depth and complexity and help understand the phenomenon of interest shared among the various cases, the multiple case study design is critical (Anaf et al., 2007; Stake, 2000). This involved, five cases selected in London, where I observed community, space and production amongst makerspaces, addressing how makers, members, managers and community managers work and experiencing the environment.

In this section, I will dive into the case studies of the dissertation in which I conducted semi-structured interviews and participant observation. I also visited the spaces to analyse their architectural layouts and 3D spatiality. I aimed to understand the forms, functions and role of these makerspaces in their everyday life. In these cases, individual stories were built up to a broad cohesive portrayal of these makerspaces. It is crucial to mention that the assumptions from case studies were used to refine the data collection and analysis methods. I refer to Stake, as he believes the case study is all about "particularisation, not generalisation" (1995, p. 8). Stake highlights that "we take a particular case and come to know it well, not primarily as to how it is different from others but what it is, what it does. There is an emphasis on uniqueness, and that implies knowledge of others that the case is different from, but the first emphasis is on understanding the case itself" (Stake, 1995, p. 8). Similarly, Yin describes a case study "as an empirical inquiry which investigates a contemporary phenomenon within its real-life context, when the boundaries between phenomenon and context are not clearly evident, in which multiple sources of evidence are used" (2014, p.23). I have used these real-life

contexts to employ an interdisciplinary approach and tackle the complexity of the human experience.

2.4.3. Data Collection Methods

I will now outline the three main methods of data collection that are part of the case study methodology, including how they were retained and what practical and ethical issues were encountered. According to Creswell (2007), data collection is an interactive phenomenon in which participants' narratives, context, and extra sources can be used to obtain insight into the experiences of cases.

Before I present my data collection methods, I will share my fieldwork timeline. Figure 25 visualises the cases in a timeline, and some of the makerspaces around London, demonstrating the data collection process. My first data collection was through observational data. The fieldwork for this study began to be conducted in January 2018 in London, United Kingdom. As Pole and Hillyard state, successful fieldwork requires the researcher to "immerse themselves in what action is taking place" (2016, p.15). My observations, especially maker faires and open days, were about a candid reflection of the maker's way of life. I also took field notes to support and triangulate narrative case studies, as Clandinin and Connelly (2000) discussed. My notes were about the setting, providing the material and intellectual base for the semi-structured interviews focused on the maker environment. My second method was semi-structured interviews.

According to Berg, the value of interviewing is not only because it builds a holistic snapshot, analyses words, and reports detailed views of informants, but also, "enables interviewees to speak in their own voice and express their own thoughts and feelings" (2007, p.96). Edwards and Holland, on their side, discuss the qualitative interview format focusing on the setting where the interaction takes place; for instance, face-to-face interviews, walking and talking interviews, and online or e-interviews (2013).

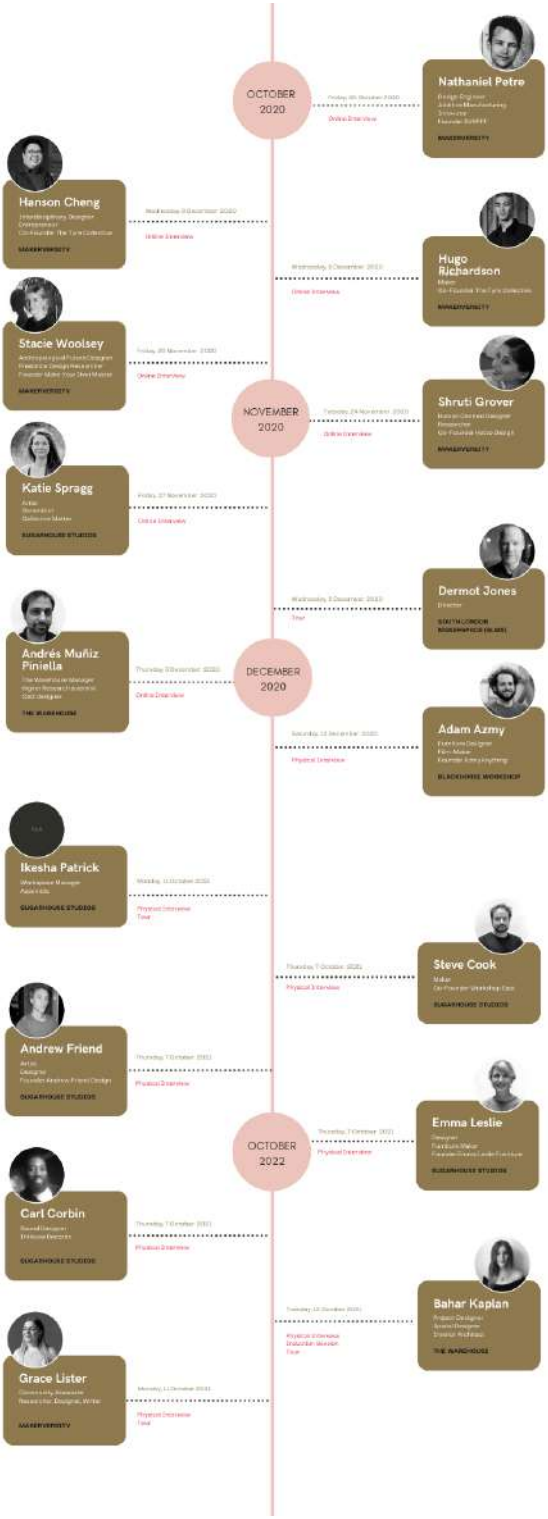
Figure 25: Research interactions to makerspaces

Source: Drawing by the author

As previously mentioned, I conducted both physical and online interviews. Remarkably, makers or community managers have chosen to talk with me in their makerspace, even if we do an online interview. Likewise, Cohen et al. highlight that interviewing is “a valuable method for exploring the construction and negotiation of meanings in a natural setting” (2007, p.29). Therefore, I observed and took notes of the surroundings and the physical and non-verbal elements while I was conducting the interviews.

According to Kahn and Connelly (1957), interviews formalise everyday practice with purposeful conversations. Therefore, I carried out semi-structured interviews to gain further insights into the ways makers and managers reflect on their work and life in a makerspace. As Kvale and Brinkmann (2009) state, semi-structured interviews follow a standardised script; however, the interviews also follow up on themes introduced by the interviewees themselves. Therefore, the interviews allow participants to develop their own terms to describe their own experiences, in this case, their relationships with the makerspaces. Soss argues that semi-structured interviews are appropriate for interpretative research, which seeks to understand participants’ self-understanding and sense-making (2015). This is what I experienced first-hand when talking with the makers. They are all makers but have different backgrounds, experiences, and expectations. Therefore, I considered interviews to be best suited to explore themes with participants who have “a personal stake”, as Braun and Clarke state, in the phenomenon being explored (2013, p.81).

Figure 26: Timeline of the interviews



Source: Drawing by the author

In total, I conducted 17 semi-structured interviews (ten physical and seven virtual) with makers, community managers and makerspace directors across the five field sites of study (see Appendix 1). To be a part of the research process, I carried the physical (face-to-face) interviews at makerspaces where the makers were based, and interviews took between 20-40 minutes, audio-recorded using the Voice Memos[97] application. Interestingly, some makers needed to work while we were having the conversation, which made an interesting outcome for the audio recordings. The other seven interviews were conducted virtually, where I used the online communication software Zoom, whereby the interviews were also recorded. And participants were informed about the research context, and the conversations were recorded with their consent. I saved all the recordings as password-protected electronic files on my computer and on the cloud of Google Drive. All interviews were transcribed using the application Descript[98]. Figure 26 presents a timeline of interviews with a brief description of each interview session. The insights from these interviews provided me with valuable and unique findings, which I will address in the case study chapter of this thesis.

As briefly mentioned in the Introduction (see above p.10), podcasts were an alternative method used for this research, which I developed from the semi-structured interviews. Llinares et al. (2018) argue that podcasting can be more than a communication tool; yes, it can also be a qualitative data collection and analysis method, critical inquiry, and knowledge mobilisation. I would further argue that podcasting is more than this definition, in the form of an interdisciplinary collection method to be explored with a media and cultural studies lens. Moreover, Brumley et al. indicate how podcasting can extend opportunities and "diversify content", whereby podcasting equipment enables visits to "unexpected places" (2017, p. 165). In this regard, both the researcher and the listeners can understand elaborate

[97] Voice Memos is a built-in application for iPhone.

[98] Descript is a collaborative audio and video editor that transcribes audio to a text document for editing.

topics and see them from a new standpoint. Crofts et al. (2005) state that podcasting also represents a transformation from mass broadcasting to personalised media. In the current research context, podcast interviews, as a medium, allowed me to approach my data collection in innovative ways. Moreover, podcasts in academia can help the distribution of research findings, showcase academic expertise and reach new audiences (Harter, 2019; Kwok, 2019; Brumley et al., 2017). On the other hand, semi-structured interviews as podcast episodes also raise methodological challenges. Indeed, creating a podcast episode can be highly time-consuming, with technical expertise and distribution skills needed.

I have been producing and hosting a podcast since 2019, where I carry out interviews with creative people under Anylabtalks (see above, Footnote 11, p.9). Therefore, I was familiar with interviewing, recording, transcribing, editing and launching processes. I used Anylabtalks podcast as a base for my dissertation, whereby I launched a new season for makers based on selected semi-structured interviews (see below, Figure 27). What makes podcasts different is their unique ability to capture in-depth and personal conversations with individuals in a more informal and conversational format. Unlike a regular interview that is publicly accessible, a podcast can provide a more intimate and in-depth look into a particular topic or theme.

There were three main reasons behind the idea of transforming some of the semi-structured interviews into podcast episodes. First, the accessibility of research participants as many were incentivised to participate in the research due to the possibility of being part of a podcast. Second, podcasting resonates with production and reflects upon my research's potential. Lastly, podcasts might enable researchers to participate in academic and public discussions in novel ways, creating knowledge that is more accessible and interesting to address the general public. Alongside the data generated in the research, these podcast episodes were also a learning experience for me.

Figure 27: Anylabtalks Season 3 Episode Cover Templates

Source: Images by the author for Anylabtaks Podcast

For the semi-structured interviews, I developed a draft of questions to guide the conversation toward participants' everyday experiences of the makerspace, as well as their more intimate thoughts on the nature of being a member of a makerspace, with a particular emphasis on community and production (see Appendix 2 for the set of questions). These questions evolved around makers' motivations and values in their relationship with the makerspaces, on themes such as:

1. Personal background
2. Projects/practices in the makerspace
3. Makerspace experiences (opportunities, challenges)

By communicating, exploring, and accessing makerspaces, I attempted to understand and define the neighbourhoods and the local community relations of the makerspace. I generated observational data with these visits and makerspaces organisational documents. One of the aims of this study was to analyse the variation

in makerspaces contexts. My research methods included a content analysis of makerspaces' websites and their relative social media accounts. The data I gathered were in the form of photography, website, online brochures, textual statements by makerspaces in the social media posts, articles, podcasts, and blueprints of makerspaces, such as their floor plans and function diagrams. An example of this is the Blackhorse Workshop's axonometric illustration[99] (see Figure 28), which was designed by contemporary visual artist Mason London, and can be bought from the makerspace's website. I believe this is essential because it is a connection between the public and the makerspace as a producer.

Figure 28: Partial view from the Blackhorse Workshop limited edition print by Mason London

Source: https://blackhorse-workshop.myshopify.com/products/blackhorse-workshop-limited-edition-poster

[99] In 2017, Assemble commissioned the artist Mason London alias Joe Prytherch to design the Blackhorse Workshop limited edition graphic, which shows a detailed and entertaining cross-section of the workshop.

I have visited some of the makerspaces, such as Makerversity, not once; to understand what members were producing, I visited the Institute of Making [100] during its public day at the University College of London (UCL). I have learned the stories of the makers, technicians, machines, and projects, and I have experienced using technologies from idea to object. I've observed and discussed with makerspace participants, who have given me valuable ways to approach writing about my research questions. Similarly, Shivers-McNair (2017) studied corporate makerspaces using a GoPro on her head, which she calls the 3D interviewing tactic. Therefore, the researcher pays attention to how bodies are made in movement and the three-dimensional space (Shivers-McNair, 2017). The source of this method comes from sensory ethnography approach of Pink (2015) to which means the researcher has the attitude of "walking and talking" to understand how practice, place, and the senses are intimately entangled. Shivers-McNair claims that this methodology is an apprenticeship model for research that helps to understand a makerspace. According to Gollihue (2019), Shivers-McNair earns into how a GoPro camera constructs certain bodies, including the researcher's own, within its frame by using videography to capture what is real in a makerspace. When I began the research, I thought about how makerspaces might inform or even transform the ways in which these spaces are designed. I wondered how making and maker culture needs collaborative, creative spaces called makerspace and how we might theorise these spaces according to their relationship with the community, space and production.

2.4.4. Selecting Case Studies

The selection of field sites in the case study methodology must be considered carefully because they significantly impact the study's findings (Blatter, 2008; Seawright & Gerring, 2008). Consequently, purposive sampling requires making deliberate decisions about where to conduct the research (Hammersley & Atkinson,

[100] The Institute of Making is a multidisciplinary research organisation open to anybody with an interest in the world of manufactured objects, including those who create chemicals, buildings, synthetic skin, spacecraft, soup, diamonds, socks, and cities. All UCL employees and students have access to membership and daily use of the Institute of Making. See more at https://www.instituteofmaking.org.uk

2007; Palys, 2008). My process of selecting cases and interviewees began with a web-based investigation into current makerspaces in London. My engagement with the community supports my observations and increase my focus on makers who are making but have a background in not only engineering but also arts. In terms of choosing the case study sites, I composed a list of makerspaces, hackerspaces and fablabs in London. I included the following three inclusion criteria of selection:

1. Membership (whether through free entrance, drop-in sessions, or alternatives to become a member)
2. Not affiliated with any sort of educational institution
3. Access to resources and encouraged a wide range of making skills

I considered these criteria to be comprehensive enough to allow heterogeneity in cases without undermining the study's goals. In the end, I settled on five cases in London that represented a range of features, priorities and aims. There was a wide range of institutional, sociological, and functional differences amongst the cases, despite their shared nature as makerspaces. Their proximity to each other in London meant that easier comparisons could be made, and possible relationships between the spaces could be recognised.

2.4.5. Challenges and Ethical Considerations

Critically important to the research process is, to collect and analyse of data utilising methods that ensure validity and generalisability (Merriam, 1985; Stake, 1995; Yin, 2014). Additionally, I believe it is critical to consider one's own function and influence in research in order to make it more open, honest, and dependable. As discussed in the Introduction, I have a substantial architecture and urban design background. One of the biggest challenges of this research was not to impose the values acquired from my background into makerspaces but to find novel meanings. Before I started my fieldwork, the research proposal was approved by Istanbul Bilgi University's ethical review board. In line with their recommendations, semi-

structured interview participants were given a consent form to sign (see Appendix 3), which specified the steps taken for participant confidentiality and anonymity required, for example, participants were free to withdraw from the project at any time. It is also stated that some of the interviews would be launched as podcast episodes, and the research published publicly. Upon consent, I included interview participants' names and professional affiliations as part of the analysis.

2.4.6. Data Analysis Process

The data was organised according to my focus on selected themes that addressed discourses of community, space and production in keeping with my epistemological view supplied by the domains of communication studies, cultural studies and architectural discourse. The data that I gathered during my process included the following:

- Interview data, in the form of audio recordings and video recordings
- Field notes in the form of handwritten notes and sketches during my makerspace visits
- A matrix for makerspaces through their organisational reports and websites
- Photographs of the makerspaces taken during my visits
- Architectural drawings and floor plans of makerspaces taken from directors.

Accordingly, I framed lenses under the trilogy of this dissertation. This facilitated a ground chart including the interviewees' names and their makerspaces. I organised these data using Excel spreadsheets with thematic categorisation. This process allowed me to comprehend the core concepts emerging from the interviews and compare these with observations and notions from the literature. It is critical to underline that this qualitative analysis does not claim absolute judgement of themes in relation to makerspaces as the information provided by respondents. Responses were gathered during a certain timeframe (2018-2022) from a particular group of people; therefore, they are based upon a limited data set.

I believe that this categorisation permitted me to interpret relationships between different themes that were related to the three main research themes. This process involved working iteratively between observations and affirmations, refining themes using a Radar chart. Moreover, I re-read transcripts and highlighted relevant passages for each makerspace, where selected quoted passages are presented in Chapter 3 to frame the cases. Combining photos with interviews provides detailed information about how informants see their environment and allow the interviewees to reflect on ideas and experiences they may not usually think about (Albers & James, 1988). I used photography to prompt participants' responses and elaborate meanings of their relationships with the makerspaces. Therefore, it allowed me to deeper penetrate into makers' experiences with the space as well as my own experience as a visitor at the makerspace.

I also created a matrix from the data, and with the help of this base, I formed a map using Graph Commons[101] to understand the relationships within and between case studies regarding their supporters. Accordingly, as I had the floor plans of my cases, I realised an analysis of their programme and compared them with each other. Consequently, the methods utilised in the study were adapted to overcome the challenges inherent to qualitative research. In an effort to establish validity, a summary of the study techniques and the whole research procedure was provided. I also described the framework, which integrated interdisciplinary principles and made data analysis straightforward. In the following chapter, I will describe my data analysis and proceed to the cases one by one.

[101] *Graph Commons* is a platform for collaboratively creating, analysing, and publishing network maps. It enables individuals and organisations to convert their data into interactive maps and decipher intricate relationships that affect them and their communities. See more at https://graphcommons.com/

CHAPTER 3: CASE STUDIES IN LONDON

Guy Debord once noted that, in a sense, we are never outside of everyday life, so we have to place everyday life at the centre of everything (1962). Accordingly, I decided to look into the everyday life of makerspaces which I will discuss through cases of this dissertation. First, I will describe London's social and economic context that was identified under the theme of making and manufacturing. The chapter will further illustrate the foremost research on makerspaces in the UK and London. Both with the literature and the data, such as history, location patterns and global networks of makerspaces, I will form my selection criteria for the cases of this dissertation. Therefore, I will describe five makerspaces in detail based on their spatiality and socio-cultural positions. Afterwards, in the final part of this chapter, the emerging themes of these data will be analysed and compared through the cases and their relations with each other.

In addition to defining the constructivist paradigm within which this study is located, Yin (2014) and Stake (1995; 2000) emphasise the significance of having a specific theoretical framework that structures data collection in a case study. Yin (2014) proposes developing a procedure for case studies that describes the essential information acquired from each case and primary sources. In addition to developing the first step of methodology, which allowed for data collection planning, my case study's experimental core prompted me to follow Stake's advice and identify each case's primary issues (Stake, 1995). In a multiple case study, these issues will focus on the situations that highlight the contextual nature of the cases, in the words of Stake, "issues are not simple and clean, but intricately wired to political, social, historical, and especially personal contexts. Issues draw us toward observing, even teasing out, the problems of the case, the conflictual outpourings, the complex backgrounds of human concern" (Stake, 1995, p. 17). Thus, my objective is to maintain "a critical, reflexive relationship with our own and others' practises of dominance" (Haraway, 1988, p.579). This chapter is significant as it delineates the interdisciplinary framework of analysis developed as one of the critical

contributions of this research. Hence, it will concretise the basis of this dissertation's theoretical and methodological contribution.

3.1. THE CONTEXT OF LONDON

In the global metropolitan of London, manufacturing has historically played a critical role in the city's economy and society (Warden & Dellot, 2018). According to Brown and Bosetti (2017), Brexit[102] is the most significant event to happen in London in a very long time, possibly since World War II. Even with the impacts of Brexit, London has continued to grow over the last few years. However, the full extent of this shift is still uncertain, but it will surely have an impact on London's maker community.

In Britain, the industrial revolution began in the late 1700s and resulted in significant changes towards the manufacturing. Consequently, British products dominated international trade during the first part of the nineteenth century. Pat Hudson argues in *The Workshop of the World* [103] that UK was once the world's largest manufacturer (2011). From the late 18th century through the middle of the 20th century, London was a key centre of UK industry, employing around one-sixth of the country's manufacturing workers in 1861 (Warden & Dellot, 2018). During the Second World War, policy interventions aimed to link the industry growth in cities like London with growth in other regions of the country. But again, London's population was declining during the War, while its manufacturing grew at half the

[102] Brexit is the name given to the United Kingdom's departure from the European Union, on 31 January 2020. It is a combination of the words Britain and exit.

[103] The article *The Workshop of the World* by Pat Hudson was published in the BBC History. In this article, Hudson examines the forces that transformed Britain into the world's workshop and explains why this industrial dominance was so short. Hudson is a professor of history at Cardiff University's School of History and Archaeology and specialises in the effects of economic and social change in various regional and local economic, social, and cultural contexts.

national rate (Ferm & Jones, 2017). According to Warden and Dellot (2018), London and its surrounds had become desirable to live in again by the 1990s.

In recent years, London has had substantial potential for fostering innovation according to the Draft New London Plan, presented by the Mayor of London and the London Assembly[104] (2017). On the other hand, as Warden and Dellot suggest, manufacturing is the key to these innovative businesses; therefore, manufacturers tend to go outside of London and the UK, especially to China (2018). This means we should think about the notions of creativity, innovation, and manufacturing with different parameters in London.

In a study called *WRK/LDN Shaping London's Future Workplaces*, by NLA there is an essential discussion on the manufacturing economy of London (Murray, 2016). According to this study, London has a long, proud, and varied tradition of making, manufacturing, and industry; therefore, London's economy of making, manufacturing, and light industry are fundamental for bringing vitality to local areas and delivering goods and services (Murray, 2016). London encourages outstanding designers, but these designers must also be able to take products to market. Accordingly, making is also under the tagline of manufacturing as well as connected to the designer. There has been a rebirth in London for making crafts, locally sourced goods and bespoke designs. This can be seen in the rise of makerspaces, open-access workshops, based on the co-working and shared workspace model, co-housing start-ups and independent practitioners.

[104] The Mayor of London is accountable for the governance of Greater London. The mayor, along with the members of the London Assembly, serves a four-year term with committees investigating planning, housing, economy, and the regeneration as issues related to manufacturing.

3.1.1. Makerspaces in London, the UK and Worldwide

The public sector in London created some of the early makerspaces. During the early 1980s, when there was a deep recession, London voters elected a leftist city council to protest the austerity policies of the Thatcher governments. After that, the Greater London Enterprise Board was established by Labour politicians, with facilities that aimed to democratize the means of production and access to education for unemployed manufacturing workers (Holman, 2015). There are currently thousands of makerspaces around the world today, with over 100 in the UK (Rosa et al., 2017). According to Warden and Dellot (2018), London has played an important role in UK industry for centuries with a heritage of trade, culture, and productivity. This can also be interpreted towards making in the city of London. There has been substantial research conducted on makerspaces in London[105]. I will look closer at some of these studies, which will give us a standpoint for the UK-based makerspaces and worldwide interactions.

The Open Workshop Network (OWN)[106] is based on a research project in the broader making community of London. OWN aims to develop a rich dataset that encapsulates the material, technical, social and cultural nature of this growing and changing culture of making. In addition, OWN's digital platform provides a place for people to learn about and connect with the many London-based organisations dedicating themselves to publicly accessible means for making. According to OWN, there has been rapid growth in makerspaces since 2015. There is an online map tool (see Figure 29 below) of OWN, which allows users to search by name, location, services, disciplines, materials or tools, which is also guidance for makers, makerspaces and researchers. We could see in this map that makerspaces have

[105] There are initiatives such as the British Council, Nesta, London Legacy Development Corporation, We Made That, Enterprise Nation, Microsoft, Deloitte, the Mayor of London and The Greater London Authority.

[106] OWN is a network of open-access workshops in London such as makerspaces, fablabs and hackerspaces. The original source of data for this site was research work by Liz Corbin a, PhD student at University of London (UCL), all data listed was with the approval of the directors, trustees or senior staff of the organisation at the time of publishing. See more at https://openworkshopnetwork.com

different organisation systems and ownership models or ones within institutions, such as University College London's Institute of Making or ones that are community-run such as London Hackspace[107].

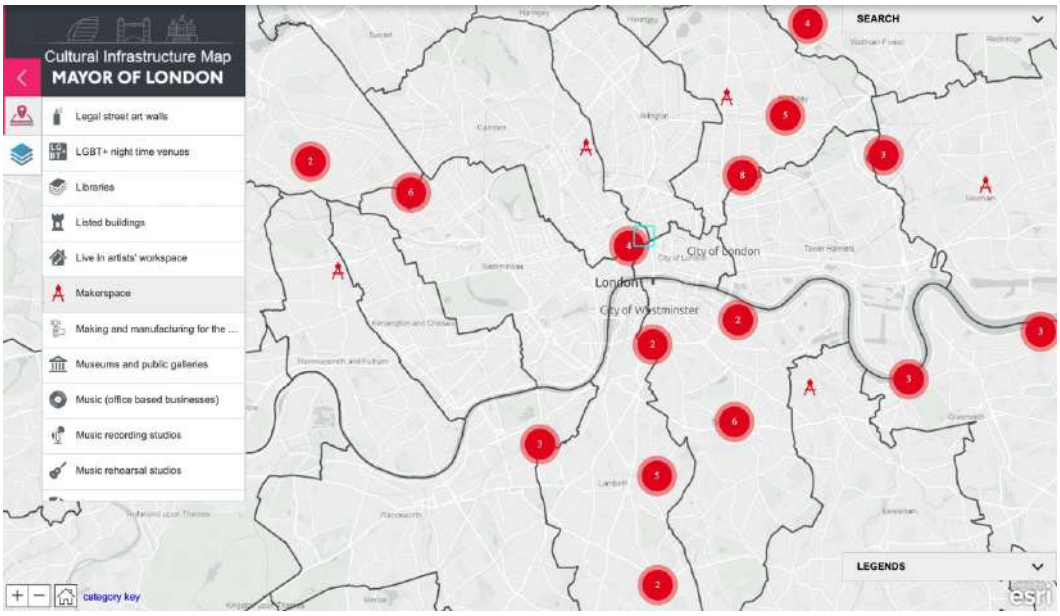
Figure 29: The OWN web platform

Source: https://openworkshopnetwork.com

Like OWN's map, the Mayor of London proposed an online platform called London Cultural Infrastructure Map (see Figure 30). The aim of the map is to present the scale of London's cultural infrastructure, which is ever-changing, evolving, and sometimes difficult to locate. This online platform aims to bring the cultural infrastructure of London with contextual data. For instance, in Figure 30, the selection in the data shows makerspaces in London.

[107] The London Hackspace is a non-profit hackerspace in London, where people to come to share tools and knowledge. See more at https://london.hackspace.org.uk

Figure 30: Cultural Infrastructure Map of London



Source: https://www.london.gov.uk/programmes-strategies/arts-and-culture/cultural-infrastructure-toolbox/cultural-infrastructure-map

In a separate study titled *Creating Open Workspaces Regeneration Guide*, also authored by the Mayor of London (Greater London Authority), open workshops have been secured either indirectly through planning policy and obligations or directly through the use of Council-owned property or public financing (Greater London Authority, 2015). In this study, open workspaces comprise makerspaces, co-working spaces, incubators, and artist studios in which firms and professionals share space, resources, or specialised equipment to decrease expenses. According to this study, makerspaces serve businesses that execute prototyping and production and have physical requirements such as floor-to-ceiling heights and service access in order to accommodate larger equipment and supplies. Moreover, there is another study[108] which provided an overview of 'co-making' in London, defining co-making space as any space with tools, specialist equipment, facilities and space shared by two or more individuals or small businesses for the purpose of making and production (Kirk & Morgan-Hatch, 2015). Based on this

[108] *Co-Making: Research into London's Open access Makerspaces and Shared Workshops* was commissioned by the London Legacy Development Corporation in partnership with the Greater London Authority in 2014. The report published in 2015, authored by Workshop East with Engel Hadley Kirk and Rhianon Morgan-Hatch.

definition, the research collected data from 89 co-making spaces (see Figure 31). The study frames all the data through location, building type, facilities, age, user costs, and business type. Finally, it discusses the current state of co-making spaces in London and makes recommendations for supporting them as a vehicle for fostering enterprise and creating positive social space.

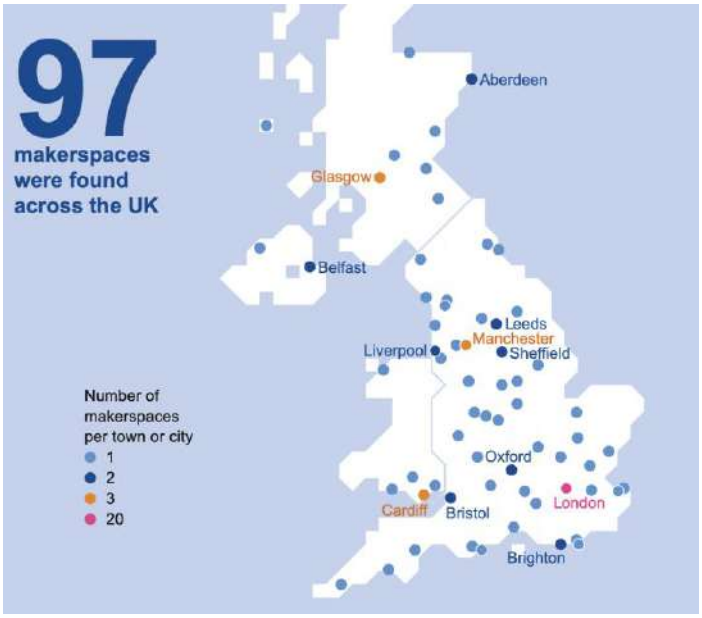
Figure 31: Map of co-making spaces

Source: Co-Making: Research into London's Open access Makerspaces and Shared Workshops, 2015

Alongside this research, specific to London, there is a critical open data set of UK makerspaces, which Nesta commissioned researchers Andrew Sleigh and Hannah Stewart both with a background in the UK makerspace scene, worked for four months on this project. In this open dataset, makerspaces appeared to be well connected with their local communities, and most of them appreciate their neighbourhoods and attend or run off-site events (Sleigh & Stewart, 2015). In this study, Sleigh and Stewart found 97 makerspaces across the UK, almost in every region, and most of the UK's cities having at least one makerspace (2015). This

study shows not only the data of makerspaces but also inform the public about makerspaces.

Figure 32: A diagram from the Open Dataset of UK Makerspaces



Source: https://www.nesta.org.uk/report/open-dataset-of-uk-makerspaces-a-users-guide/

It is also critical to mention the network of makerspaces called the Maker Library Network[109]. This platform backed by the British Council, aims to connect designers and makers all around the world. Maker Library Network facilitates knowledge and skills exchange amongst professionals and encourages public engagement with making. The network only covers active maker libraries in the UK, South Africa, Turkey, Mexico, Nigeria and Ukraine, as well as a growing portfolio of interventions and pop-ups. According to their criteria, each maker library is a combination of three elements: a workplace, a library and a gallery.

Considering all these studies, we can say that London's makerspaces play an essential role in opening new paths for making and makers. Still, they face challenges in developing sustainable business models and protecting their space

[109] The Maker Library Network website highlights Maker Library Network activity from 2014 to 2017 but does not reflect the current status of the project, which is now managed independently by Maker Library Network members. See more at https://design.britishcouncil.org/projects/makerlibraries/

from losing (Dellot, 2015). Tincq believes that London has to support makerspaces; as in the case of the illustrative example of making, architecture and city relationships in Barcelona's FAB City[110], London makerspaces could be a model for the City Council, private businesses and makers (2017).

From a worldwide view, it is also noteworthy to observe China and their makerspaces, as they have made an obvious attempt to overcome the stereotype of being designed in the West and made in the East (Unterfrauner & Voigt, 2017). For instance, after launching its first makerspace in 2010, the number of makerspaces in 2016 exceeded one hundred (Saunders & Kingsley, 2016). According to Marshall and Rossi (2017), makerspaces in China range from self-funded hacker workshops to places for middle-class recreation similar to those in the UK. On the other hand, financial stability has always been an unresolved issue for makerspaces in China (Lindtner & Li, 2012), with makerspaces wrestling with funding, institutions and supporters. Nevertheless, Chinese makerspaces have a specific focus on public and private investment for product innovation as incubators and/or accelerators (Marshall & Rossi, 2017). For China-based makerspaces, manufacturing is the most important feature (Marshall & Rossi, 2017), although product characterisation is low due to the constant dominance of industrial production (Shirky, 2015).

Consequently, there has been cooperation between the British and Chinese makerspaces. For instance, a research project was funded by the Arts and Humanities Research Council (AHRC), in collaboration with Brunel University and Tongji University, aiming to foster creative citizens through co-design and public makerspaces. This project was designed to share experiences and learning between the UK and China to help inspire future communities and makerspaces in both countries. In this context, Marshall and Rossi (2017) suggest two projects as

[110] In 2011, the Institute for Advanced Architecture of Catalonia (IAAC), the MIT Center for Bits and Atoms, the Fab Foundation, and the Barcelona City Council launched the "FAB City project" at the FAB7 conference in Lima, capital of Peru. The FAB City is a global initiative to build cities that are self-sufficient, locally productive, and globally connected. It is a decentralised, open-format project. This effort asks other cities, towns, and villages to collaborate in the creation of a more humanitarian and habitable world**.** See more at https://bcn.fab.city

examples for such relationships. The first one is 'Living Research: Making in China', sponsored by the British Council and AHRC, which took place in October 2015. The goal of this project was to better understand how manufacturing in China and the UK differs from one another on a human level. Nine makers and academics from the UK spent a fortnight visiting various makerspaces in Shenzhen and Shanghai as part of the project. The other project is that 'China's Creative Communities: Making Value and the Values of Making' funded by the AHRC and Newton Fund, in 2014. This project brought together practitioners and academics from China and UK, in order to conduct research and share knowledge about the various types and values of making.

In a global standpoint, there are online platforms to find and reference makerspaces from around the world. 'Maker Map' is an ongoing open-source project which aims to create a global database of maker resources, from workspaces to incubators, which is powered by the maker community and easily searchable on any device. The most crucial data from Maker Map is finding makerspaces through business types. Another platform is Maker Tour[111] (see Figure 33), a non-profit organisation exploring and connecting makerspaces from around the world. The main aim of this initiative is to contribute to the maker identity and maker culture by using digital tools. It is critical to note that these kinds of studies and maps are by no means complete. They do, however, tell the stories of the makerspaces. I will now continue by presenting the case studies and illustrate how makerspaces initiated their journeys, manifested themselves and displayed their influence in the maker culture.

[111] Started in 2015 in the city of Lyon, MakerTour is a French non-profit organisation exploring, sharing and connecting community workshops and makers from around the world.

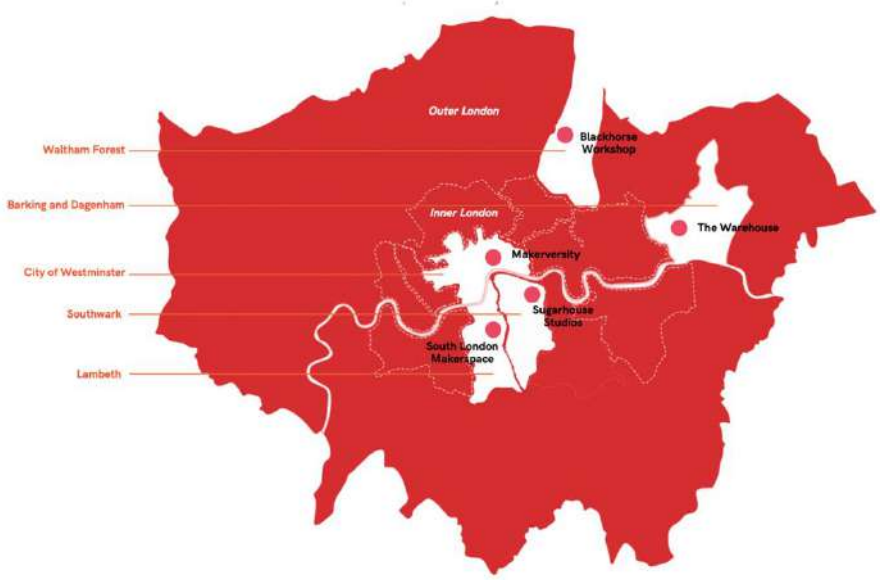
Figure 33: Maker Tour map

Source: https://www.makertour.fr/map

3.1.2. Overview of the Cases

Case studies provide an opportunity to learn about the proposed research field and answer the research question (Stake, 1995). I selected five case studies from different parts of London (west, central and east) that depicted diverse settings with different neighbourhoods (see Figure 34). The following five case studies will be examined: Makerversity, Blackhorse Workshop, South London Makerspace, The Warehouse and Sugarhouse Studios. Eventually, there will be a general scheme of these makerspaces, including their location, history, vision, purpose, machines, tools, members and their global networks. This will be connected to the framework of community, space and production.

Figure 34: Cases in London Map with Borough[112] names



Source: Drawing by the author

3.2. A COMMUNITY WITH AN ENTREPRENEURIAL MINDSET IN THE CITY: MAKERVERSITY

This part is the first of five cases that analyse how communities, spaces and production generate makerspaces. Makerversity defines itself as one of the pioneer makerspaces of London, providing space and support for some of the world-leading entrepreneurs, creators, and innovators (Makerversity, n.d). My first experience with a makerspace (see Figure 35) was with Makerversity, participating in open day in November, 2018.

[112] The London boroughs are the thirty-two local authority districts along with the City of London, comprise Greater London's administrative territory; each is governed by a London borough council. See the information of the boroughs which cases of this dissertation based in the Appendix 4.

Figure 35: Photos from Makerversity

Source: Author's photo archive (2018)

During this visit, a community manager of Makerversity guided a tour for almost 20 people who signed up for this event. I had an initial prejudice that makerspaces would be more like proper offices with different technologies. On this first excursion, I observed that makerspaces could have certain similarities with other places that I have experienced. This familiarity helped me understand how makerspaces are also places of thinking and making. For instance, we can say that there are some unwritten rules of a makerspace that are similar to an architectural studio. Especially the workspaces of Makerversity reminded me of my architectural studio[113] days (see Figure 36).

[113] In my own experience of the architectural studios at Middle East Technical University, every architecture student is given their own desk space in the studio and has access to shared workshop facilities. Review spaces are crucial to the studio environment, where the mid reviews and final juries are placed in them. The studios were flexible multi-purpose spaces in which most architectural education activities take place and are the heartbeat of architecture courses. The architecture studios all benefit from volume and natural light.

Figure 36: Photo from the second-year architecture studio of the Middle East Technical University Architecture Faculty, Ankara / Turkey

Source: Author's photo archive (2007)

To understand and examine the formation of Makerversity as a private, limited company[114] of making, I will now explore its circumstances through the following themes. First, I will examine the timeline of this makerspace, including where the idea for Makerversity came from, and how co-founders realised this idea in the context of London. I will particularly argue the growth of Makerversity around its vision and motivations. I will then explore its organisational structure and management, while adding information from yearly reports and other documents. Next, I will examine the notions of collaboration and community, which relate the discussion to the physical space of Makerversity and provides a sampling of spatial diagrams to illustrate how makers are using the space. Then, I will describe the special manufacturing and production processes that some businesses and makers have been using at Makerversity. In this vein, I will share my observations during my field visits and data from semi-structured interviews

[114] A private limited company is the most common form of UK company incorporation. It is established directly by registering with Companies House and acts as a separate legal entity in the eyes of its directors and stockholders, where the company is an individual in its own right.

with the makers. In conclusion, I will discuss how we can classify and learn from the data and interviews' analysis.

3.2.1. An Ambitious Story

Before Makerversity became a shared space, the founding members, Tom Tobia and Joe Smith, were already working on the makerspace concept, and their initial ideas were based on understanding the social implications of digital manufacturing and other making technologies. For instance, they wanted to understand various accessibility issues for which they designed many events. In this sense, accessibility to technology that promotes manufacturing was the main motivation behind designing and opening a makerspace. As a result, they opened a CNC workshop in an old café inviting people from all backgrounds, which may be considered the first step in overcoming accessibility issues in the technology (British Council, 2015). From the humble beginnings of this café workshop, Makerversity was founded in 2013, when the founders ran an array of experiments with some young people. The founders, Tobia and Smith, taught a group of young people to design and make things and infused them with the idea that learning skills can create different work opportunities. Their skill sets differed from the expertise schools provided at that time, such as fabrication through 3D printing. Therefore, Tobia and Smith, began with a group of six people paying £100 for these workshops and they spent most of their personal time with them.

After some time, they were approached by Somerset House[115], which proposed that members of Makerversity could use the unused area in the Somerset House Studios[116] as space for converting their ideas into prototypes. The Somerset House and Makerversity founders shared many common goals, and the

[115] When Tom Tobia was notified of the possibility given by an empty 25,000-square-foot room in London's Somerset House, he teamed with Joe Smith, Andrew Merritt and Paul Smyth to transform rooms at Somerset House into a makerspace. See more at https://www.nesta.org.uk/feature/new-radicals-2016/makerversity-1/

[116] Somerset House Studios is designed to be a platform for the development of new creative projects and collaboration, engaging with urgent societal issues and pioneering new technologies.

collaboration went smoothly. The Makerversity became one of the residents at Somerset House Studios, and currently works with a number of groups and individuals involved in critical design and emerging technologies (Something & Son, n.d.). Makerversity and Somerset House Studios collaboration has been critical in the makerspace's development over the years. Makerversity places its community within the lower floors of Somerset House, which is also home to Somerset House Studios and Exchange (see Footnote 14 above, p.14).

Figure 37: Photos of the Somerset House from the courtyard and the New Wing entrance (main entrance for Makerversity)

Source: Author's photo archive (2020)

The first functional year of Makerversity made a substantial impact in its surrounding community (which covers people who interacts with Makerversity, not the local community). For example, Makerversity created 72 jobs, with 900 young people enrolled in Makerversity's own learning programme (Makerversity, n.d). In addition, there were more than 40,000 public visitors, and the makerspace received a £5.5 million investment and funding from its supporters (Makerversity, n.d). Ideas

flourished in the context of peer collaborations and feedback sessions, but venture capital was also necessary for converting ideas into something tangible in part due to its significant success in its first year of establishment, The Shell Centenary Scholarship Fund[117] helped the Makerversity expand outside the UK. A second site was established in Amsterdam, the Netherlands, in April 2016, to further expand its innovative making facilities and inspire more young minds.

Makerversity's mission in Amsterdam is to explore, support, and help expand maker start-ups by preparing young people for high-value jobs in cutting-edge industries. Co-founder Tom Tobia has highlighted the aim of exploring Amsterdam's innate entrepreneurial mindset. According to him, the city is perfect for setting up technological entrepreneurship, but in parallel, progress in this direction is also hindered by a huge range of needs (Marineterrein, 2016). Like the impressive location of Makerversity in London (by the Thames River), the location of Amsterdam's Makerversity is also exceptional (see Figure 38). Marineterrein is an island close to the Central Station and possesses a Naval heritage similar to that of Somerset House in London. The establishment of Makerversity in Marineterrein, Amsterdam, further draws parallels with Somerset House, London, as the premise, which later developed into a makerspace energised by makers' creative practices, was earlier an unused space. The establishment of a makerspace revived the space as a public domain after being used as a naval base for the past 400 years.

With Makerversity, Marineterrein has been transformed into a futuristic campus of innovative industry. In the Netherlands, Makerversity has continued to create significant impacts similar to that of the UK, whereby 3000 learners have joined the makerspace and helped in generating 150 start-ups since 2016. The newly established makerspace has supported and hosted many educational programmes: for example, the space hosted Amsterdam's Maker Festival, which welcomed over 15,000 visitors in 2016. Unfortunately, Makerversity closed its Amsterdam branch

[117] The Shell Centenary Scholarship Fund is a UK-registered charity to support the capacity building of future leaders and the development of the talent skill pool of a global workforce through the advancement of education (https://www.shellcentenaryscholarshipfund.org).

in 2018, and no public announcements were made. This closure reminds the maker community, especially, that economical sustainability is also critical for makerspaces.

Figure 38: Makerversity at Marineterrein Amsterdam (left), Makerversity at Somerset House London (right)

Source: Google Maps

Makerversity London is becoming a makerspace capable of earning its own income through various partnerships and generating rent, making co-working an income-earning prospect. The management generates considerable revenue by charging makers for space as per different requirements. For instance, there is a roaming membership[118], with hot desking and unlimited workshop hours at £250 per month (PM). An unspecified desk space (hot desk) which anyone can use, costs £250 PM. A fixed desk membership used permanently by a member costs £415 PM, while a vaults membership for teams of up to eight people who require private studio space costs £3000 PM. As for being a part of the community, there is also an option called remote membership for £50 PM, including software and learning resources, while being a part of the community of makers (Makerversity, n.d.). Additionally, various workshops are held to strengthen corporate team-building skills by teaching the use of technology such as 3D scanning and laser cutting,

[118] As I mentioned in the Introduction (see p.14), Makerversity is one of the residents of Somerset House Studios, and these studio spaces are also open to creatives with membership fees, like the one I had for the Exchange. To compare the fees between a makerspace and these studios would be noteworthy. Exchange is a creative co-working space; Studios have dedicated office spaces, fixed desks, shared workspaces, artist studios. All of these spaces have some criteria to apply, and the fees range from £60 to £270 PM for Exchange.

which also act as a source of income for Makerversity. Other income-earning ventures of Makerversity include their partnership with Autodesk, who pays for a desk if their company member works in the makerspace and also provide Autodesk software for all the members of Makerversity. The makerspace is also in a partnership with Ultimaker 3D printers, which have donated many 3D printers for Makerversity's makers and, in return, hold meetings and events within the space.

3.4.2. Individual Entrepreneurs, Social Enterprises

In 2018, Fiona Dent was appointed as the first-ever CEO of Makerversity, declaring that "[m]akerversity will be a place of collaboration, a platform to launch from, a place for sharing knowledge, members around the world; also linked to academia, a mediator between science and art" (Makerversity, 2018, para. 4). In this respect, we have been witnessing the community and collaboration beginning with their own location at Somerset House. As the British Council (2015) highlights, they have an affordable shared space in the heart of London. Accordingly, Somerset House Studios and Makerversity, both located in Somerset House New Wing, continue to work together with their benefactor to make making it approachable and easier by championing collaboration and experimentation (see Figure 39).

According to the Somerset House Trust Report, Makerversity is a prospering makerspace with 302 members as of March 2020, and consists of pioneers and excellent field practitioners from diverse backgrounds (2020). Moreover, the community of Makerversity is made up of technologists, engineers, fashion designers, software developers, animators, product designers, and architects. As the diversity in members is increasing, the professional makers further include freelancers, designers, entrepreneurs, and people working for not-for-profits.

Figure 39: Photos from the entry hall of Makerversity and stairs to the entrance hall

Source: Author's photo archive (2020)

When I talked to Grace Lister, a Makerversity Community Associate, she told me how members perceived their community, "people have different needs, and not everyone is making; some people are kind of like thinkers who are still creating. So, it's really important that we kind of cater to everybody in that respect" (interview 11/10/21). We can say that makers of Makerversity belong to various fields, including fashion design, architectural design, gaming, artificial intelligence, virtual reality, the internet of things (IoT), sustainability, experimental product design, coding, material innovation, hardware, and research. As a single building with such a variety of professionals, the innovation process has yielded many novel ideas and products, where the cutting-edge atmosphere of the space is crucial in such successful collaborations (Somerset House Trust, 2021). This collaboration can be considered a growth strategy that has been adopted by the makerspace to keep innovation alive and yield beneficial products.

Correspondingly, the number of makers associated with Makerversity has been steadily increasing over the years. Starting with the original pioneer group of eight members (including founders), the makerspace has increased its members to approximately 140 in 2015 and over 360 in 2020 (Makerversity, n.d.). In 2021, Makerversity consisted of 36% female makers and 64% male makers (Makerversity, 2021). As the number of associated makers increases, so does the number of businesses and start-ups. The 2021 Makerversity report noted that every year brings in new members and events, and thus the space was able to produce 24 new businesses in the span of just one year. For instance, in 2021, at least 250 members were associated with 71 businesses. These businesses are made possible through the income earned by renting out space for different events and meetings. Hanson Cheng, one of the makers based in Makerversity, commented that "I think it's quite important [renting a makerspace] in terms of as a kind of intermediate step before you have your own studio at some point […], but makerspace is a great kind of intermediate step to get you to that place and having access to those facilities is quite important" (interview 11/11/20).

Makerversity feels like a busy and thriving space, yet it welcomes you and exudes a strong sense of community. All the members have been empowered by being provided access to a workspace, technology, workshops, and collaborative opportunities. In return, members pay a membership fee, but it is made clear that the main objective of the makerspace, which it requests of its members, is to teach, support, and inspire practical skills and creative thinking in people. For instance, Hugo Richardson and Hanson Cheng are The Tyre Collective's founders, a clean-tech company founded in 2020 and now based at Makerversity. They plan to reduce pollution from tyre wear by capturing and repurposing the waste particles (Mills, 2022). They explained to me how their master's project at Imperial College London and the Royal College of Art brings industries together to tackle the complex problem of tyre wear. They have been working with manufacturers, policymakers and researchers to develop and scale their technology at Makerversity. In our interview, Hugo shared that "a makerspace offers a place for all these people to

kind of come together and call ideas […] the good thing about our project is that we have all these different backgrounds and are working together […] it's then kind of an extended version of that and pulling all these different people who have lots of, you know, varying experiences and lots of different fields and how they might, you know, contribute to the problem we're working on" (interview 11/11/20). This diversity of people and ideas working together is a characteristic of makerspaces.

All the participants of Makerversity have told me a similar thing, the people gathering at the makerspace are very like-minded. I interviewed Nathaniel Petre, a design engineer based in Makerversity, who was once a researcher at Imperial College's Dyson School of Design Engineering, specialising in digital disruptive manufacturing. During the Covid-19 pandemic, his 3D printer farms had a new home: Makerversity. I asked him what makers are looking for, and he answered, "people are looking for community, they're looking for that, and I don't think it's progressive, conservative or any of those sorts of things, politics aside". He explained how he perceives the community: "there are a lot more people coming and going like some people are members for a while, and some people aren't […] because everybody has this different path to get into the shared space, and once you are there, it's like a safe space where you can share ideas even if you're new or you've been in this for 30 years […] there isn't an internal competition, you're not competing for the boss's approval; you're not looking to get somebody's like you are not climbing any ladder internally because it's a justice space where everybody might be better at machining or good at electronics, and you're going to go to them to help you with this new idea or path that you've got" (interview 30/10/20).

Another member of Makerversity, Shruti Grover, a human-centred designer and researcher, was another interviewee. I asked about the community, which she described as "genuine", like there is "openness and being grounded so that anybody can go and speak to other, you know, other members" (interview 24/11/20). As a result of these circumstances, another interviewee called Grace explained their community as "strong" as "there are people that are really like-minded […] if you're

making where it's innovative and emerging, you need other people who are doing that too so that you can feel kind of empowered and excited about that too" (interview 11/10/21). Grace further added that "community is ultimately one of the ingredients of a makerspace […] like in terms of the community, some people will get stuck in a project; they'll come to us, or they'll just have a chat with somebody else within the community, and they'll say, 'well did you know about that person who can do that?' […] you can collaborate when you did not do things like stuck, so that's been exciting to me (interview 11/10/21). This collaboration comes from community engagement and supportive activities in the makerspace.

Makerversity organises networking events, one-on-one mentoring, and accelerator programmes. Moreover, there is an effort to engage the public with open studios, sector-specific networking, and career workshops. In this context, Makerversity also works in collaboration with schools, children's charities, and other organisations to provide free learning opportunities for young people (Makerversity, n.d.). Makerversity supports the idea of children and young people equipping themselves with skills which are different from the usual graduate students' skills by keeping innovative ideas alive in young minds. For example, easy access to technology allows problem-solving skills to develop in children and young people as they learn to understand and solve problems on their own with the right tool in their hands (Tobia, 2016). Such programmes are designed for primary school children and thus plan to equip the minds of children with problem-solving and decision-making skills and help them understand the power of working within a team (Makerversity, n.d.). Makerversity also partners with different private companies, trusts, and educational institutions to deliver useful services to the local community (Makerversity, n.d.). For instance, a partnership with The Prince's Trust was devised to run a product design course in musical instruments.

Makerversity community is also self-organised by communicating through Slack Channels[119], which helped them define their response to make something for society during pandemic. In 2020, Makerversity members who were part of the Humanising Autonomy project[120] expanded rapidly, raising approximately £4 million, which helped it graduate from Makerversity to a separate office space in Somerset House (Somerset House Trust, 2021). Makerversity was also praised for developing an algorithm that can successfully predict vulnerable road user movements across different cultures. This algorithm was used to rationalise the social distancing impact in Manchester, UK. Another example is Shellworks[121], a part of the Makers with a Mission[122] programme, which utilises and reclaims seafood waste to make compostable materials. Shellworks have contributed substantially to Makerversity's February Learning programme on materials and pigmentation, along with the Prince's Trust, which has supported Makerversity in many of its ventures (Somerset House Trust, 2021). We can see that these various partnerships have assisted the Makerversity in getting involved in projects that create innovative and socially relevant products.

3.4.3. Inside the Historical Landmark

Makerversity has been labelled by its designers and members as a Factory-on-Thames (see below, Figure 40) (Trew, 2014). As Grace also told me during an interview, location is one of the ingredients of a makerspace. She especially noted Somerset House "being attached to history here" (interview 11/10/21). I found out that makers in Makerversity, recognise both support and challenge while

[119] Slack is an instant messaging tool which organises conversations into dedicated spaces called channels. Although Slack was developed for professional and organisational communications, it has been adopted as a community platform.

[120] See https://humanisingautonomy.com

[121] See https://www.theshellworks.com

[122] "Makers with a Mission" is a 6-month residency for supporting maker businesses with value-driven production. Makers with a Mission are looking for makers to challenge societal ideas and behaviours through making. It could have a social or environmental agenda or use disruptive technologies and manufacturing processes to transform the way of making. See more at https://makerversity.org/makers-with-a-mission/

working/making in central London. The space also provides access to various tools and technology; and essentially brings people from many different fields together in one place.

Figure 40: A view of the River Thames from the Makerversity

Source: Author's photo archive (2020)

As Makerversity is in central London, Somerset House's spatial arrangement has its own difficulties in terms of navigation, especially for a first-time visitor to Makerversity. I explored this issue in my field notes:

> I booked a Talking and Touring tour at Makerversity from Eventbrite, and my ticket[123] stated that the tour's meeting point was the New Wing entrance. The absence of a sign for Makerversity outside Somerset House makes it difficult to look for where Makerversity is; luckily, I found the New Wing entrance; and there

[123] https://www.eventbrite.co.uk/o/makerversity-london-7656461673

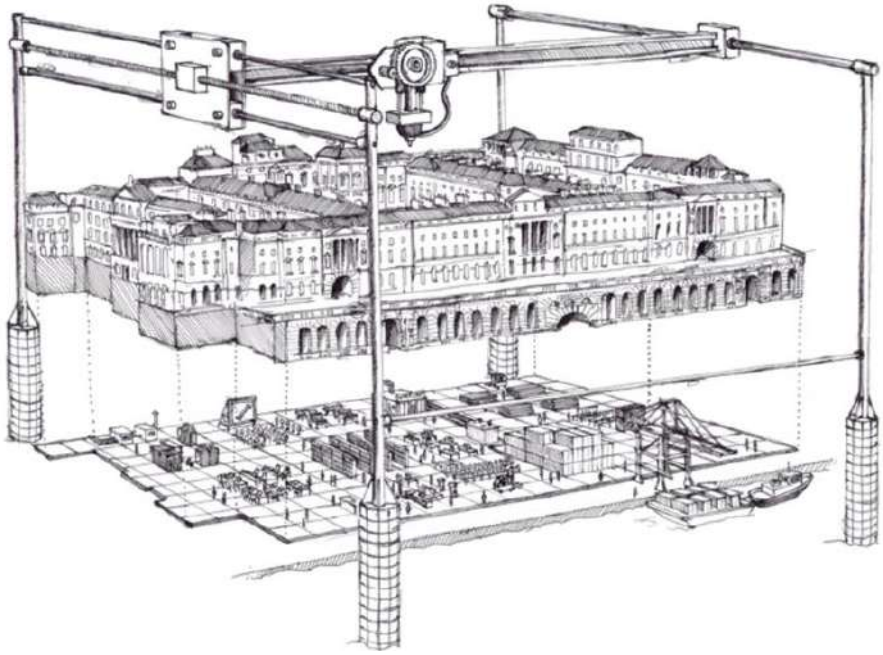
> are staff for both Studios and Makerversity. As a group, we followed the person from the makerspace, and the first time we experienced the entrance, it was only via an access card, meaning it was closed to the public. The spatial design of Makerversity provides circulation. There are signs indicating the type of spaces and workshops, but walking the first time through the space, you are unable to understand the layout without a community manager (visit, 22/11/2018)

Accordingly, Makerversity is a part of a historical building, which is a motivation for supporting creative industries. Makerversity sets its motives to inspire and support makers and help the community of makers grow in London.

Makerversity comprises of an area of 2000 square meters of lower floors of Somerset House (see below, Figure 41). Nathaniel shared that he was lucky to find Makerversity: "for having a space where there are other creative people and the tools that enable you to be creative […] it's got all the bits and pieces I want; the membership is relatively affordable for Central London; it could be much more expensive" (interview 30/10/20). Likewise, when I talked to Hanson, he mentioned the reason why he chose Makerversity, "not only the types of equipment they have, but also it's quite easy to get access to […] it is kind of in central London, which is quite rare; many of the other makerspaces were outside of London, making it a bit challenging in travel and such" (interview 11/11/20).

In terms of plan layout (see below, Figure 42) Makerversity serves a typical engagement for the visitors with the natural space relationships from the main entrance area to coworking spaces, from studios to fabrication workshops.

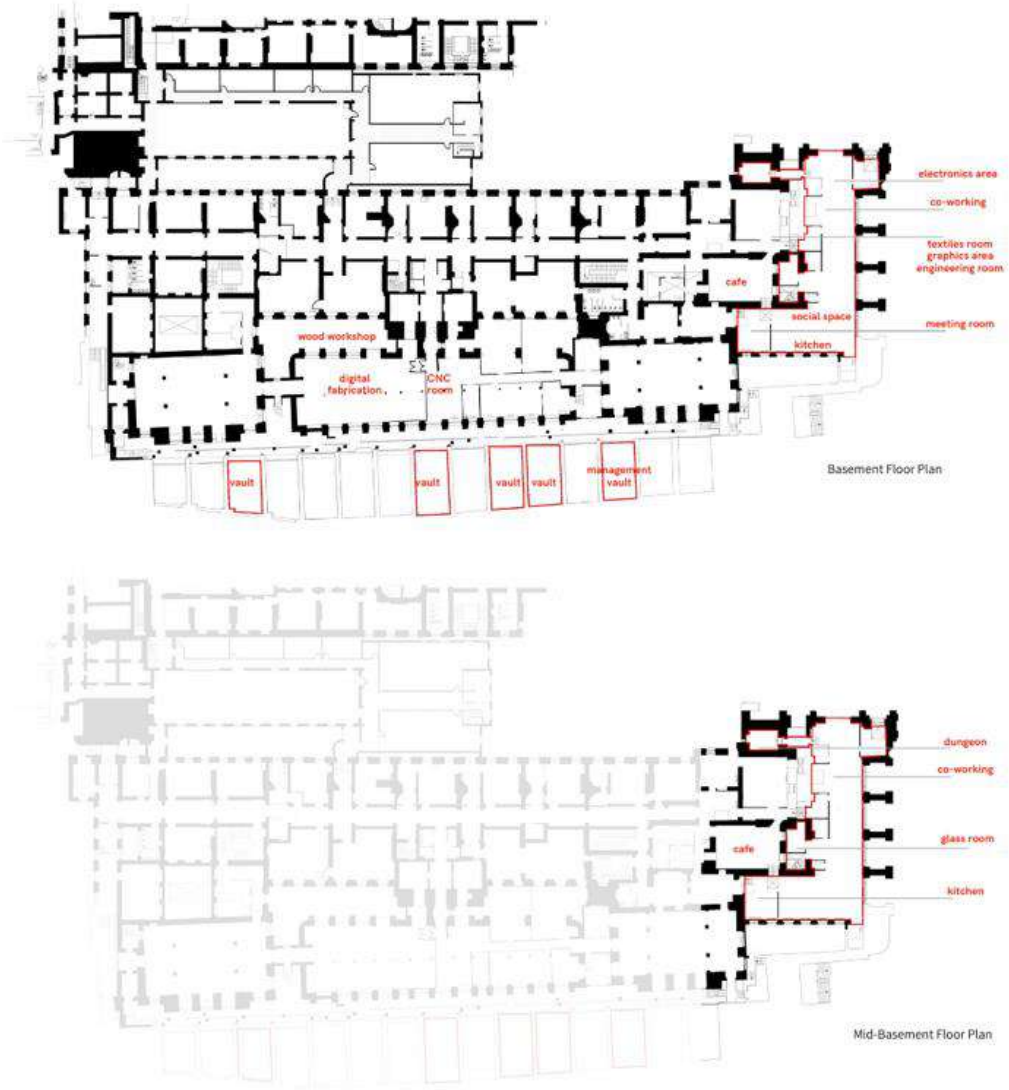
Figure 41: Makerversity illustration



Source: https://makerversity.org

Even though it exists as a subspace of Somerset House structure, it creates an active environment with the interfaces between spaces, such as the electronics area, glass rooms to magnify the making process, and the paint room café, allowing members to exchange ideas among not only themselves but also somerset design residents. This open and flexible plan affects makers in a positive way. Hugo shares, "I think in terms of the building itself, it's an open plan, so it gets people to collaborate and talk to each other, and you can't help but say hello to people when you come in; you get talking. I think that's how new ideas come about" (interview 11/11/20). Stacie Woolsey, the founder of Make Your Own Masters, used the term "amazing space, kind of quiet" for the space she used, saying that "even though I'm a hot desker, I have my favourites, but because it's not built like this, the open-plan works for space, everybody almost has their own spot […] it's kind of really nice to go and visit them where everybody lives" (interview 20/11/20).

Figure 42: Makerversity floor plans located in the Somerset House New Wing



Source: Drawing by the author, adapted from Makerversity

On the other hand, the functional spaces beyond making are also critical for meeting new people. For instance, Stacie told me that the biggest turning point for her was when Makerversity introduced a café (see Figure 43). Stacie told that "before, it was completely dead space, but it just made the biggest difference; now, it's such a hub for everybody passing through, and it gives people that kind of reason to mingle and socialize" (interview 20/11/20).

Figure 43: View from the Makerversity café

Source: Author's photo archive (2020)

You may access a variety of smaller spaces from the main coworking space. A makerspace is like a beehive in which each room is dedicated to a different kind of technology but nevertheless works as a cohesive unit.

The vaults (see Figure 44) are another section, with a small alley lined with separate units for companies and residences for Makerversity and Somerset House Studios (Holden, 2020). Hanson explained that he also has the "architectural studio vibe" like me. He shared that "it is quite reminiscent of what you get in most kinds of architecture schools or product design schools […] I think having a dedicated workshop space and more flexible desk space is important". However, as he knows that space is premium in central London, he wished for "larger office spaces that you can kind of test your prototypes in your own office space within this larger flexible plan" (interview 11/11/20). There are also different meeting rooms (see Figure 45) that have the vibe of making in the process.

Figure 44: Photos from the vaults

Source: Author's photo archive (2020)

Figure 45: Photos from the meeting rooms

Source: Author's photo archive (2020)

3.4.4. Cutting-edge Making and Prototyping

Makerversity is a home for makers as well as many start-up companies, including businesses in digital manufacturing, such as Unmade or Candy Mechanics, which were established through crowdfunding. There are also mission-driven ethical, sustainable, and wellbeing-led projects such as Avy, which is a free aircraft for humanitarian purposes (Makerversity, 2017). As Grace Lister, told me, "when businesses come into our doors, the people that are applying for memberships ultimately have a social impact at the core of their business" (interview 11/10/21). What is important and obvious here is that the spaces are charged with creative energy; everyone has their own task and a way to input something. And the space and community invite you naturally to join them and put your effort into making or creating something. Hugo also shared, "somewhere like Makerversity, everything kind of feels like it's been made in the workshops; it doesn't limit your creativity. It's like, I need a bench; I just go and just make one" (interview 11/11/20).

Starting with Cromatica, the Makerversity's first invention to be introduced in the market, the makerspace has blended innovation and locally available technology (Trew, 2014). Cromatica is a Bluetooth speaker lamp that provides light according to the users' needs by using a blend of voice and gestures. In 2020, one of the founders of DAM[124], Nathaniel Petre teamed up with Makerversity members to make comfortable and sustainable face shields from bio-plastic filaments and recycled ocean plastic. These face shields could be disinfected several times, which is different from the usual personal protective equipment (PPE) used in hospitals, especially during Covid-19 pandemic, which created considerable plastic waste due to one-time-use PPEs. These face shields were developed in partnership with Healthcare Workers' Foundation. Furthermore, the Makerversity again partnered with Prince's Trust to create a programme called 'Get Started in Product Design',

[124] DAM is a digital manufacturing company that employs 3D printers to create answers to global issues, which has the mission is to recycle ocean waste. DAM exists in United Kingdom, Jamaica, Uganda, and the United States. Nathaniel Petre and Gabriel Robson are the founders of DAM UK. (https://dam.london/about).

which helped members and participants of the virtual workshop to design and create PPE.

The interviews I carried out with Makerversity makers or directors have shown the critical role of makerspaces. For instance, Hanson believes that there is always a need for makerspaces, “like you're at school and have all this great equipment you can access. And then once you graduate, you know how to use all this, but then there's no space. Access to a makerspace like Makerversity and many others is crucial in continuing what you want your passion to be” (interview 11/11/20). In my interview with Grace, I asked her about the extent to which facilities and tools are critical for a makerspace. Grace replied that “accessibility is helping people to give the tools […] like we offer the facilities, and we've got loads of different machines, which people can use […] I think this gives them accessibility, which is different to many other working environments, such as co-working spaces. If you just need to do desk-based work, that's fine; but here it is a lot about you learn about different industries” (interview 11/10/21). The tools are essential; however, when I talked to Shruti, she mentioned that “makerspace is definitely about making, but it doesn't matter whether there's a 3D printer or a really nice laser cutter; there's that element of doing something with your hands in a maker space” (interview 24/11/20). This shows that it is not all about the tools in a makerspace, but also about the practical experience of working with your hands.

Makerversity runs two free programmes, which justify its mission to educate and prepare young minds, and help and support those who are working towards a better world by tackling global challenges. The Under 25s series democratises access to technology for youth. The other one, Makers with a Mission, is designed to support those who possess the potential to solve global issues (Somerset House Trust, 2021). These two programmes cover 20% of members at Makerversity. As an example, one of the makers of Makers with a Mission programme has launched the Airwatch project, a real-time indoor air quality visualiser that helps us understand the environmental impacts of our lifestyles (Ellard, 2018). Accordingly, each maker has an inspiring story of their own. For instance, Isabel Fletcher is an

innovation design engineer who specialises in designing human-centric technologies. She is another maker-with-a-mission who creates immersive clothing that connects different crafts forms.

In 2021, Makerversity introduced a "health-tech cohort" with a mission to develop solutions for the health sector. This programme was inspired by Makerversity's previous work with HWF. This health-tech cohort was facilitated by its applicants with a six-month residency and provided access to the makerspace's workshops, business support, extensive membership benefits, and mentoring from a variety of health, physical manufacturing, and digital product experts. Makerversity also places a special emphasis on supporting professional makers who are in the business of making for a living. The range of makers is wide, such as designers, engineers, entrepreneurs, technologists, inventors, craftsmen, technicians, and artists. The makerspace is also open for start-ups or design studios that need physical space, machines and tools.

I can argue that Makerversity is a melting pot constantly bubbling with not only making but also making something novel. Shruti told me, "makerspaces are excellent for getting an idea, getting the confidence, making your idea, prototyping your idea, and starting to bootstrap it because the costs of being in a makerspace shared workspace are brilliant" (interview 24/11/20). Makerversity, in this case, has the capacity to turn an idea into a prototype, with other makers all working on something that will continue the constant flow of change. Such a process of any makerspace can restructure the creative value chain, reorganise production, and help transform the world into a better version of the present.

3.4.5. Pioneering Makers, Thinkers, Designers

Makerversity, alongside Somerset House, did not inspire a visitor at first sight than the latter. Because it is situated down in a basement underneath the Somerset House's New Wing with a complicated floor plan (see Figure 41 above, p.167) and the makerspace is not at all open to the public. However, in my time with

Makerversity, especially in the Vaults, I witnessed the unique environment where creatives and makers come together.

In this part, I examined Makerversity as a makerspace with its community with an entrepreneurial mindset, as I framed in the title. Then I looked at its history's influence on its current-day iteration and the ways it has evolved with the collaboration between Somerset House Studios. After, I tried to examine Makerversity's community and spatial design (which is a different style to landing a new building) and its functions discussing how these motivate and help makers through their practices. I also explored, in particular, how Makerversity is open to communities in terms of using the space, which they were facilitated under some programmes.

My aim in spending time with Makerversity through makerspace visits, observations, interviews and as a resident in Somerset House Studios was to develop an understanding of working in a makerspace situated in the very heart of London. This is related to how makers, in their individual positions and through collaborative efforts, are introducing prototypes, new products, and technologies, which can help transform lifestyles, society, tech, and the economy. In conclusion, my research finding in this case study relates that a strong sense of community drives Makerversity among its makers, employees, partners, visitors, and benefactors. The role of Somerset House is applaudable, and its relationship with Makerversity is dynamic. Both set-ups have continued their partnership as makers continue to contribute, and the House continues to support them as well.

3.3. A COLLABORATIVE ENVIRONMENT EMPOWERING INNOVATORS: BLACKHORSE WORKSHOP

This section presents the second case study of this dissertation, examining Blackhorse Workshop, which is established in 2014, and has since been an open-access and well-equipped metal workshop and wood workshop for makers (Hitchcock, n.d.). According to Sam Jacob "at Blackhorse, you can escape your role as a mere spectator by getting involved in the gritty act of putting stuff together; if the maker revolution is happening anywhere, it's here" *(*Blackhorse Workshop, 2019, p.32). Blackhorse Workshop is a "community interest company"[125]; thus, it is supported by an organisational board that meets quarterly and actively supports the organisations' projects and their development. The board consists of volunteers from different areas of making, finance, community projects, and social enterprises.

Figure 46: Blackhorse Workshop entrance view from the road

Source: Photo by author (2020)

[125] A community interest company was first introduced by the UK government in 2005 under the Companies Act 2004. These are companies/ social enterprises use their profits for community's betterment, i.e., these companies must work for the benefit of the community https://cicassoc.ning.com.

Blackhorse Workshop defines itself as a social enterprise aiming to inspire a new generation of makers and creative business generators (n.d.). There is a mission statement about being home for the community, whereby the founders, supporters and makers of the Blackhorse Workshop believe in the power of making, which can improve well-being by bringing people together and changing attitudes towards consumerism through using sustainable technologies. This case study is organised as follows. I will briefly examine the Blackhorse Workshop's history and the management of the space to promote collaboration through wood and metal workshops. This will be followed by the community made up by the makers of Blackhorse Workshop and the types of residencies. I will then explore the architectural space of the workshop, with reference to its functional structure, practices, and relations between makers and the public. This section will then address the impacts of metal and wood workshops on their users' making, prototyping and manufacturing projects. I will conclude this case with a discussion of my findings.

3.3.1. Forming the Identity of the Neighbourhood

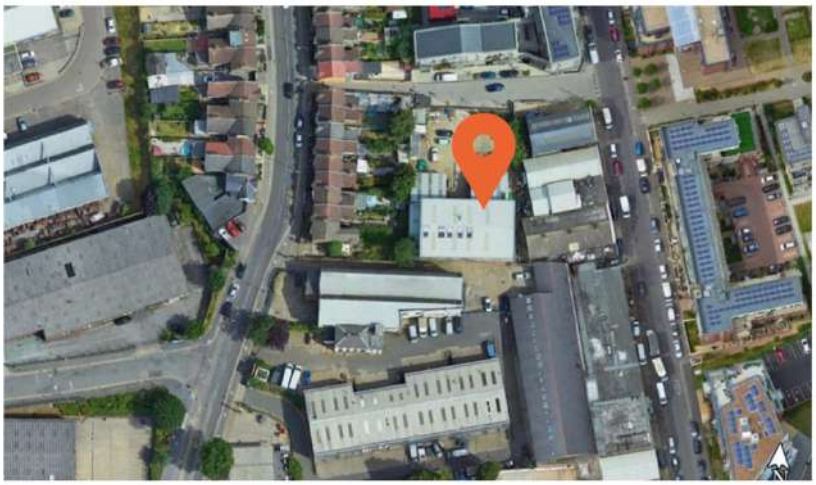
Blackhorse Workshop supports established, creative businesses to grow by providing business owners with affordable studio space, access to industry experts, and a community of makers that help in the inspiration and making process. The makerspace was established the year 2014, as a part of the wider regeneration project of the Mayor's Outer London Programme[126] and the London Borough of Waltham Forest for the Blackhorse Lane area. The project was created to support the local economy of the existing manufacturing industries and celebrate the area's industrial heritage (Blackhorse Workshop, 2019). According to Rebecca Davey[127],

126 The Outer London Fund was launched by the Mayor of London in 2011. It was a three-year effort designed to boost the development of chosen London high streets and town centres. The primary categories selected to receive funding were economic growth, event creation, event planning and community engagement.

127 Rebecca Davey is the Assistant Director for "Employment, Business, and Skills" at London Borough of Waltham Forest, which also funds Blackhorse Workshop alongside other supporters.

the Blackhorse Workshop has played a significant role in forming the identity of the neighbourhood as a center for creative industries by offering accessible space, workshop facilities, and technical support (Blackhorse Workshop, 2019). The makerspace is located in a working-class, industrial area (see Figure 47) and has a mission to foster the heritage of the area. According to Mayor of London (2020), Blackhorse Workshop as a project received £90,000 from Mayor's Outer London Fund. Later, the London Borough of Waltham Forest gave £80,000 for this makerspace and Create London[128] also gave £50,000 (Miller, 2016). With consistent support from various organisations, the makerspace has evolved to become a permanent workshop space for small maker businesses.

Figure 47: The Blackhorse Workshop



Source. Google Maps

Blackhorse Lane was an industrial area, and industrial development accelerated after 1910, as the area was located in close proximity to London (8 miles) and had access to water, energy, and flat land that allowed the establishment of warehouses and mills. Together with industrialization, the area was also

[128] Create London works with local communities in cities to commission art and architecture that is ambitious, purposeful and useful. (https://createlondon.org)

developed for living by allotting homes and sports fields. The area had intensive industrialisation and produced such goods, including printing, leather, dry batteries, tyres, furniture, omnibus and motors, and propellers. By 2010, much of the industrial sites had been converted to transport depots and storage sites, but the diversity of usage continued, which included the addition of arts and community usage. Blackhorse Lane has slowly evolved to be known as Blackhorse Workshop and has been home to many makers since 2014 (Waltham Forest Council, 2016, 2022; William Morris Design Line, 2022). Large industrial units have left the place, and a diverse mix of businesses, such as Creative Works Space, Arbeit Studios and Switchboard Studios, have taken their place, along with other co-working spaces and artisan manufacturing units (see Figure 48). We can clearly see an interface between the industrial areas west of Blackhorse Lane and the residential areas to the east.

Figure 48: Signs from buildings in the neighbourhood of Blackhorse Workshop

Source: Photos by the author (2020)

The location of Blackhorse Workshop in the London Borough of Waltham Forest has contributed to establishing Blackhorse Lane Strategic Industrial Location as a hub for makers and entrepreneurs. The area is home to a large and growing number of makerspaces, breweries, and small businesses. The area has attracted more visitors and workers in recent years as it is being developed to protect the industrial capacity and encourage investment and intensification. Its strategic position as an industrial location is being used to regenerate neighbourhood centres and industrialization. Under the Mayor's programme, the whole area is being redesigned through coordinating plans for streets and urban blocks, industrial reprovision, access and servicing principles, sustainable lifestyles, and public spaces.

Figure 49: Artwork at Blackhorse Lane and Forest Road junction, by Chris Bracey

Source: Photo by the author (2020)

Blackhorse Workshop is approximately half an hour from central London with the London underground, which further puts it in a good position to support creative makers of London and its surrounding areas (Lam et al., 2021). As I stated in my field notes:

> I've just taken the Victoria Line and out at the Blackhorse Road Underground Station stop. When I first went to the station, my first view was a wall sign saying, "welcome to the home of people who make and create. After this welcoming, I began walking to the Blackhorse Workshop; there were many signs about the spaces being transformed into creative workplaces, which makes sense to me about the artwork (Blackhorse Workshop visit, 12/12/2020).

According to Blackhorse Workshop's Five-Year Impact Report, the neighbourhood of the makerspace has a high number of economically inactive adults in the UK compared with the national average number (2019). This includes a higher-than-average number of working-age adults and young people struggling for job opportunities due to their lower qualifications. The makerspace was designed with three basic requirements that needed to be fulfilled: affordable access to the workspace, affordable access to tools, and access to on-site technical expertise. There are five main strands to the activities, which support its missions to help hobbyists, beginners, and creative entrepreneurs to prosper and grow in their creative ways:

1. providing open access to woodwork and metalworking tools and machinery
2. providing desks, studios, and working space at affordable prices to makers at any stage of their career
3. organising courses, both on- and off-site that provide training starting from basics and going all the way to advanced skills in wood and metalwork techniques for all age groups
4. getting the local community involved by organising creative projects and events in partnership with cultural organisations

5. advocate for making at various forums and platforms by showing what making can do for the community, country, and economy (Blackhorse Workshop, 2019).

With these activities in mind, Blackhorse Workshop offers both permanent and part-time spaces for small makers and businesses, hobbyists, freelancers, and other amateur makers. The membership packages are different; for instance, one-day access is charged at the rate of £29 and £1,590 for a complete year's membership (Blackhorse, n.d.). The open-access facilities were thought to be the main income generators, but they only make up 18% of the income of the makerspace. Instead, the main revenue is earned from studio rental, including 18 benches and studios (Green, 2021). Blackhorse Workshop also has dedicated desks within an open plan studio for £296 PM, with a minimum three-month period. According to Miller (2016), the space is highly popular with graduates and fresh start-ups who are always looking for lower costs of workspace and access to experts in their fields.

3.3.2. Professional and Amateur Makers, Together

Blackhorse Workshop has a feeling of openness in its public outdoor space. Accordingly, the members come from diverse backgrounds; for instance, some are architects, set designers or furniture makers, whereas some simply come to do DIY projects for their homes (Lam et al., 2021). In the span of five years (2014 - 2019), the makerspace has trained 2,600 people to use tools and machinery (Blackhorse Workshop, 2019). Summer activities for children have also been set up, which have been attended by 2,500 children. The courses designed by the makerspace have educated over 3,000 adults, with many courses being entirely women centred. These efforts have also helped in the establishment of a total of 46 creative businesses. The vision of Blackhorse Workshop makerspace is that makers can continue their work without worrying about take out loans to buy machinery for starting a business. For example, in the year 2020-21, Blackhorse Workshop taught 279 people to use tools and machinery. A 45% increase in turnover in businesses

was observed, with 14 new makers joining the makerspace and a 64% increase in collaborations. This was all possible despite the strict governmental lockdown measures in 2020 due to Covid-19 (Blackhorse Workshop, 2022). As of 2021, the space had 50 resident makers (Green, 2021) who are spread across creative fields, including set design, architecture, fabrication, furniture making, and product designing.

Since the makerspace opened its doors, Harriet Warden[129] has been the director of the workshop. Warden noted that Waltham Forest has many makers and artists, and the area is already a hub of making activities alongside existing manufacturing spaces in this district, and as a result, she believes that the area's variety of start-up businesses and creative individuals would use the makerspace to flourish (Blackhorse Workshop, 2019). The technical team also consisted of wood and metalwork specialists, who later got involved in the technical training of makers, designing training programmes, and teaching amateur makers, hobbyists, and freelancers. Blackhorse Workshop also hires full-time technicians who are responsible for managing the space and ensuring that members are trained properly to use more risky tools. From a financial aspect, Blackhorse Workshop partnered early on with Culture LLP[130] (Blackhorse Workshop, 2019). This organisation supports creative businesses to plan, manage, and prosper. The expertise provided by this organisation has been crucial in the development of viable and financially stable business models in the context of London's creative economy. The pioneering team of Blackhorse Workshop makerspace has continued to expand, for example, through building the administration side of the business, financial management, programme development, and teaching delivery.

129 Harriet Warden has worked across a variety of institutions across the cultural spectrum; as one of the founders behind The School of Life, she previously worked for Zaha Hadid Architects and Tate Modern (Blackhorse Workshop, n.d.).

130 Culture LLP/ Counterculture LLP is an organisation that provides business, strategic, and legal advice to cultural, creative, and educational initiatives, which can help them to plan, manage, and prosper (https://www.counterculturellp.com)

The makerspace is shared by paying members who are offered workbenches. The members and makers can choose from four different kinds of spaces in the makerspace. Every space is designed to suit makers who may be at the beginning of their career or have fully operating businesses. For instance, Adam Azmy[131] is one of the makers based in Blackhorse Workshop, and who works with visual effects in the film industry. He is a bespoke furniture maker and an active member, supporting the Blackhorse team by creating short film projects, and with his experience working with digital manufacturing processes. Adam explained to me how he first came and how he perceived the community of the space. "I started to come to Blackhorse while I was still working in film […] I would come here on Saturdays and do my own little projects, either for films that we were doing or for our flat and that stuff; it was like making a coffee table or this kind of like stuff just to build my confidence again with it" (interview 12/12/20). This shows the importance of makerspaces in providing spaces for people to begin experimenting with making.

Regardless of ability level, Blackhorse Workshop accepts makers of all ages. People in their 30s to 50s make up the majority of the age group using the makerspace, reaching for 40%. The other 14% of the makers are in their 40s and 50s, while another 34% are in their 20s and 30s (Green, 2021). The makerspace works in collaboration with the local council to support youth groups and schools. For example, it organised a Kids Holiday Club[132] for local families and children. We can see that this makerspace is designed with comfort in mind; for instance, the makerspace is well-furnished with equipment and is also designed in accordance with the ease of use for each level maker, either amateur or expert. Makers who are members have complete and shared access to various hand-held tools, other

131 When I met Adam Azmy in Blackhorse Workshop on 12 December 2020; he was a member of Blackhorse Workshop. Now he is also a board member of the Blackhorse Workshop. See more at https://www.blackhorseworkshop.co.uk/about/board/

132 Kids Holiday Club are 90-minute sessions for 9-11 years old arranged by the Blackhorse Workshop. Kids are taught various techniques of woodworking. See more at https://www.blackhorseworkshop.co.uk/kids-holiday-club/

specialised metalworking and woodworking equipment, and a spray booth open for 6 days of a week (Kirk & Morgan-Hatch, 2015).

The makerspace aims to help local enterprises and locals themselves develop making skills by offering different packages ranging from half-day access to full-year memberships to their metal and woodwork workshops. Various training courses are also offered, which include leatherwork training courses and workshops. The makerspace was originally designed for professional makers, but it has expanded its facilities to cater to hobbyists and families. It arranges and manages various events where professionals from different walks of life - such as designers, expert fabricators, artists, and craftsmen - come together to share their creations and ideas with the general public (Lam et al., 2021). Adam defined the community as "a collaborative group of people that don't necessarily all work together all the time, if necessarily ever, but we're all held together in the fabric of this place" (interview 12/12/20). The space is a melting pot of creativity, where makers are eager to share their skills with amateurs and for the betterment of the local community. Blackhorse Workshop is playing an active role in empowering its local community. The collaboration with local organisations is helpful for the community as organisations to recognise the target communities and their motivations, which in turn informs the business models of the makerspace, and makers are able to provide more suitable activities and services for the community.

3.3.3. Space as a Workshop

Blackhorse Workshop's design and project development was carried out by the architecture collective Assemble (see footnote 15, p.14 above), commissioned by the London Borough of Waltham Forest, and funded through a consortium, including Create London, Arts Council England and the London Legacy Corporation. Assemble put together this space by converting an underused office space into a number of large workshop spaces, with a café on the ground floor and other smaller studios on the upper level. The design of Blackhorse Workshop

includes an open, outdoor, messy workspace, with the added benefit of free parking, both of which are very rare in central London (Kirk & Morgan-Hatch, 2015). These benefits have attracted a number of people and projects.

The open-plan nature of the makerspace and the courtyard enables people to socialise and share ideas. The adjacent café (see below, Figure 50) is also open to the general public. This has been an important step in creating awareness among locals about the makerspace. As stated in my field notes; “Blackhorse Workshop visit, December 12, 2020: I talked with Adam before coming to makerspace, and I was waiting for him at the café of the Blackhorse, which is open to everyone in the neighbourhood. It is good to take your coffee and sit outside watching all the makers come and go. Also, there was a bulk of wood section, which inspired me to make something. After we met Adam, we entered the makerspace through the main door, and I feel the atmosphere is pleasant, a nice mix of ages, and there are kids in the workshop area.”

When different people and interests share a working space, they add creativity and bring new ideas. Blackhorse Workshop is unique in many ways, especially with its community, so the makers coming to this place often experience this environment, as shared by Adam, “at lunchtime, you can pass someone and ask someone's advice on something, which can help change […] I've had that change design of something, or I'm like, that's not quite working” (interview 12/12/20). This aspect of community and feedback are very important for the vitality of a makerspace.

Over the years, the space has evolved from two perspectives: one from the aspect of makers and the other from financial viewpoint. The interior space design has enabled the development and expansion of education programmes by Blackhorse Workshop.

Figure 50: Blackhorse Workshop café views

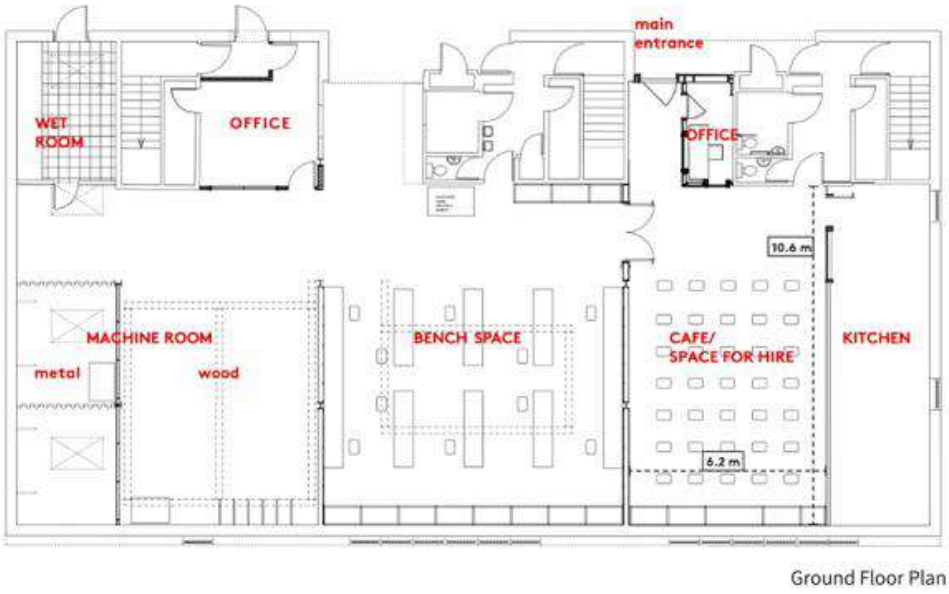
Source: Photos by the author (2020)

There are three main functions on the ground floor, which is separate from the external areas, and further consists of a reception and offices (See Figure 51). The bench space for permanent members, and other makers who cannot find desk space are also accommodated here. The makerspace has also financed the purchase of eight shipping containers (See Figure 52) labelled as grow on studio space (Miller, 2016), which are flexible workshops that can be easily moved if a change of site is needed in the future. The space's simple and utilitarian architectural design allows for flexibility, where spaces can evolve as makers continue to work.

Blackhorse Workshop utilises its environment and provides the outside independently scattered studio units from converted containers. The landscape offers a unique engagement for anyone to witness the making process even in advance of learning Blackhorse Workshop's complete spatial layout. The outside becomes the inside. The bench space, which is the central area of the ground floor, is a unique co-working area as a front interface of Blackhorse Workshop. The

dynamism of creating is to be encouraged on the first layer from outside to inside with its social and production spaces, café, and fabrication workshops which are located on opposite sides of the ground floor. Unlike the most active and transparent ground floor layout, the first floor is mainly organised with coworking spaces.

Figure 51: The Blackhorse Workshop Floor Plans



Source: Drawings by the author, adapted from Assemble

Figure 52: Converted shipping containers

Source: https://pencilandbrick.co.uk/projects/containers/

3.3.4. Making, Mending, Learning

Blackhorse Workshop was developed with the aim of promoting craftsmanship but was significantly centred towards local people. The makerspace provides tools for makers to manufacture anything from simple sculptures to furniture. The available woodworking equipment includes a disc sander, bobbin sander, chop saw, bandsaw, table saw, pillar drill, thicknesser, mortice, and lathe (See Figure 53). The metalwork machinery includes a plasma cutter, bench shear, metal bender, angle grinder, MIG welder, TIG welder, chop saw, polisher, linisher, sheet roller, and box-and-pan folder (Miller, 2016).

One of the resident makers, Tim Worsley, is a passionate maker who creates custom-made garden rooms from sustainable materials. Tim has been a member of Blackhorse Workshop since 2016, and has participated in furniture installation events, constructing garden structures, and 3D modelling. In his own words, “I have been a member of the makerspace for over five years and have seen it evolve through the efforts of a small but dedicated team into a vibrant community of designers, makers and artists. I have learned many new skills through working with

other members. Going forward, I would like to work with other makerspace members and local tradespeople." (Blackhorse Workshop, 2021, para.8).

Blackhorse Workshop runs on the principles of inclusivity and sustainability (Blackhorse Workshop, 2014). Furthermore, the makerspace is on a mission to reduce the environmental impact of wood and metal working by using sustainable methods and technologies. Worsley is one of the makers experiencing this social impact of the makerspace. He has more than ten years of experience as a set carpenter in the television, film, and events industry, where he witnessed huge amounts of waste being generated first-hand (Blackhorse Workshop, 2021). This inspired him to make products that could last longer and were also eco-friendly. Before becoming affiliated with Blackhorse Workshop, Tim started his own 9T9 percent company, which uses 99% repurposed materials to make furniture and homeware. In the beginning, Worsley built a smaller room in his local area using repurposed material. These custom-made rooms are high-quality, with a strong focus on using eco-friendly and sustainably sourced materials. He also does not use any prefabricated panels; instead, he uses the traditional timber frame construction method that allows for more flexibility, enabling the maker to change the design during the building's progress. This helps in constructing a truly tailor-made. Worsley is currently researching cellulose insulation material, which will be made of 80% recycled paper (Blackhorse Workshop, 2021). Thus, it can be concluded that the makerspace and the makers work in harmony to develop and polish the skills of makers and help the community.

Figure 53: Photos from the workshops

Source: Photos by the author (2020)

When I talked to Adam, he also confirmed that, "being able to have my own space here, but also a workshop, equipment; I wouldn't be able to afford on my own to have […] people can come here, and you can do something very simple; often do it as a gift like chopping boards or make something more complex for their own home, which I think is wonderful" (interview 12/12/20). Tools are critical for making; accordingly, Adam also told me these tools and equipment are thought to be at the core of Blackhorse Workshop: "it focuses a lot on a lot of traditional woodworking, and metalworking tools are the core of the spaces that are shared spaces, but then the makers themselves bring a lot of different things to that as well….I tend to take on projects that I maybe don't know the skillset so that I can try to adapt and learn it anyway […] while I can do little bits of metal work and I'm still trying to improve my skills with that, someone from makers who is much better metal worker teaches me the stuff" (interview 12/12/20). In this sense, makerspaces are considered places where you can exchange ideas and discover great talent around you, which can become part of your project.

3.3.5. Take the Course, Become a Maker

Blackhorse Workshop is a progressing makerspace. Having been set up in recent years, the space is still growing but has established a good reputation as the Blackhorse Lane area of London is now known for its maker community. The makerspace brings out and pays tribute to the industrial heritage of the area yet maintains the spirit of making by welcoming makers from all sorts of backgrounds in metal and woodwork. Adam expressed in this regard, “for me, the importance is that it’s a collection of different people and businesses, even if the business is just one person; I think it’s very important to do that, especially in somewhere like London, where space is obviously tricky” (interview 12/12/20). Here, amateur or new entrepreneurs do not have to worry about buying machinery for their business as the space helps these individuals by providing them with space, tools, and technology.

As I already give examples of the projects for the kids, this makerspace not only involves adult makers but has also opened its doors to young people. Blackhorse Workshop arranges events and classes for children and helps them learn wood and metal techniques. In a way, the makerspace is cultivating future makers. Blackhorse Workshop maintains the industrial aspect of the area without harming the environment, as the makers are working hard to find sustainable and eco-friendly solutions to the community’s problems. And thus, it is also working to bring the community together by asking about their problems and helping them find solutions through utilising easily accessible and local resources. It would not be wrong to conclude that Blackhorse Workshop is not a local makerspace for local people, but it triggers with the help of the neighbourhood's policy of creativity and making.

3.4. A COMMUNITY-LED WORKSHOP WITH ONLINE VISIBILITY: SOUTH LONDON MAKERSPACE

On a Saturday in March 2019, I visited the maker faire (see Figure 54) organised by the South London Makerspace (SLMS). In my field notes, I wrote, "from the entrance to meeting the makers, I recognise that I am in maker faire, although this is my first experience. Two hours into my visit, I saw the unusual use of electronics, 3D printing fixing and repairing services and manufacturers, and robots of all possible types. What caught my interest, however, was the people as makers" (Author's fieldnotes, 2019).

Figure 54: Photos from the SLMS Maker Faire

Source: Author's photo archive (2019)

In this part, I will discuss SLMS in South East London. This is a makerspace that has both challenges and opportunities in terms of my community-space-production trilogy in this dissertation. SLMS is a not-for-profit social community workshop voluntarily operated by its members. All the members in the makerspace

determine how the space is run and can access all the facilities. This case study will proceed as follows. I will begin with a short history of SLMS and the challenges behind the founding journey. I will then discuss the community of SLMS as well as their online visibility, faires and events. This will be followed with a spatial analysis of the space, discussing its different spaces under the railway arches (see Figure 55) and the interactions between makers and the community. I will conclude the section with an examination of how members of SLMS have been making and learning about each other's practices, manufacturing methods and new ideas.

Figure 55: The entrance to the railway arches and a view of SLMS's arches

Source: Author's photo archive (2021)

3.4.1. A Journey under the Railway Arches

SLMS was incorporated as a company limited in September 2013, though the idea behind the makerspace was conceptualised in 2012 when the Victoria and Albert Museum hosted the "Power of Making" exhibition in collaboration with the

Crafts Council. This exhibition, curated by Daniel Charny, was attended by over 30,000 guests. The initial space had an area referred to as the ‘tinkerspace’ with 3D printers and a workbench that allowed people to get involved in the making process during the exhibition (SLMS About, n.d.). Upon incorporation, the next step was to establish a makerspace.

At the time, an empty shop in Herne Hill was identified as a suitable location on Norwood Road, and inquiries were made concerning its availability. Upon negotiations, the leadership managed to secure two months of rent-free use of the space. The acquisition of this space was followed by extensive rebranding efforts (SLMS History, n.d.). March 2014, marked the date the SLMS opened its doors for the first time. Many events happened during the first two months of operation, and the Makerspace was allowed to operate for an additional two months from this location before they had to move out. This first four months of operation saw membership grow from three to over 60 people, and the space managed to host various open public events, including The Restart Project and The Herne Hill Free Film Festival. After four months, the community could not find a new space and had to move to storage towards the end of July (SLMS History, n.d.). In October 2014, Arch 1129 (See Figure 56) became the community's new home. Joint efforts saw the railway arch turned into a shared space where locals could be members and work with like-minded individuals and specialist tools to build their projects.

The Spring of 2015 marked the opening of the South London Makerspace, this time around with a wider range of facilities (SLMS History, n.d.). The community also applied for funding to complete the workshops. I talked with Dermot Jones, who is one of the founder-director of SLMS, maker, facilitator and now the Fixing Factory's project manager, which is a co-production between The Restart Project and Possible. Dermot shared that “SLMS is a not-for-profit company that is limited by guarantee, and the company is considered an association or club rather than a charity” (interview 9/12/20). Therefore, the administration consists of three directors, including Dermot, tasked with the responsibility of

covering the legal and financial operations of the company. The directors organise payment transactions, collect funds, establish rules, and facilitate the smooth running of the space. Dermot also told me that "since there is no paid staff, everything is done on a volunteer basis" (interview 9/12/20).

Figure 56: South London Makerspace

Source: Google Maps

3.4.2. Owned, Run and Maintained by Members

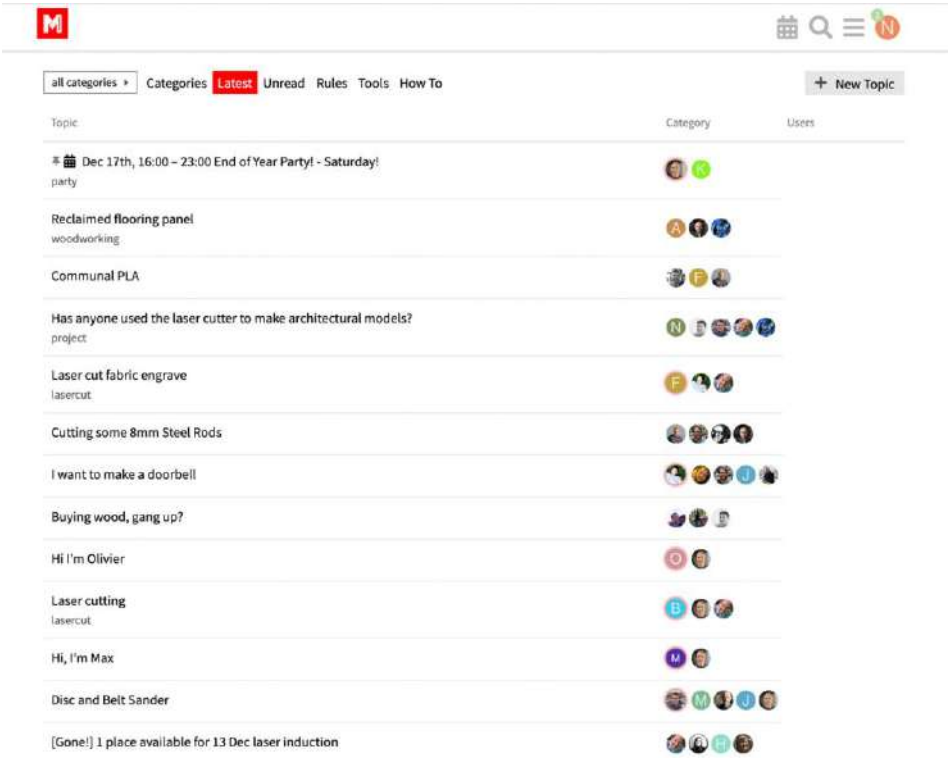
SLMS has approximately to 350 members, which is close to the limit of the space available (SLMS Discourse, 2022). Since its incorporation, the makerspace has seen a steady growth in its membership to create the social mix evident today. However, the finite space available requires the company to be realistic about the number of members that their space can comfortably accommodate.

Currently, the management controls the acceptance of new membership applications through a waiting list. Individuals interested in being members of the SLMS are required to fill out an online forum called Discourse[133] with a link to a

[133] Discourse is an open-source discussion platform, especially designed for communities. The platform Discourse is a great addition to a makerspaces and makers when their making activity can be shared with

pre-membership survey. In the Discourse group, makers can introduce themselves or share why they are looking for the space, for example, to make something together or just ask for other members' help or ideas. This process can see through the different groups in the Discourse channel (see Figure 57) in which new members introduce their backgrounds and what they will make.

Figure 57: An example of a Discourse channel with member profiles



Source: https://discourse.southlondonmakerspace.org

For instance, one member shared that he is particularly looking into a laser-cutting woodwork project right now, but has a broader interest in woodwork, CNC, and 3D printing. Another member stated that he is especially interested in laser cutting, 3D printing and woodworking, but open for any other projects to collaborate on. The membership to the community is approximately £23 PM, which is economical since

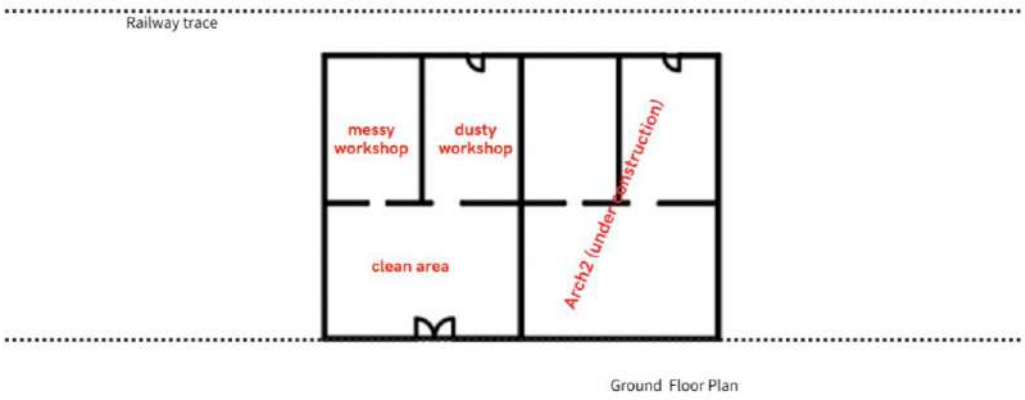
hundreds or even thousands of other makers. Accordingly, they are also surveyed globally with maker communities to investigate what they are getting out of Discourse. See more at https://www.discourse.org

the space is built and run by volunteers. However, reduced rates are also available for members experiencing financial hardship (SLMS About, n.d.). The workshop is highly interested in makers helping out in different areas, including metalworking, printmaking, and woodturning.

3.4.3. Maker-Designed (Maker)space

SLMS is currently located at one railway arch, with a neighbouring arch also to be incorporated. During my visit, Dermot showed me this neighbouring railway arch (Arch 2) which SLMS members have been designing and constructing.

Figure 58: Floorplan of SLMS



Source: Drawing by the author

The physical space at SLMS consists of three main workplaces (see Figure 58). The first is the clean area designed for activities that do not involve a lot of noise, smell, or dust. Some of the activities that take place include electronics, sewing, and coding. The space has a big table for the users to sit around. Other amenities include a dedicated electronics workstation, several sewing machines, and a 3D printer. This space also includes a social area, a kitchen, and an accessible toilet (see Figure 59).

Figure 59: Photos from the clean area

Source: Author's photo archive (2021)

The second space is the messy workshop (see Figure 60) which is designed for activities that result in smells, messes, or noises (SLMS About, n.d.). This is the physical space where one can do the general-purpose assembly. Metal working tools such as the mill, lathe, drill press, and bandsaw can be found here. Other tools in this space include those designed for screen printing, such as the vacuum table, washroom, and screens.

Figure 60: Photos from the messy workshop

Source: Author's own photo archive (2021)

The third space is the dusty workshop (see Figure 61), designed for woodwork. The structure of this space can accommodate sound and dust from heavy-duty machine tools (SLMS About, n.d.). Tools common in this space include a solid table saw, band saw, and cross-cutting mitre saw. Some tools used to shape things in this workshop include a planer/ thicknesser, spindle moulder, mortiser, and router table. Other power tools available in this space include a lathe for turning, sanders, drills, and drivers. There are also hand tools for managing delicate work.

Figure 61: Photos from the dusty workshop

Source: Author's own photo archive (2021)

3.4.4. Who You Are and What You Like to Make

SLMS provides a workshop for members and visitors to meet, work on projects, and socialise. The space only accommodates legal activities. For instance, some of the activities that are not allowed within the space include copyright infringement, consumption or distribution of illegal drugs, and unwarranted access to computer systems (Hepp & Schmitz, 2021). The workshop does not allow the use of its space for unethical and socially unacceptable activities that could harm others, including the use of porn, the use of equipment that emit harmful substances, and phishing or spamming (SLMS History, n.d., Hepp & Schmitz, 2021). Members who engage in such activities can be removed from the space or have their membership terminated.

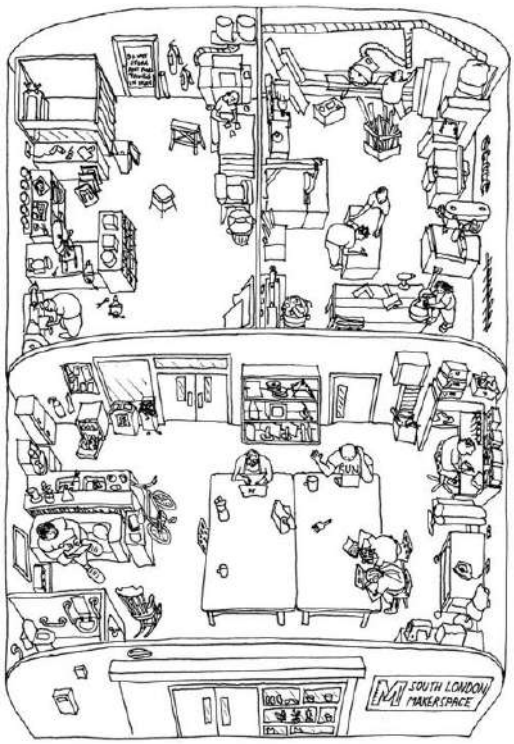
Guidelines exist concerning the use of tools and equipment. For instance, the tools must be used only for the intended purpose and in line with safe operating procedures. Members are advised not to use any tool until they are familiar with its

safe use. Members are required to undergo orientation before using certain tools and equipment (Hepp & Schmitz, 2021). In case of damage to the tools, the workshop requires that the responsible member makes a report so that the other members are aware of what happened, and the management has the tool fixed (Hepp & Schmitz, 2021). Safety in the workshop is the responsibility of each maker at the makerspace. Members are encouraged to speak up whenever they have safety concerns while in the workshop. When an incident compromises the safety of an individual within the space, an Incident Report Form must be filled out and sent to the directors (SLMS About, n.d.). While all members can host events within the space, certain conditions must be met. First, the activities planned in the space must not contravene the established rules. Second, permission must be sought in advance. Finally, a minimum of 30% of any profit resulting from the event must be donated to the space (SLMS About, n.d.).

3.4.5. Small Space, Huge Community

As a distinctive example, SLMS has no transition in its spatial layout (see Figure 62). The first space is designated as a coworking studio the moment you pass through the entrance door, the clean area with its own definition. Even though the specialised areas are organised to prevent cross-contamination of materials such as wood (dusty) workshop, metal (messy) workshops, the presence of integrated spaces is wisely achieved.

Figure 62: SLMS floor plan illustration (Arch 1)



Source: South London Makerspace

Overall, SLMS stands out as an informal multipurpose site designed to support collaborative, hands-on learning and resourcefulness. While most people set out to use the space for personal purposes, many have gone ahead to develop products for sale. Besides being a creative hub for its members, SLMS has created a solid social environment. The vision of the space revolves around the transfer of knowledge and the sharing of skills between members.

3.5. AN OPEN-ACCESS FACTORY FOR EVERYONE TO CO-CREATE: THE WAREHOUSE

This section provides an evaluation of one of the biggest shared open-access workshops in the UK, called The Warehouse. It also assesses how a makerspace connects with its local neighbourhood. I visited both the digital and physical spaces, which showed me how this engagement is actually happening. It is critical to understand the locality of the makerspace despite it being free and open to all. The Warehouse (Figure 63) is part of the Every One Every Day (see Footnote 16, p.14 above) programme run by the Participatory City Foundation[134], a Barking and Dagenham[135] based charity formed in 2017. Every One Every Day's mission is to build a support system for the neighbourhoods in Barking and Dagenham. Therefore, they shaped this support around The Warehouse and another five neighbourhood shops where residents collaborate with each other and with other local organisations.

Similar to the previous case studies, I will begin with a brief examination of The Warehouse's history, and its relation with the Every One Every Day and the Participatory City Foundation. I will then explore the community of the makerspace, with reference to its management and membership system. This will be followed by The Warehouse space, which is a critical factor with different functions, programmes and workshops. Accordingly, the case will address the impacts of both tools, workshops and the production journey of the members. I will conclude this case with a discussion of my findings of these inquiries.

[134] The London Participatory City Foundation is a charity established for the benefit of the people living and working in Barking and Dagenham. See more at http://www.participatorycity.org

[135] In addition to having a growing population, Barking and Dagenham, a borough in East London, struggles with a number of socioeconomic challenges, such as low salaries and employment rates, poor educational outcomes, high rates of homelessness, teen pregnancies, and domestic violence.

Figure 63: Photo from the road to The Warehouse (located on the right)

Source: Author's photo archive (2021)

3.5.1. An Initiative of the Borough

The Participatory City Foundation has raised £850,000 through the Good Growth Fund[136] for The Warehouse facility, a co-working and makerspace for residents. As an integral part of the Participation Platform, The Warehouse launched to the public in March, 2019. According to the *Y2 Tools to Act*, creating London's first open-access makerspace experienced some problems, such as how to ensure that the space is co-produced between residents and staff, and how to ensure accessibility for all, whilst ensuring that specialists and potentially risky machines are only operated by those who have experience (Every One Every Day, 2019). Management believed in co-designing the principles with residents, therefore solutions have been developed to address these collective challenges.

The Warehouse is a 3,300 square meter makerspace located in Thames ward. I mentioned the urban context in my field notes: "November 12, 2016: I came by the District Line in the Barking Station; took the bus stop opposite the station (see Figure 64) caught the EL1 to Estuary Close, which takes approximately 20 minutes to arrive at The Warehouse. While travelling, I also saw one of the Every One Every

[136] The Good Growth Fund is Mayor Sadiq Khan's £70 million regeneration programme to support growth and community development in London.

Day neighbourhood shops. When I got to The Warehouse, I saw the side entrance to the building, which looked like a big storage area. I rang the doorbell when I passed through the large metal gates and saw the entrance door".

Figure 64: Photo from the bus going to The Warehouse (right) and The Warehouse façade from the main road (left)

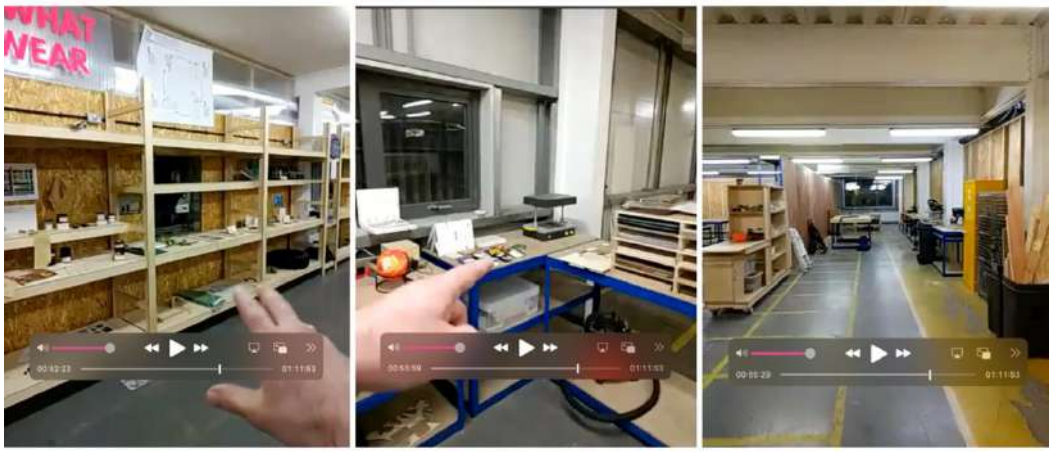
Source: Author's photo archive (2021)

Administration of The Warehouse is run by the co-production team, which includes members from the Participatory City and the Barking and Dagenham council. The team is tasked with co-production design and the universal integration of participatory ecology, services, businesses and industry (Everyone's Warehouse, n.d.). The team also integrates responses from various actors to enhance the operation of the makerspace. The co-production team includes the insights team, lab director, council specialists, and lab coordinator. The operations within the makerspace are also controlled by a development team, including the chief executive, development director, operations director, graphic designer, and office manager (Everyone's Warehouse, n.d.). While these members are based in The Warehouse, they also work across the organisation. Membership is also substantial for The Warehouse as this is an open-access makerspace. There is a priority for the members, even though individuals can still come and experience the available spaces. The management has also set up organisational membership to make it

easier for institutions to utilise the opportunities and resources that are available in the borough (Everyone's Warehouse, n.d.). Organisational membership fees include access to the spaces and equipment.

As the Covid-19 pandemic hit, The Warehouse limited its physical activities, as did other makerspaces. Most of the projects moved online to allow people to connect remotely while the national lockdown was in place (Celebrating 5 Years, n.d.). The Warehouse stored food and essentials and collaborated with a distributor to help those that needed help during the pandemic. At this time, on December 2020, I met with The Warehouse manager Andres Muniz through the video conferencing tool Zoom, where he gave me an online tour of the makerspace (see Figure 65). Andres Muniz is the manager of The Warehouse, a researcher and a CAD designer. Before working with The Warehouse, Andres worked in the National Physical Laboratory for ten years and managed his own Community Interest Company, The Centre for Advanced Defense Studies. He noted his first-hand possibilities of co-making with the community and projects with participatory aspects in the neighbourhood. As Andres noted, "I started hearing about these places called hackspaces about the same time as I was a facility manager in the National Physical Laboratory, so they kind of all came together […] hackspace, makerspace, fab lab, they're almost the same concept […] basically a place where you can come in and share tools. The way I like to see the hackspaces are more member-run, while fab labs are normally more facilitated […] there are people that are hired to look after the space, or it's attached to university where things are already happening. There are also co-working spaces, like an office where you can share computers and internet, maybe there's a 3D printer, a laser cutter, a chop saw, that kind of things" (interview 03/12/20). His comments show the variety of similar concepts involved in sharing spaces and tools.

Figure 65: Visuals from The Warehouse's online tour by Andres Muniz



Source: Author's archive (2020)

Andres also clarified that successful makerspace, "it needs to have a community of people and needs to have some sort of attachment between the people […] you can have a makerspace and use it as a service; you go in, you use whatever you want, you leave, and that's it; but unless you have like a lot of money behind it, or you charge a huge amount because it's a service and you expect things to be there, it can dwindle and die […] there should be a sort of mission statement or something that people want to get behind and feel okay, so this is what we do and how we do it" (interview 03/12/20). Andres's perception is valid through the sense of community triggering participation and engagement in the makerspaces.

Regarding the space issue, Andres also told me the aim of a makerspace is more critical than the space itself: "if I am very strict, if a makerspace is a physical space with tools there, this makerspace needs to have a mission of saying we are going to do better for the community or we're going to do something for the community […] and, they also say it's more about STEAM; some makerspaces have more of a focus; they say we're about improving the local community, we are about innovation, or sometimes they say this is a facility for our university students […] so, there's always a focus on them" (interview 03/12/20). It is interesting to note

how Andres highlights the importance of the mission of the makerspace, over the actual attributes of the space.

3.5.2. Community First

The Warehouse's community is a critical feature as it is an open-access makerspace where people "work, learn, share, grow, develop, teach and play together" (Everyone's Warehouse, n.d.). Therefore, we can say that The Warehouse reminds us of a public space, a park or a city library for people both looking for a space and other people. As Andres highlighted, "our main commitment here is to get a stronger community […] I feel that The Warehouse has the advantage over other fab labs and makerspaces because we are a community first and then a makerspace […] that's a great advantage" (interview 03/12/20).

According to the strategy of The Warehouse, anyone who lives or works in Barking and Dagenham can be a member and have free access to the makerspace and tools with an induction session. People willing to take the induction session must schedule using the Every One Every Day application. Participants who attend the induction programme are then allowed to use the shared spaces within the makerspace as long as they are open. This provision is often referred to as Level 3 membership. The shared spaces are general areas allowing members to create, work, and meet (Everyone's Warehouse, n.d.). A few extra, free training steps are usually needed for participants to gain access to the shared workshops. Andres shared with me that, "once members get the induction from one of my colleagues or me, they can come in and just use the space starting with the co-working space […] if you're inducted onto the machine, you can use it just as long as it's available […] some machines had to have bookings, like the laser cutter because it was very popular" (interview 03/12/20). During my physical visit to The Warehouse, I joined an induction session (Figure 67), given by Bahar Kaplan, a project designer at Participatory City Foundation. It was an enlightening experience to understand how

people come and take this session, asking questions and being eager to learn more about the space, tools and the production process.

Figure 66: Photos from an induction session at The Warehouse

Source: Author's photo archive (2021)

The extra training guarantees the participants Level 4 Membership. Participants who complete their training and induction are often labelled as 'keyholders'. Such participants have the freedom to access and operate the building without the attendance of staff. However, the organisation still exercises a lot of caution, considering that the workshop environment exposes the residents to an increased number of risky types of machinery (Community Participation, 2022). The management is legally responsible for insurance and has an on-site team operating during normal working hours for maintenance procedures. Moreover, another membership type is 'organisation members', which can be granted to any organisation, project, charity, team of individuals or an individual that is committed to benefiting Barking and Dagenham residents (Everyone's Warehouse, n.d.). To be approved as an organisation member, the applicant must demonstrate their

ability to create social benefit for the area residents or the borough. However, members must not use the spaces for commercial purposes. Accordingly, Andres shared their focus of this membership, "for making communities better […] that goes by doing an activity together in which we are doing batch cooking or like a collaborative business programme in which we try to create cooperatives of people that work together, and they go to business together, going to the market or selling products in a shop and stuff" (interview 03/12/20). This quote highlights the importance of makerspaces in benefitting their local community,

In The Warehouse, members also have free access to online certified training on Fire Safety, First Aid, Health and Safety, Lone Working, and Food Safety. There is also the benefit of networking opportunities with others within the makerspace (Everyone's Warehouse, n.d.). There are many benefits for individual members, such as learning opportunities, co-design, toolkits, and equipment, along with the chance to grow a network of friendships with the residents in the neighbourhood. Specifically, they can be included as members of the Organisational Members Directory. As I witnessed the makerspaces, staff is one of the critical factors in making the space works. In order to do that, The Warehouse management specifically includes a research director, programmes director, local researchers, and specialist tutors (Neighbourhood, n.d.). These members are all based in The Warehouse and are tasked with building knowledge through activities such as research, analysis, codification, development, and evaluation (Neighbourhood, n.d.). The team also disseminates knowledge and scales the rate of learning in the neighbourhoods and across neighbourhood shops (see below, Figure 68) of the Every One Every Day platform.

The Warehouse organises induction sessions, online certified training, product design and development sessions, maker training programmes and collaborative business programmes for community engagement. Moreover, as the main aim is contributing to the local community, there are programmes to support engagement with community events, magazines, yearly reports and an online platform.

Figure 67: Photos of neighbourhood shop

Source: Author's photo archive (2021)

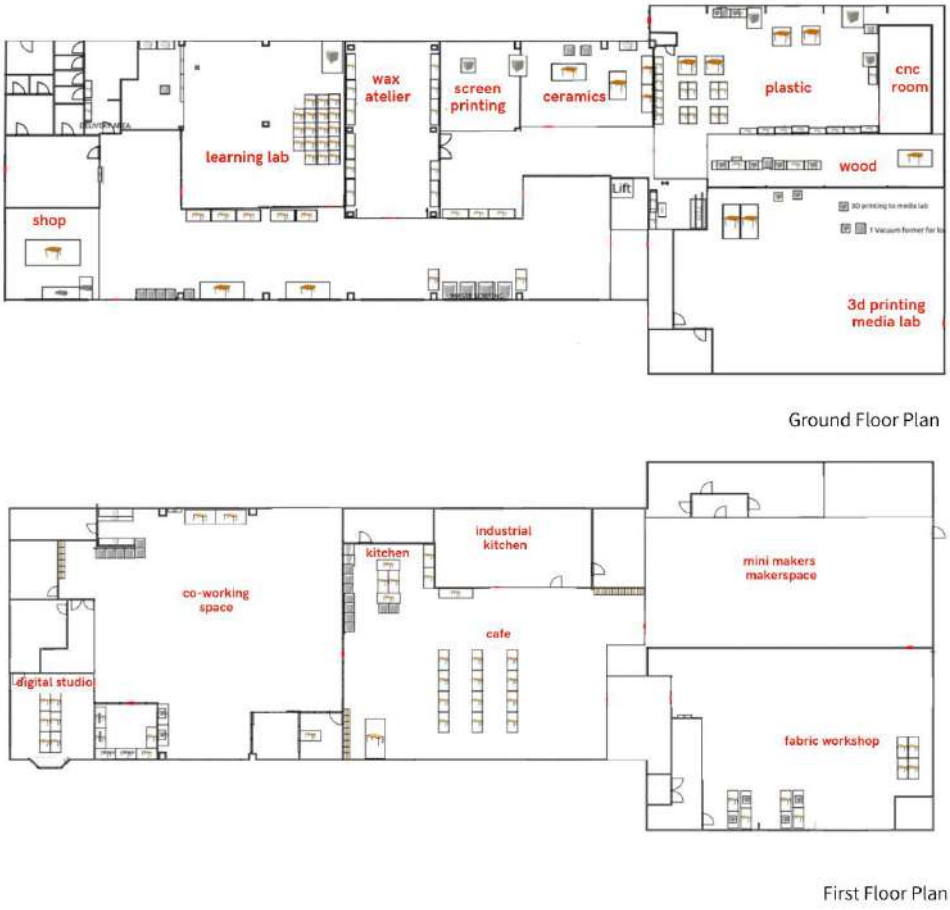
3.5.3. A Makerspace as a Public Space

The Warehouse has workshops and shared spaces where different categories of people can interact. The structure of The Warehouse can be equated to a public space that presents participants with the opportunity to survive, thrive, learn, and earn. The physical space (see Figure 69) has two floors with different workshops, ranging from a woodworking workshop, screen printing, digital making, and ceramics (Everyone's Warehouse, n.d.). Mini making areas and co-working spaces are also available within the spaces. Some of the shared spaces include the Thames Neighbourhood Shop, the Learning Lab, Gallery 1 and 2, Plastic Sorting Area, Urban Garden, Co-Working, Digital Lab, Everyone's Kitchen, Canteen, and the Mini Makers. For instance, Neighbourhood Shop is an open, inclusive, and inviting space that allows members to meet over a cup of tea and a slice of toast as they create new projects, plan new sessions, and form new friendships.

The Learning Lab is an inspiring space accommodating events and workshops. The space can hold up to 120 people sitting for a talk, performance or event, and can be reconfigured with tables for workshop events. The two galleries are placed along half the ground floor length, designed to showcase resident

products and host inspirational installations as part of The Warehouse events and the business programme.

Figure 68: Floor plans of The Warehouse



Source: Drawing by the author, adapted from The Warehouse

Gallery 1 displays resident products, while gallery 2 is a wall space for artwork, design features and signages. The co-working space has numerous workstations and areas that support small meetings and workshops. The Mini Makers space is the home for busy young minds, equipped with tools and activities that cater to different age groups (Everyone's Warehouse, n.d.). The digital lab supports aspects of learning opportunities tied to computer engineering and

software development. There is also garden space that features hundreds of raised bed planters. Unlike shared spaces, workshops are more dedicated spaces that house machinery that needs a little more learning and induction to gain access and operate efficiently. These workshops include the resident maker workshop, screen printing studio, ceramics studio, woodworking workshop, digital making, plastic workshop, CNC workshop, industrial kitchen, and fabric workshop.

Figure 69: Photos from The Warehouse

Source: Author's photo archive (2021)

From an architectural view, The Warehouse completes the plan requirement in the most simplified functional approach as a typical learning hub. It creates the optimum environment for makers to fabricate their ideas, execute the making process' outcome, and nurture themselves. In the typical plan layout, first, you access the main area, which leads participants and visitors to the studios and is able to be adaptable based on ever-changing unforeseen conditions such as Covid-19. Each studio specialises in making, prototyping and manufacturing with all required machinery and fabrication tools related to that specific process.

Figure 70: Photos from The Warehouse

Source: Author's photo archive (2021)

3.5.4. Empowering through Making

The production process at The Warehouse relies on promoting the participation culture within the community. The Warehouse directors claim that this way of doing things was common when people would naturally work together to accomplish things like growing food and keeping bees (Community Participation, 2022). Therefore, The Warehouse creates opportunities to prototype products and test ideas which can potentially become the basis of new collaborative businesses. One of these is called "Design Make Sell". Andres shared that, "people came in; they had an idea but haven't even put it on paper or even told anybody about it, so they would come and they would design it […] we would get a designer teamed up with them to think and to find out what that thing was […] then it was maybe fine-tuned and they would make a prototype, make it and then they would sell it […] that was all done within basically a month" (interview 03/12/20). We could think

that The Warehouse is an attempt to deal with the atomisation of the co-making culture in modern society.

The infrastructure at the Warehouse allows members to introduce their ideas, access resources, and connect with what is happening around them. The idea is to have the makerspace as a public amenity in the near future. The space with the tools is accessible by many people without the hindrance of a governing organisation; as previously mentioned, there is freedom to access to the building and equipment without any fees. However, the workshop provides training to participants to guarantee their safety and ensure their activities comply with regulations (as I mentioned in the induction session).

Production activities vary from plastic to clay. The Warehouse includes a lot of information on clay so that all ages can easily get comfortable right from the start (Everyone's Warehouse, n.d.). In addition, the plastic workshop presents a space for creating new materials out of materials that would otherwise be directed to a landfill. The fabric workshop attends to tailors, repairers, seamstresses, pattern makers, and those interested in learning the art of fabric. There are CNC workshops and digital making spaces with special machines that facilitate fabricating and manufacturing quality products. The screen-printing studio allows the residents to experiment with everything they can develop and print. Last, the ceramics studio has everything members would need to create and fire ceramics from the beginning to the end.

3.5.5. A Human-Centred, No-Cost System

Every One Every Day initiative is trying to build a more human-centred system and acting as an engine of positive change at the heart of neighbourhoods. Ultimately, The Warehouse helps this system as well as other parts they design within the neighbourhood. Therefore, The Warehouse is critical while co-creating and transitioning to a better way of living everyday life (Every One Every Day, 2019). The residents of the makerspace bring to life the major collaborations in the

neighbourhood (Everyone's Warehouse, 2022). The Warehouse provides a unique makerspace for members to work on imaginative hands-on projects in their neighbourhood. The practical projects run within the space make everyday life for the members and the greater community. The initiatives make life better for families, friends, and neighbours.

Overall, the space at the Warehouse makes people feel happy, welcome and connected to others from all walks of life. The projects also enhance the health and well-being of the members and increase their learning opportunities. The no-cost structure at the Warehouse is really critical in promoting the establishment of inclusive economies. The management's desire is to have community members consider the makerspace a public necessity. We could say that makerspaces are usually operating on a membership basis with well-established models, and there are many examples across London, the UK and internationally. In contrast to these models, The Warehouse is designed to be a public infrastructure. It has open access for the residents of its borough, like a public amenity.

3.6. A HUB FOR CROSS-DISCIPLINARY STUDIOS WITH A SOCIAL NETWORK: SUGARHOUSE STUDIOS

Sugarhouse Studios is a makerspace located in Bermondsey, South London and run by Assemble. At first, Assemble was involved in other projects in Greater London, with their first project being the Cineroleum, entailing the transformation of a dilapidated gas station into a semi-enclosed outdoor cinema. Following the realisation of this project, Assemble made their first designated workplace, Sugarhouse Studios. This was carried out in collaboration with the London Legacy Development Corporation, after identifying a neglected industrial area in Stratford High Street. According to Vázquez (2022), while Assemble team were working on this project, they developed workshops that were shared with tenants with the spirit

of co-working. Consequently, Stratford Sugarhouse Studios (see Figure 71) was a place to experiment for Assemble to their imminent approach to developing creative workshops and workspaces.

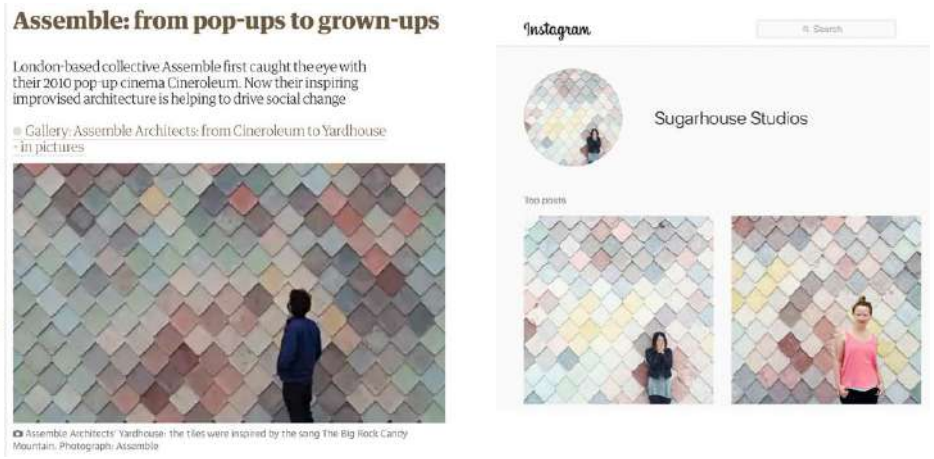
Figure 71: Illustration of Stratford Sugarhouse Studios

Source: https://assemblestudio.co.uk/projects/sugarhouse-studios-stratford

The retrofit of the space exploits the value of the existing light industrial shed with inexpensive adjustments to the fabric of the building that maintains the flexibility of interior spaces. At this time, Stratford Sugarhouse Studios gained a lot of popularity in mass media and social media channels in terms of the spatial design and the materials they used, as well as the workshops (see Figure 72). Joe Halligan, a designer at Assemble, shared that when they were having their lunch outside in the yard, they started seeing people taking photographs in front of the facade of the makerspace and "soon photos of the wall started circulating on Instagram with the

hashtag "#sugarhousestudios" and a geotag of the exact location of the makerspace" (FitzGerald, 2020).

Figure 72: Stratford Sugarhouse Studios news



Source: https://www.theguardian.com/artanddesign/2014/jul/06/assemble-from-pop-ups-grown-ups-cineroleum-2010-london and https://99percentinvisible.org/episode/instant-gramification/

Assemble's search for a new site culminated in 2017 when they settled on another transitory location in an old college building located in Bermondsey, a neighbourhood in South London. The makerspace from Stratford to Bermondsey (see Figure 73), eventually inherited the Sugarhouse Studios name, and this allowed the management to perfect the strategy of sharing space with tenants (Assemble, n.d. ; Vázquez, 2022). The makerspace now sits on the former site of a school that will be demolished to make way for a developer-led housing scheme (Edgerley & Hall, 2018).

Figure 73: Stratford Sugarhouse Studios (2011-2016) and Bermondsey Sugarhouse Studios (2017-ongoing)

Source: Google Maps (2022)

The sharing of space effectively enriched the makerspace's practice by allowing individuals to exchange expertise, knowledge and ideas. At the moment, Assemble has widened the scope of its activities by creating, building, and managing various creative co-working spaces within the Greater London area. The projects are run under the Assemble Workspace name, including Sugarhouse Studios, Fabric Floor[137] and Domeview Yard[138].

To examine how Sugarhouse Studios was produced as a pioneer home for the studios of cross-disciplinary integration, I will explore its circumstances in this chapter through five parts. First, I will examine the background of Sugarhouse Studios, particularly its history and its dialogue with its members, and look at Assemble's journey as a studio and founder.

[137] Assemble created the fashion and textiles workspace Fabric Floor as part of the Sugarhouse Studios network in collaboration with 3Space and Lambeth Council in Brixton. Fabric Floor is made to support a variety of practitioners from various backgrounds and developmental stages.

[138] Domeview Yard is run by Assemble as part of their workspace network, consisting of set of studios in North Greenwich with a large yard space in between.

Figure 74: Photos from the Sugarhouse's neighbourhood Bermondsey

Source: Author's own photo archive (2021)

After briefly introducing Sugarhouse Studios, I will explore the community by sharing the thoughts of its own residents. I will then discuss its spatial affordances and functions to illustrate how maker practices are working at Sugarhouse Studios. This will be followed by exploring the tools and ways of production by discussing my observations during my site visit. In conclusion, I will highlight what Sugarhouse Studios, as a part of other workplaces run by Assemble, mean to its makers, and what it contributes to being a makerspace.

3.6.1. Autonomous yet Interdependent

Sugarhouse Studios is run by the original founders of the Assemble. It is critical to see how Assemble team defines themselves as a workspace provider for designers, fabricators and artists. At the centre of Assemble's community-focused approach is the putting together of skills and resources within a shared affordable workspace, such as the Sugarhouse Studios. According to Hietbrink (2021), Assemble's administration of Sugarhouse Studios is based on a flat hierarchy. Each member of the team is considered equal since they all have different, but complementary skill sets. The management often forms duos that take varying leadership roles across different projects. The team has weekly meetings where they

present the progress of different projects and there are different office roles, including human resources, housekeeping, and finance (Hietbrink, 2021).

Sugarhouse Studios works for the public sector as well as projects that are self-initiated. Members choose the projects independently and remain autonomous (Hietbrink, 2021). The concept behind Sugarhouse Studios is to provide a makerspace, and makers use that space to create their own workshop space (Hietbrink, 2021). I met many makers based in Sugarhouse Studios, during my field visit. One of them is Emma Leslie, a designer and furniture maker based in Sugarhouse Studios with her company, Emma Leslie Furniture. Regarding the community value of Sugarhouse Studios, Emma shared that "we use each other's skills; if we need some metal work doing, there are metal workers here; if we need some graphic design, there are graphic designers here […] it's really useful because even if it's getting advice, there are so many people to sort of turn to if you need […] it's nice that we all collaborate many projects" (interview 7/10/21).

Another maker is Steve Cook, who is a London-based designer and maker of furniture and objects in wood. He is passionate about the meaning of craft skills and quality. I met him in Sugarhouse Studios, where his team founded Workshop East[139]. Steve shared that they set up Workshop East "for makers who are in the early stages of their careers such as people who have left the colleges […] it's a not-for-profit company with a view to making it as affordable as possible, so we just keep the costs completely as low as we possibly can […] we hope that it gives people who come in and use the facility to be able to have a little bit of breathing space to try and work on more creative work" (interview 7/10/21). The affordability aspect of makerspaces is highlighted in this quote.

[139] https://www.workshopeast.co.uk

3.6.2. A Network of Workspaces

The makerspace provides affordable studios for artists, designers and fabricators. Assemble shares the Bermondsey studio with thirteen other businesses, ranging from musicians to carpenters and architects. Sugarhouse Studios has the infrastructure and space to host over twenty studios. At present, the studios are occupied by artists, architects, designers, ceramicists, woodworkers, furniture makers, metal workers, sound designers, graphic designers, record labels, music studios, and a room used for band practice (Edgerley & Hall, 2018).

Ikesha Patrick is the workspace manager of Sugarhouse Studios and Domeview Yard, which is a set of studios in North Greenwich, set across two buildings with a large yard space in between; both of them are run by Assemble as part of their workspace network. I met Ikesha at Domeview Yard (see Figure 75), to see how their two studios support larger-scale fabrication, making and spaces for music and film production. One of the spaces is called Building A, which has a steel-frame structure with roof lights, insulated walls and ceilings, and large access doors, which reminded me of an industrial space. The other space called Building B has a masonry structure with small rooms inside with plasterboard linings to reduce sound transmission between units.

When I asked Ikesha what the ingredients were of a good makerspace she replied, “allowing people to feel like they are stakeholders in it and they're not just being told what to do […] what I've learned is that it's really about allowing people to be part of the conversation, being transparent […] I think what supports the makers here is transparency because they are business owners, many of them want to know the full story, that you can't just say a little thing, they want to know the full story” (interview 7/10/21). This highlights the meaning of participation in makerspaces.

Figure 75: Photos from Domeview Yard visit

Source: Author's photo archive (2021)

One of the makers I met through Sugarhouse Studios is Andrew Friend, who is an artist and a designer. He manages Andrew Friend Studio based in Sugarhouse Studios. Andrew shared his thoughts on the relationship between space and community, especially his experiences with the relationship between people, landscape, and their desires. Andrew told me that, "Assemble can take the credit for curating and organising Sugarhouse Studios, that the mix of people works really well and in so much as there's a good range of different skills around and good opportunities come out of being able to collaborate with each other as well […] even like having lunch outside you get chatting with one of the guys upstairs or one of the guys across the corridor or whatever, and then projects and collaborations come out of that […] And sounds really cliche and as if it's like what it is supposed to happen, but actually, it worked really well for us here" (interview 7/10/21). The quote shows the importance of day-to-day interactions in creating community in makerspaces.

Hayatsu Architects is another corporate member of Sugarhouse Studios. The structure of Hayatsu's office consists of architectural models placed on shelves, and they demonstrate founder of the office, architect Takeshi Hayatsu's interest in both modelling and fabrication (Kucharek, 2022). Another member of the makerspace is the graphic design studio Stinsensqueeze, founded by Stina Pariente Gromark and Louise Naunton Morgan (Stinsensqueeze, n.d.). The studio specialises in publications, exhibitions, visual identities, typefaces, art direction and digital platforms meant for individuals, commercial brands and cultural institutions. Assemble recently collaborated with Hayatsu Architects and the Stinsensqueeze studio to redesign The Blue outdoor market (see Figure 76) in Bermondsey. The collaboration led to the construction of a clock tower that featured an inventive roof made of tin cans and the creation of benches, bollards, and a drinking fountain fabricated from waste (Mairs, 2022). Sugarhouse Studios' workshop manager Ikesha also told me about this project in the neighbourhood. It is a good example of how these members collaborate with each other, with Assemble and with the local community.

Figure 76: Photos from the Blue Outdoor Market

Source: Author's photo archive (2021)

There are times when Sugarhouse Studios is open to the public through events, workshops and classes hosted by the tenants in the studios. The membership process of Sugarhouse Studios is carried out through an online form. For instance, there is an opportunity for a studio for £450.00 PM for a 22 square meter space, with an additional service charge of £23.36 PM (Assemble, n.d.). After you become a tenant, the workshops are free in the same manner as other makerspaces. Hietbrink (2021) claims that Sugarhouse Studios is not designed as a space where people go to work but rather as an environment that allows people to socialise and develop a strong sense of autonomy.

Being a member of Sugarhouse Studios allows the member to consider the community, which encourages the making process more collaborative than isolated workshop culture. For instance, Steve considers that "there's a great mix of people and unlike a lot of artist studios, which tend to be locked rooms and corridors, this is quite serious space, but it's a great way of meeting people, mixing ideas, generating work, collaborations, all sorts of things like that. […] and you get to see, I just spoken to Andrew, just some amazing things from making boats to set designs" (interview 7/10/21). Emma also compares other artists' studios to Sugarhouse "lots of artists who are in studios who never see their neighbours, which always I find surprising […] if you're in a building of loads of artist studios and it's just a corridor with everybody's individual studio […] this is what's so great about Sugarhouse, is that you actually do, we all know what each other are doing, and we do see that a lot and people's doors are open" (interview 7/10/21). We see here some good examples of how makerspaces provide opportunities for interaction between individuals, which can lead to a maker community.

Carl Corbin is a sound designer at InHouse Records, a social initiative with a proven track record of creating positive change for society. InHouse Records is a rehabilitative record label for change which operates in and outside of UK prisons across the South East of England since 2017. I met Carl at the sound studio on the second floor of the Sugarhouse Studios. Carl shared his experience of having a

“community bubble” at Sugarhouse Studios and gave the following example “today I had a chat with a guy that does metalworks, I have seen him around and all I said is hello […] that's the first time I've actually had a conversation with him, and then he showed me his workshop […] I spoke a bit about what we do here […] I feel it's good because, sometimes you have time to just stop and talk to people and you find out a little piece about, about their lives” (interview 7/10/21).

Emma is also happy about the community in terms of the diversity of makers, “we've always helped each other through all the jobs that people borrow, tools they get advice […] we all look to each other, and we're interested in what each other are doing as well” (interview 7/10/21). Emma also shared “community feels more important to me in some ways than the space […] I mean the space is important, but I feel like I could compromise on that in order to make sure that not necessarily, it doesn't have to be with exactly the same people, but to be part of a community of makers is, feels quite vital to me […] because I definitely wouldn't want to do it on my own in a workshop alone […] everybody here, all potentially, could all be competitors, but it's so supportive and it always has been” (interview 7/10/21). These quotes show a reoccurring theme in that the community itself is more significant than the facilities of the actual space.

3.6.3. Studios within a Retrofitted School

Assemble is interested in constructing sites that provide production space within the city in order to establish a network of artistic workspaces that may contribute to a thriving creative industrial economy (Assemble, n.d.). Sugarhouse Studios is one of these spaces, and we can witness this vision coming true. Therefore, the makerspace has been a proof that the type of light industrial workspaces could be a model for a makerspace. Assemble’s own working space is also based in Sugarhouse Studios (see Figure 77-78). Assemble is interested in affordability in terms of value rather than lowest cost, offering shared resources for diverse communities of tenants, encouraging collaboration and social space.

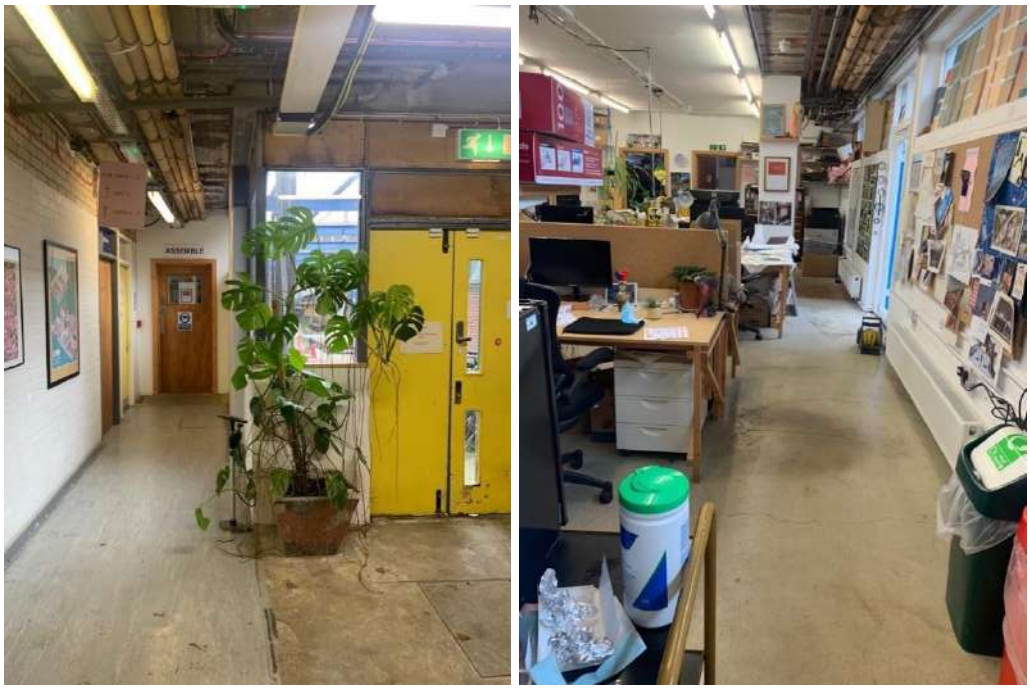
Sugarhouse Studios planning scheme has a range of units suitable for different uses, from woodworking to music and desk space. Moreover, there is a limited amount of space which is suitable for activities such as metalworking.

Figure 77: Photos from Sugarhouse Studios entrance

Source: Author's photo archive (2021)

About the spatial design of the makerspace (see Figure 79), Andrew told me "the architecture of the space is not the main thing here, of course, it helps like there is a courtyard which is really positive thing to have that shared common space that is kind of especially outside […] but the community I think, kind of makes Sugarhouse work" (interview 7/10/21).

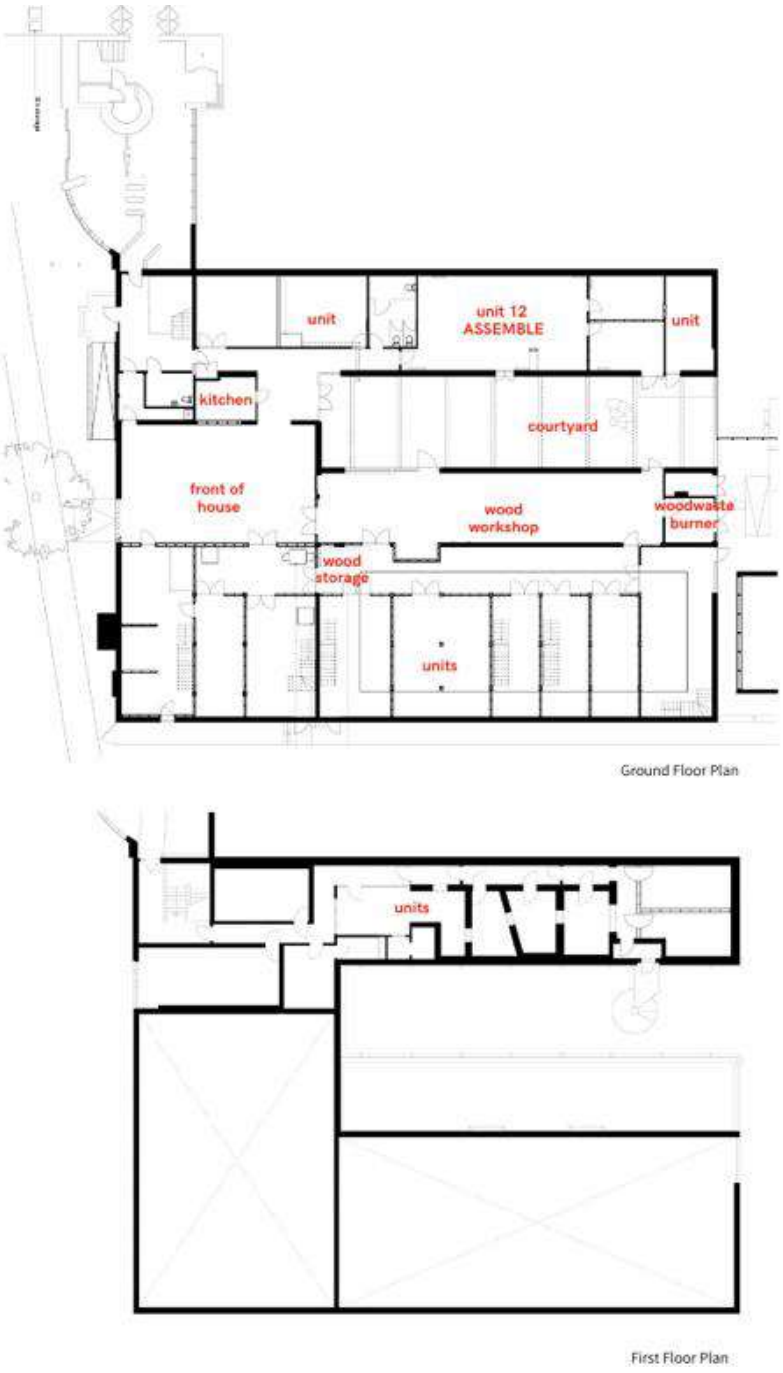
Figure 78: Photos from the Assemble's studio (unit 12) at Sugarhouse Studios



Source: Author's photo archive (2021)

Regarding the space, Steve shared they need space, especially for some technical staff "we always have an issue with the machine room, which is the essential part of what we do […] it takes up quite a reasonable amount of space and a little bit noisier and dirtier than a laser cutter in a nice clean room" (interview 7/10/21). These quotes show the importance of the spatial design of a makerspace and the fact that there will also be competing needs and interests for these spaces.

Figure 79: The floor plans of Sugarhouse Studios



Source: Drawing by the author, adapted from Assemble

The most welcoming part of Sugarhouse Studios is the courtyard (see Figure 80 below) right after the main hall for everyone and it can be used as a social coworking space for its members. The centralised fabrication wood workshop space offers a gathering place for its residents. The double-storey studios are located on one side of the ground plan having direct access to the wood workshop area. The second floor provides a more private area for the maker studios. As far as the spatial design is concerned, Emma told me similarly, one of the makers I talked about the flexibility of the space "if somebody's needed a spray room upstairs, they've been able to build that and make it […] the whole building is able to adapt it in a way that works […] if you need a quiet office upstairs, you can basically build one" (interview 7/10/21).

The studio employs a shrewd strategy designed to gather valuable networks, talented people, and ideas (Hietbrink, 2021). When we talked about the potential of the makerspaces, Emma told me, "it is a very social space; I mean, it's quiet at the moment, but there have been lots of social events, and it's felt like a real community. And it has done for, we've all been together now for six years, so we're very close, and we work closely together, and it also brings together people from different disciplines" (interview 7/10/21). These quotes highlight the value of adaptable and multipurpose design in fostering cooperation among makers.

Figure 80: Photos from the courtyard

Source: Author's photo archive (2021)

Another maker based in Sugarhouse Studios is Katie Spragg, who is an artist, a tutor at the Royal College of Art, and a founding member of Collective Matter. Under Collective Matter, Katie facilitates workshops for professional artists and younger people in the arts; and in their clay studio at Sugarhouse Studios. Katie told me she would like more people to come and use Sugarhouse Studios. She further shared that "as the infrastructure and the capacity of the space allow, we've always had an open-door policy at Sugarhouse Studios, for instance I used to run Clay Clubs, which was for all the members of Sugarhouse […] there's maybe like 60 different artists and designers and makers working within the building. and I knew that people were really keen to work with clay, so we'd just like have a beer in the evening, sit around the table, make some stuff out of clay, and then I'd be there to help people if they had, like any technical things […] it's kind of that attitude, if we've got the knowledge, we want to be able to share that with people […] that's the driving force for a makerspace" (interview 27/11/20).

Figure 81: Photos from the studios

Source: Author's photo archive (2021)

The studios consist of multiple layers, with the first layer including the entrance hall and the open courtyard where people first encounter the makerspace. This is followed by a workshop with a vibrant environment made up of members who have their own businesses. In our interview, Steve shared that "the social nature of a space is great, such as the openness of the through space where you bump into people or where you'll go out and have a coffee, but we're still here to work" (interview 7/10/21). Steve also compared Sugarhouse Studios to other makerspaces "some of the so-called makerspaces that are being developed are quite specific, and they're sort of high-end if you know what I mean? […] whereas most creative people are happy with, as long as you've got quite a dry space; we don't need a concierge, we don't need a café and all these things, what we need is just the space to get down and work […], and it's the mix of the people that makes a great makerspace, not nicely painted walls and that kind of thing" (interview 7/10/21).

Once again, we realise the focus on the people and community over the infrastructure and facilities of the makerspace.

Figure 82: Photos from the studio of Emma Leslie Furniture

Source: Author's photo archive (2021)

3.6.4. Through the Celebration of Tools

The makerspace has several self-contained studio spaces created from the former school's ground floor swimming pool and dance studios. Tenants can access a fully equipped woodworking workshop and mill that is developed and maintained by the Workshop East (Projects, n.d.). The space is commonly used for developing, constructing, and assembling various projects for the local community and further afield. The workshop consists of artefacts that create a sense of ownership for the people who understand the story of manufacturing and making. According to Ong, the production process within the Sugarhouse Studios takes into account the history, function and aestheticism in the design process, and storytelling is a key part of the creative process (2021).

Figure 83: Photos from the workshops

Source: Author's photo archive (2021)

3.6.5. A Playground for Possibilities

The makerspace is one of the strategies Assemble use to address the gap between the people and spaces and is central to making the neighbourhood more malleable. Rather than having an opaque and incontestable neighbourhood, Sugarhouse Studios makes its formerly invisible space a playground of possibilities. Andrew shared what will be the future of the makerspaces as "we have kind of everything in terms of the digital tools and traditional tools […] evolving on from that, makerspaces keep moving to kind of more awkward places as we get priced out and moved along […] that's a model in Greenwich, where the property developers, landowners are exploiting, they put a name as design district to pump up the property values and make some kind of atmosphere and culture in a place" (interview 7/10/21). Steve is also optimistic about the future of makerspaces and articulated, "the people way younger than me and more creative than me, will

develop London […], and I'm sure that makerspaces will be part of that, and London needs to support them more" (interview 7/10/21). The Sugarhouse Studios is a space suitable for designers, fabricators and artists. The shared space aims to enable and support collaboration across disciplines.

3.7. REFLECTION ON CASES

In this final section of Chapter 3, I will reflect on the cases based on the insights acquired from the analysis, which address the dissertation's research topics. This part ends with a discussion of the limits of the research and a consideration of the wider context of the study and the potential parameters of makerspaces. Therefore, selected cases shed light on my research questions, aiming to generate clarity about whether there are distinctive values in the community aspect, spatial approaches and production outcomes that can be attached to makerspaces. I will also compare cases looking for highlighted narratives or repeated patterns with the qualitative analyses mentioned earlier in the methodology part of pe which serves as a foundation for the organisational structure and management, community relations and membership scheme, urban setting, physical space, and production tools of makerspaces, while examining these subjects in greater depth.

This matrix also simply showed similarities and differences between selected cases. It made it possible to find key connections between the data from various disciplines, which led to a better socio-spatial understanding of how authenticity is built in the makerspace. Therefore, I also used my observations and semi-structured interviews to pull together and develop other assumptions from the cases.

Table 2: Matrix of cases: Organisational structure and management

	ORGANIZATIONAL STRUCTURE AND MANGEMENT						
	Date Established	**Company Type**	**Definition**	**Founder**	**Supporters or Partners**	**Working Hours**	**Staff**
MAKERVERSITY	2013	Private limited Company	A work space for start-up making and manufacturing businesses	Tom Tobia Joseph Smith	Somerset House Studios Ultimaker BRM Lasers Living Wage Foundation The Venture Studio	*with membership* 24 Hour access *Staffed Hours* Monday - Friday 9:00 - 18:00	Workshop Technician General Manager
BLACKHORSE WORKSHOP	2014	Private limited company *by guarantee without share capital* *community interest company*	Open access wood and metal workshop for professional and amateur makers	Assemble	Big Issue Invest Art Council of England Greater London Authority Borough of Waltham Forest William Morris Big Local	*Staffed Hours* Monday - Saturday 9.30 - 5.30pm	Co-ordinator Finance & Operations Director Programme and Events Manager Building & Maintenance Technician Junior Technician Creative Programme Manager Senior Workshop Technician Creative Director Membership Co-ordinator Tutors
SLMS	2014	Non-profit company *limited by guarantee registered in England and Wales, not a charity*	A social community workshop	Tom Lynch Matt Copperwaite	Mayor of London Trotec Hitachi aa.net.uk	*with Booking System* 24 Hour access	Directors No paid staff
THE WAREHOUSE	2019	Registered charity	UK's largest public maker space for stimulating an inclusive and circular local economy in Barking and Dagenham	Participatory City Foundation	Borough of Barking and Dagenham Esmée Fairbairn Foundation Big Lottery Fund City Bridge Trust Mayor of London City of London Barking Riverside London BD Collective Bitfolk Bloomberg Philanthropies	*with Booking System* 24 Hour access *Staffed Hours* Monday - Closed Tuesday - Thursday 10.00 - 6.00pm Friday - Closed Saturday - Event Specific Sunday - Closed	Premises & Tech Manager Head Of Learning and Design Project Designer Head Of Programmes Business Programmes Designer Office & Finance Manager
SUGARHOUSE STUDIOS	2018	Private limited company	A creative workspace run by Turner Prize-winning collective Assemble	Assemble	N/A	Monday - Saturday 08.00 - 18.00 Fridays - Saturdays for rare exhibitions and events 08.00 - 23.00	Director Workspace Manager

Source: Original table by the author

Table 3: Matrix of cases: Membership and community (continued in Appendix 5)

	MEMBERSHIP AND COMMUNITY					
	Membership Options and Fee (per month)	**Number of Members**	**Free Residency**	**Member / User Profiles**	**Community Support Activities**	**Public & Local Community Outreach**
MAKERVERSITY	1. Fixed Desk Membership : £415 2. Roaming Membership : £250 3. Remote Membership : £50 4. Vaults Membership : £3000	300	1. Under 25 Membership (Free for 3 months) 2. Makers With A Mission (Free for 6 months)	Makers Hobbyist Startups	Networking events 1:1 mentoring Accelerator programme Open studios Sector specific networking Career workshops	Free training and courses for local young people
BLACKHORSE WORKSHOP	1. Studios membership : £296 2. Daily workshop : £29 - £31 3. Monthly membership : £225 4. 6 Month membership : £855 5. 1 Year Membership : £1,590	44	1. Blackhorse Responders (15-25 year olds from Walthamstow, 5 months of free WEEKLY workshops)	Makers Hobbyist Startups Sole traders Microbusinesses SMEs Corporates Students Teachers	Supported Sessions Inductions Courses Makers market Competitions	Women only courses Partner with local primary school
SLMS	Membership: £23	217	N/A	Makers Hobbyist Startups Students	Inductions Open Evening Maker Buddy	Workshops Open Evening
THE WAREHOUSE	Level 3 Membership : Free Level 4 Membership : Free Organisational Membership : Free	N/A	Makers in Residence	Makers Hobbyist Startups Students Bakers Cooks Gardeners	Membership Induction Online certified trainings Product Design Development sessions Maker-in-Training programmes	Collaborative Business programme Maker-Meet-Ups
SUGARHOUSE STUDIOS	Available unit (22 sqm): £450 (All tenants are charged according to their unit size)	34	N/A	Makers Artists Designers Fabricators	Open Studios	Workshops Exhibitions

Source: Original table by the author

According to Bertin, a visual system that served as a research tool was necessary for expressing interviews (2011). So, to figure out what the data necessarily imply, I use interactive maps, Radar charts, and spatial analysis. Especially for the Radar chart related to the data coming from the semi-structured interviews, I re-read the transcriptions and highlighted each maker's position under the themes. So, it is possible to say that the themes indicating the relationships between the interviews and the themes were created from the verbal data. Table 4 explains how the literature, observations, and semi-structured interviews form the basis for my dissertation's themes. I selected four of these lenses' focus to concentrate on each theme (presented in red).

Table 4: Distribution of themes

DISTRIBUTION OF THEMES									
COMMUNITY RELATED									
ACCORDING TO **LITERATURE**	MAKERSPACE COMMUNITY	LOCAL COMMUNITY	COLLABORATION	SENSE OF COMMUNITY	GLOBAL NETWORKS	PARTICIPATION	COMMUNITY ENGAGEMENT	VIRTUAL COMMUNITIES	COMMON IDENTITY
ACCORDING TO **INTERVIEWS**	INTERACTION BTW. MEMBERS	NETWORKING	KNOWLEDGE EXCHANGE	CREATIVE PEOPLE	DIFFERENT TECHNICIANS	EVENTS FOR COMMUNITY ENGAGEMENT	NEIGHBORHOOD (LOCAL COMMUNITY)	OPENNESS	GENUINE COMMUNITY
ACCORDING TO **OBSERVATIONS**	SHARED SENSE OF CULTURE	MEMBERS BACKGROUND	ROLE OF COMMUNITY MANAGERS	COOPERATION	SOCIAL INTERACTION				
SPACE RELATED									
ACCORDING TO **LITERATURE**	THIRDSPACE	PROGRAMME (FUNCTIONS)	SOCIAL SPACE	LIVED SPACE					
ACCORDING TO **INTERVIEWS**	OPEN SPACES	PHYSICAL SPACE	MY OWN SPACE	A CORNER SHOP	SPACE TO WORK				
ACCORDING TO **OBSERVATIONS**	ARCHITECTURAL DESIGN	SPACE FACILITIES	URBAN SPHERE	PHYSICAL PROXIMITY	URBAN CONTEXT				
PRODUCTION RELATED									
ACCORDING TO **LITERATURE**	CREATIVE VALUE CHAIN	CO-MAKING ECONOMY	INDUSTRIAL REVOLUTION	NEW CRAFT ECONOMY	ENTREPRENEURSHIP	INNOVATION	SOCIAL INNOVATION	CIRCULAR ECONOMY	DEMOCRATISED FABRICATION
ACCORDING TO **INTERVIEWS**	NEW BUSINESS	PROTOTYPING	TRADITIONAL TOOLS	PROTOTYPE YOUR IDEA	EQUIPMENTS	CONFIDENCE	MAKING WITH YOUR HANDS		
ACCORDING TO **OBSERVATIONS**	USE OF TECHNOLOGY	INDUSTRIAL REVOLUTION	SUSTAINABILITY	TOOLS FOR MAKING					

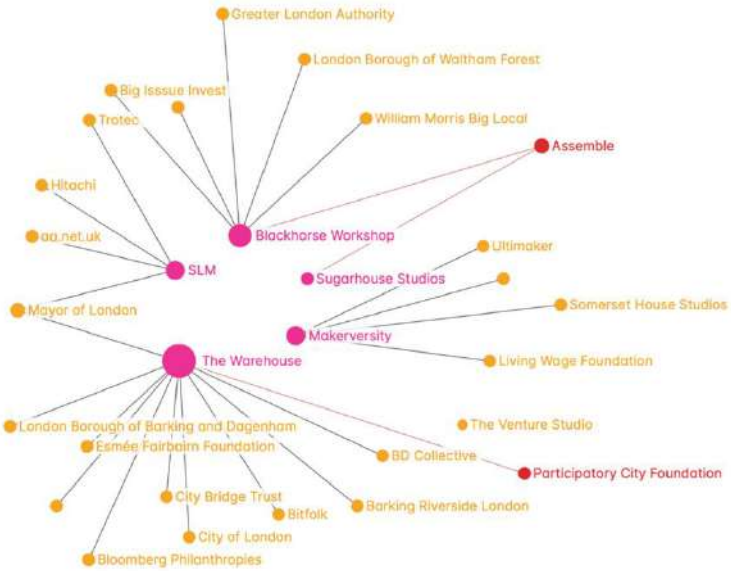
Source: Original table by the author

3.7.1. Intersectionality of Management

In the first chapter, I already indicated that makerspaces vary greatly in terms of their overall profile due to the fact that their models of management, economic structures, and membership categories which are all distinct. Since its founding, SLMS has served as an absolute social community workshop and non-profit organisation. Whereas Makerversity is a workspace for start-ups and manufacturing businesses, Sugarhouse Studios is formed through individual studios, Blackhorse Workshop is an open-access wood and metal workshop for professional and amateur makers, and these three makerspaces are designed to be private limited companies. The Warehouse is defined as a public makerspace for stimulating an inclusive and circular local economy and a part of the registered charity of the UK. Nonetheless, they are all funded or partnered by corporations and foundations.

To keep track of these encounters, I created a network map (see Figure 84), in which the nodes specify the supporters and partners, including the founders of makerspaces. As seen in this network map, even a makerspace is a private limited company; it is partly relying on capital funding from enterprises, local government or other funding bodies.

Figure 84: Network map of makerspace supporters



Source: Drawing by the author using Graph Commons (map is available as an interactive visualisation on Graph Commons, see at https://graphcommons.com/graphs/5417018d-542a-4ce2-8129-2d4607680ed0

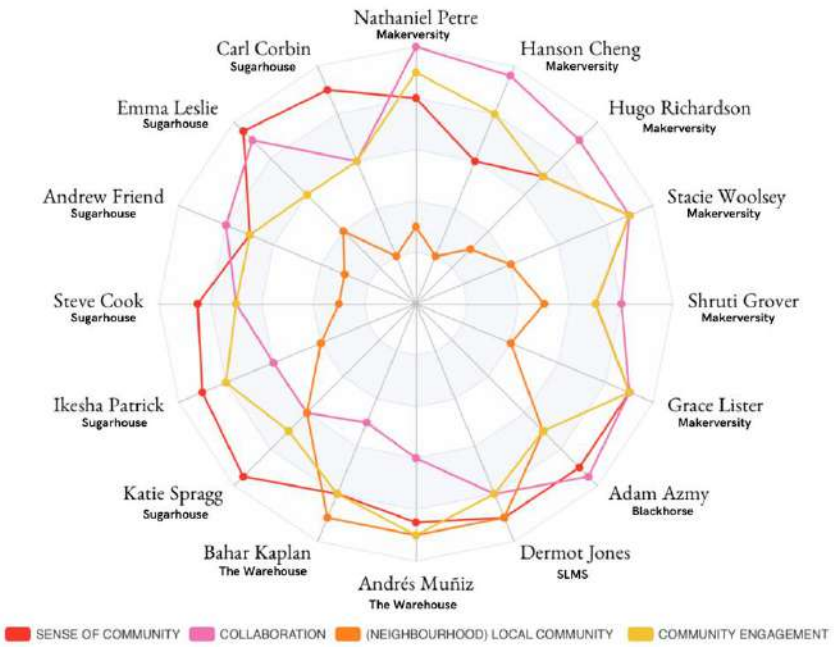
3.7.2. Community Possibilities

Although makerspaces have different member demographics, financial structures and equipment, they all have the common characteristic of their roles in how they would like to serve their maker communities or local communities. Here, it is critical to remind the differentiation between the maker community in the makerspace and the local community, as I also define it as a neighbourhood (see below Radar chart). Accordingly, in all the cases in this dissertation, we are witnessing alongside the makers, there are directors or community managers together with the technicians.

Under the main themes of the dissertation, I use four of the lenses on community and by using semi-structured interviews, I try to position the interviewees' thoughts on them. Therefore, Figure 85 reveals how makers were engaging with different approaches.

It is hard to interpret the distribution of lenses among interviewees with well-defined tendencies. However, there are some similarities and differences. For instance, makers from Sugarhouse Studios stand out, particularly with the theme of "sense of community", which also triggers "community engagement". In Makerversity, an inclination for "collaboration" among their members can be observed, which means these makers underline collaboration themes under the community theme.

Figure 85: Distribution of lenses on community according to interviewees



Source: Radar chart by the author

Alongside the inner community of makers, the position of the local community was also underlined in The Warehouse and SLMS more than in other makerspaces. This means the maker community and the projects of these makerspaces interact in their neighbourhood as "a local makerspace". Also, I argue that if these interactions are lower such as in Makerversity and Sugarhouse Studio, there are many barriers may exist between the community and the makerspaces. These can be coming from more physical reasons, such as the building security, or more economical ones, such as high membership fees.

3.7.3. In the Urban Context

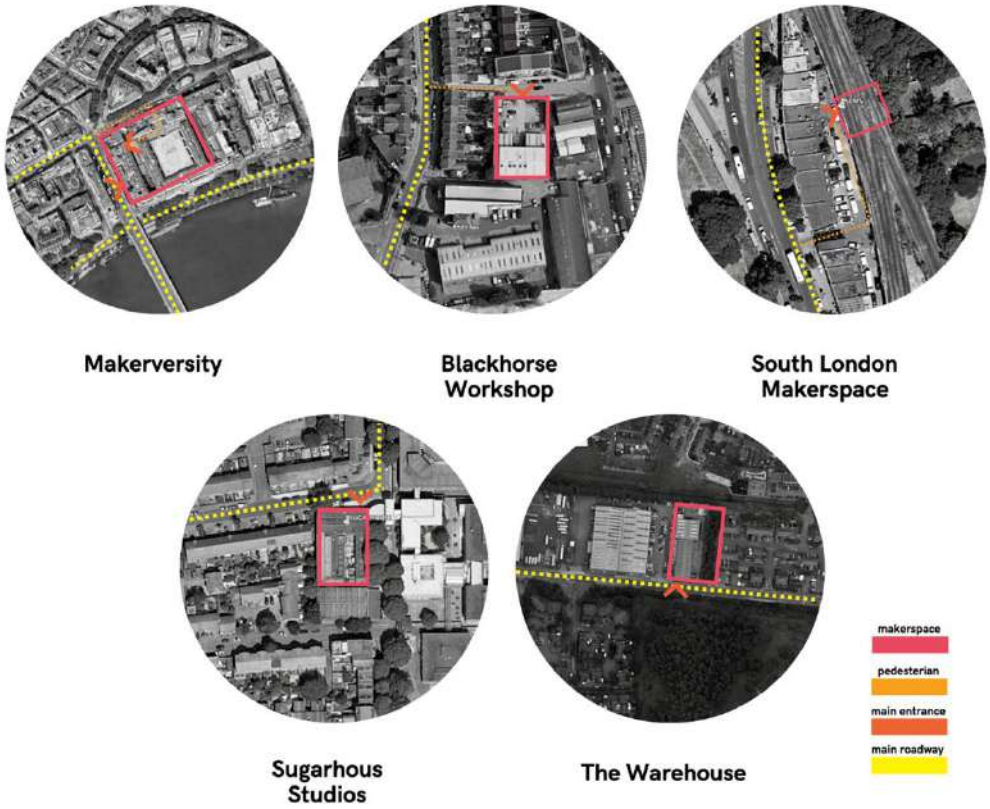
As I described in Chapter 2, the urban sphere is significant for accessibility and participation in the makerspaces. Figure 86 depicts the surroundings of the cases. Accordingly, the access from the main road works for the Makerversity,

Sugarhouse Studios and The Warehouse, whereas Blackhorse Workshop and SLMS have a connection to the main road by a pedestrian road. On the other hand, the urban fabric of these cases is differentiated from each other. Makerversity is located in the centre of the city, middle of the commercial activities, whereas The Warehouse is in the middle of the factories but near the housing area.

Apparently, these contexts impact a makerspace's physical space and the types of facilities it offers. Therefore, neighbourhood character is one of the parameters affecting the community and the access. Regardless the design of the built environment also supports and challenges a makerspace to attract more members or facilitate workshops for their local communities. As an example, being in the heart of London presents a rare opportunity for Makerversity, which has been well received by its enthusiastic members. On the other hand, public access is very limited for security reasons and spatial design. Whereas The Warehouse is located in an outer borough of London, and its members are still delighted with the choice of location as they are also based in this borough; and if you book through the system, anyone has right to enter no matter who.

This combination of location and access has enriched my understanding of how a makerspace can be envisioned and produced by illustrating its space (see Figure 88). This is not to say that there is necessarily an explicit causality between a city centre makerspace and an open-access space but rather that these ways of doing are, in its case, co-constituted. It did mean, however, that SLMS and Blackhorse Workshop were similar in terms of their public relation despite their physical scales.

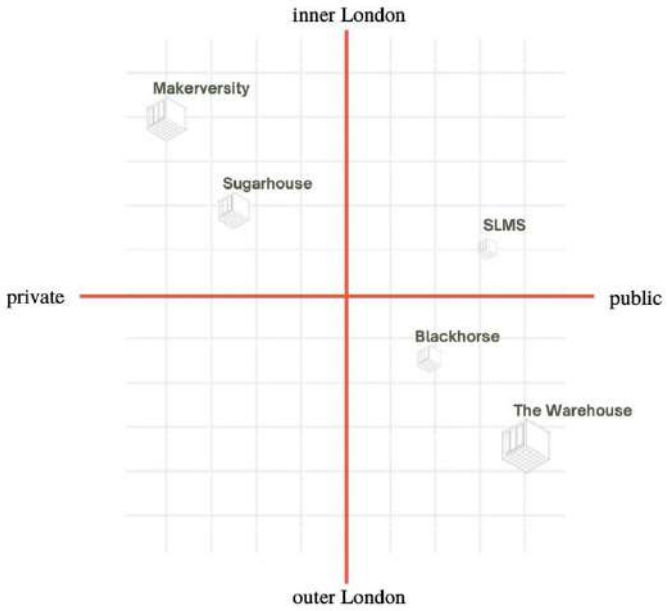
Figure 86: The urban context of makerspaces



Source: Original drawings by the author, based on Google Maps

Makerspaces choose to be open to the public or be affordable or more dedicated spaces for their members. On the other hand, they are aware of their urban contexts and position themselves accordingly. In the case of Makerversity, located in central London, we expect that it could be more welcoming to the public or the local community, whereas The Warehouse, located in outer London, will be a more private makerspace to its members. As can be seen in the diagram above (Figure 87), public access to a makerspace is opposed to its location in the city.

Figure 87: Comparing makerspaces through their location and public access

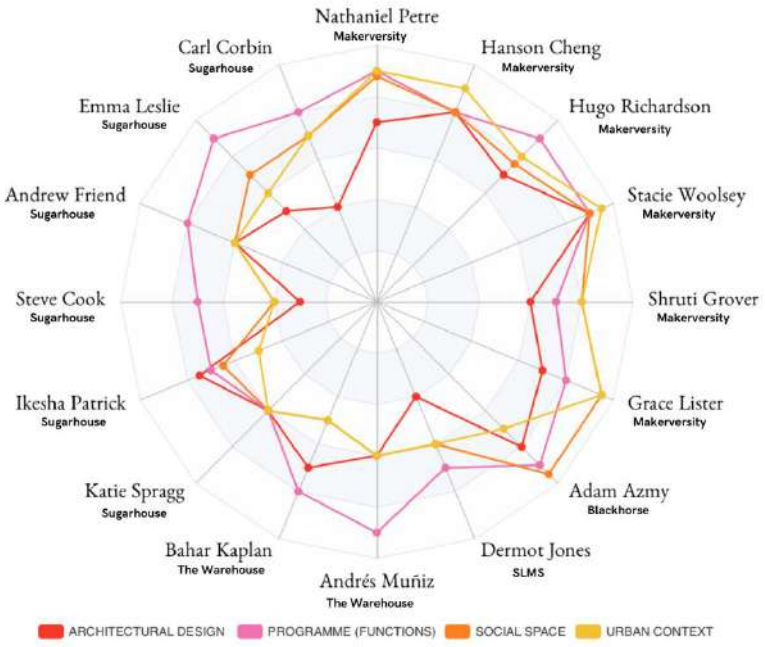


Source: Original drawing by the author

3.7.4. Consequences of Space, Facilities and Layout Relations

My goal in analysing the data was to gain insights into the social and physical contexts in which makerspaces operate. It is also essential to consider how makerspaces' physical spaces can affect their future success and the quality of their connections to their surrounding neighbourhoods. In Figure 88, I observed that the design of the makerspaces formed through the functional programme stands out as a common and dominant concern for makers. However, only makers based in the Makerversity emphasised the urban context as a critical factor for a makerspace located in the city centre of London. Both the Blackhorse Workshop and the Makerversity makers underlined the "social space" notion of their spaces more than the other makerspaces, even though their makerspaces do not resemble each other. Within this comparison and alignment, it can be said that the distribution of lenses under the space is not highly correlated with the community.

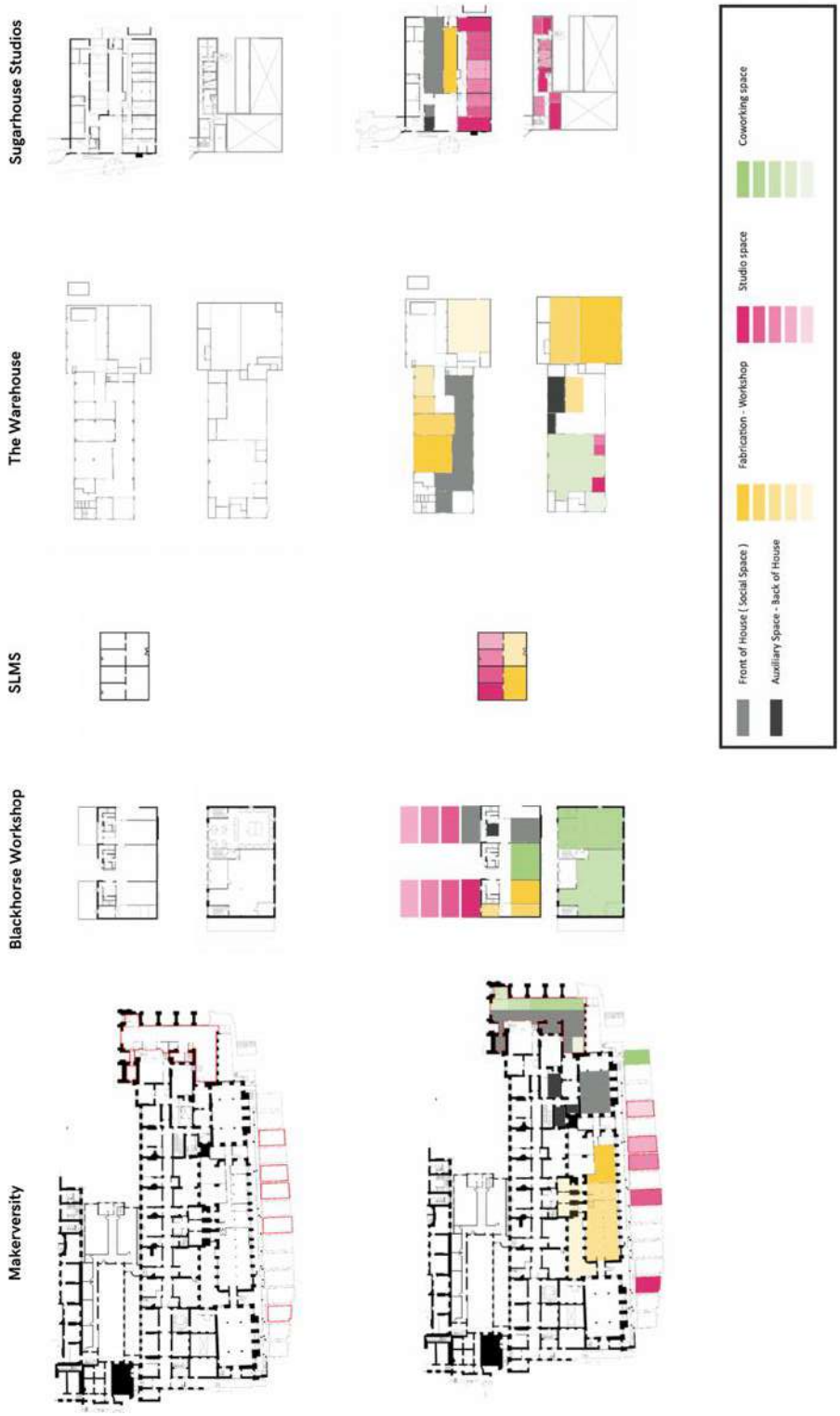
Figure 88: Distribution of lenses on space according to interviewees



Source: Radar chart by the author

Moreover, I used the floor plans of makerspaces to understand if the spatial data, such as the relations of functions, would contribute to the discussion of this research. Therefore, I simplified the plan layout of each relevant makerspace with sub-programme-related colours (see Figure 89). The yellow colour represents the fabrication and workshop space locations, whereas the green colour indicates the co-working areas, and the red colour highlights the studios. Moreover, I assigned dark grey and light grey colours for the main entrances (front-of-house elements) and auxiliary spaces (back-of-house units), respectively. In essence, makerspaces are organised so as to promote the potential makers with the ultimate outcome that they can reach the maximum efficiency level. Even though makerspaces have certain architectural, programmatic, and spatial layout requirements, each and every one of them was observed to bend the physical realm they existed in based on their own organisational philosophy and their members' needs.

Figure 89: Floor plans of the makerspaces and spatial layout diagrams



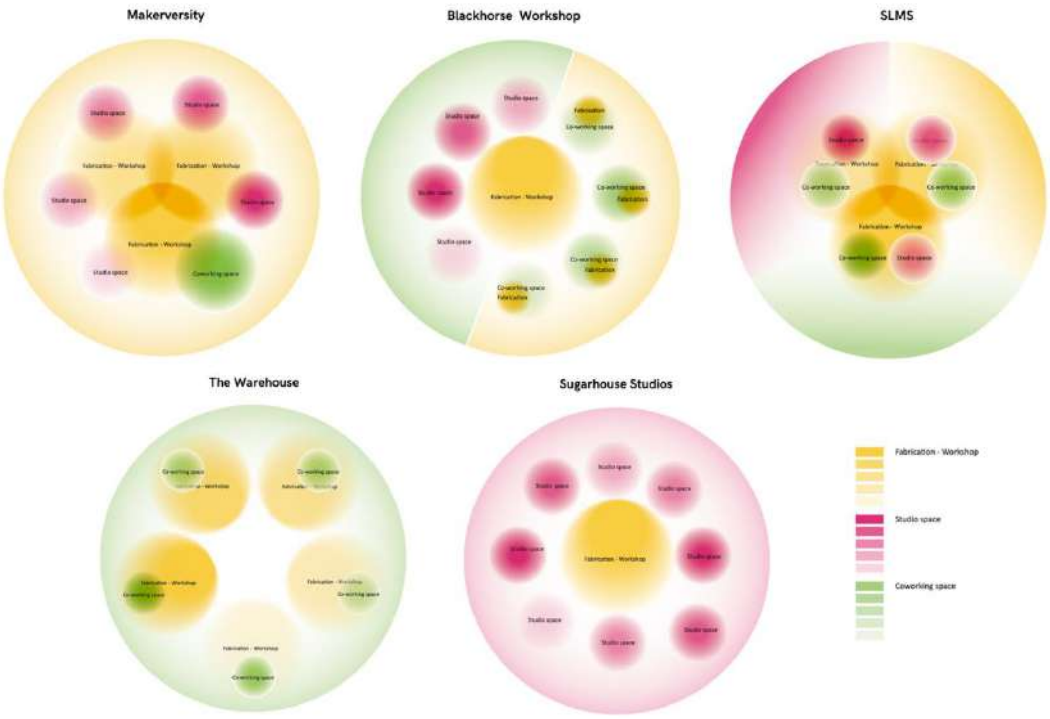
Source: Drawings by the author adapted from original floor plans

For this discussion, I also framed the strengths and weaknesses of each space, demonstrating that makerspaces are complex and evolving. This combination of narratives has enriched my understanding of how a makerspace can be envisioned through its opportunities and challenges. It is crucial to highlight that this discussion does not argue that there is an explicit design principle for the makerspaces but rather an insight into their development journeys.

Figure 90 shows my analysis of my cases' function and space relations. The Makerversity as a merged institution fused into Somerset House, which thrived in the mainly production-oriented studio spaces. Every separate studio or co-working area that Makerversity provides is formed around fabrication and workshop spaces. It could be argued that Makerversity is fabrication-centred and surrounded by its members' practices. Similarly, the Blackhorse Workshop draws a similar layout plan as the Makerversity. Still, it strengthens its co-working spaces, with additional internal units becoming their own centre of fabrication. The Blackhorse Workshop functions in both separate studios from converted containers as well as spacious co-working spaces.

The Warehouse is based on co-working spaces and workshops with specific fabrication units deployed in each of them. At first, it might seem that The Warehouse is formed completely by separate fabrication spaces, but the makerspace also supports 'co-making' with specifically designated spaces for its community. As a truly structured but unsurprising space because the functions are arranged side by side, and when the users continue along the circulation axis, they can see or enter any room one by one. As this seems to comprehend the space easily, on the other hand, this forms a makerspace that is not very different from any school or office space layout, where the chance of encountering people is reduced. On the other hand, Sugarhouse Studios has customised 'studio' spaces with its wood-fabrication unit located in the centre. Even with the central workshop at its core to maximise community engagement, customised studios are its strongest assets. Because this spatial design is valuable due to the interactions and connections between the studio owners, regardless of how independent the studios are in and of themselves.

Figure 90: Functional analysis of makerspaces



Source: Original drawing by the author

Overall, SLMS has all the aspects; some are similar, while some are differently executed than the Sugarhouse Studios. Each separate dedicated area - as in SLMS's definition, 'clear, messy and dusty'- still has the tools necessary for fabrication. Naturally, it efficiently offers collaboration and participation within its physical spaces. As seen in figure 90, these five cases have different spatial qualities and quantities, each in their own way. Additionally, they are changing by adjusting to their vision, the environment they fit in, and the demands of the making process.

3.7.5. More than Production

Throughout my research, I have seen many makerspaces that match the image of a makerspace held in the popular imagination: rooms filled with exciting tools, materials and makers indeed. On the other hand, what I have come to understand is

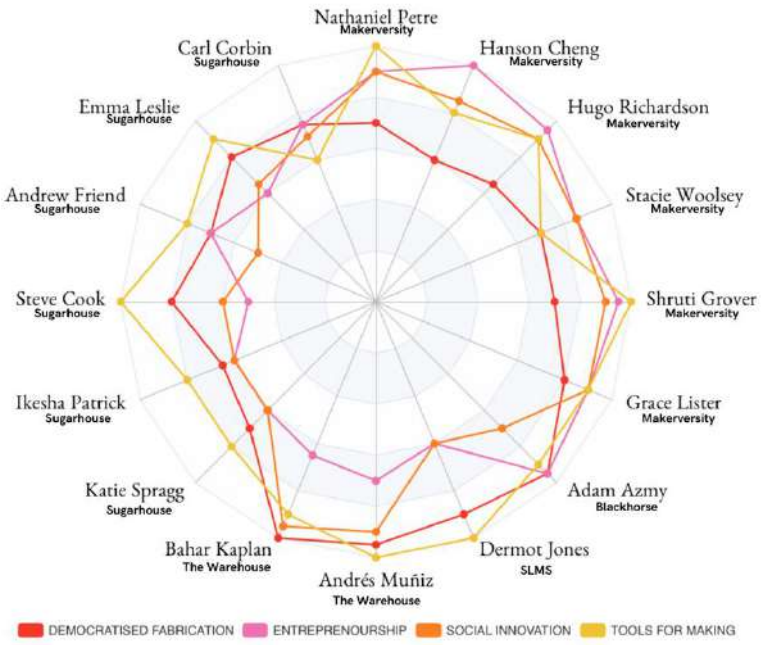
that while tools for the spaces are essential, for makers there is much more beyond their relationship with making. The intention of makerspaces is to become spaces of production for the widespread cultural and economic endeavours of cities. Therefore, makers are also involved in the production, not only as one stage of the economic process, but also in learning how to develop processes and create, to a certain extent, the conditions under which they are being developed. This could, for example, be related to the democratisation of the fabrication process because of makers developing customised products (Unterfrauner & Voigt, 2017). As I mentioned earlier (see Chapter 2, p.114), the democratisation of entrepreneurship and the rise of alternative routes to the market (i.e., Etsy, Kickstarter) require novel approaches to product development, testing, and prototyping (Aldrich, 2014).

Moreover, makerspaces can encourage its member to be entrepreneurs by exploring and carrying out product development. In addition, the process of prototyping is crucial in bringing a product to market. As the products' initial users, makers are in a privileged position to provide input during development stage and address any issues that may arise. Members of a makerspace can get immediate input from other members when they produce a prototype, which can then be used to improve the final product. Although makerspaces provide a positive environment for product development, scaling production can be difficult, as manufacturing can require fabrication from a few dozen to millions of units (Kalpakjian, 2020).

On the other hand, contributing to entrepreneurship may not be the major role expected from makerspaces. They can also make a difference in community development and have a social impact, such as building environmental sustainability or endorsing CE. As I mentioned earlier (see Chapter 2, p.121), industry 4.0 also relates to CE and crowdfunding, which are concepts also related to makerspaces. We can especially see crowdfunding platforms supporting the product development process and fostering communities around the product. Accordingly, this research has ranked outcomes by interviewees according to themes through a Rada chart (see Figure 91). This analysis revealed that makers mostly prioritise tools for making in their spaces. SLMS and The Warehouse

makers stated that the democratised fabrication developed more than the makers in other cases. In another parameter, the tendency for social innovation can be observed by makers based in The Warehouse and the Makerversity. Akrich (1992) argues that if there is a confrontation between the makerspace's purpose and the maker's perception, then there will be innovation. Accordingly, the objective of the makerspaces also triggered entrepreneurship in both the Blackhorse Workshop and the Makerversity, based on the maker interviews. Therefore, depending on the nature of the makerspaces, makers find themselves immersed in social innovation, entrepreneurship, or simply accessing fabrication tools.

Figure 91: Distribution of lenses on production according to interviewees



Source: Radar chart by the author

As I also described in Chapter 2, some makerspaces urge makers to collaborate in solving problems and stimulating the local economy. Thus, makerspaces can be viewed as locations that challenge established production and consumption patterns with, for example, the help of digital manufacturing. Makerspaces can have a significant impact on the future of innovation because they

encourage collaboration in product design by groups of people who may never be involved otherwise. Makerspaces are the most recent example of the democratisation and widening of access to innovation that has been seen by scholars over the past decade (Chesbrough, 2003; von Hippel, 2005). Therefore, I argue that makerspaces are not just manufacturing environments but also spaces for creating resources for innovation and collaboration in a bigger cultural and political framework.

3.7.6. Defining Identities Beyond Making

> "There exists a mutually influential and formative relation between the social and the spatial dimensions of human life, each shaping the other in similar ways."
> Edward W. Soja, 2010

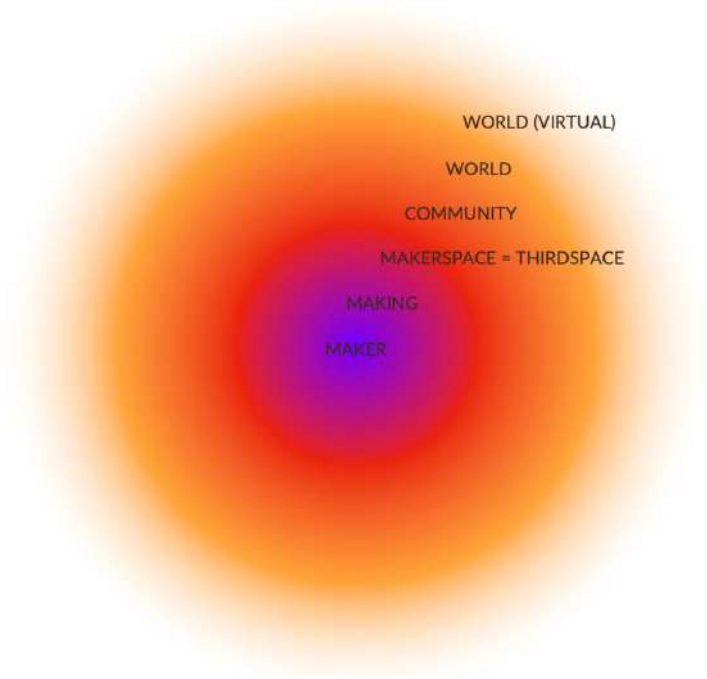
In the course of this dissertation, I made several trips to several makerspaces, had numerous casual conversations with makers, and conducted semi-structured interviews with both makers and directors of makerspaces. By showing how a makerspace can be placed in context by its community and space, the data gathering and analysis have deepened my understanding of how a makerspace may be understood. There were three primary findings I was able to draw as a consequence of this process.

My first finding is that the widespread perception of makerspaces as "alternative sites" of "experimental collaboration", in contrast to the more prevalent "collective studios" has resulted in the formation of a distinct network of social relations that support the growth and development of the "typical maker persona." The act of making is central to makerspaces, which are isolated but interconnected physical locations.

My second finding is based on Lefèbvre's "lived space" and Soja's "thirdspace" theories. Lefèbvre's lived space helps to interpret makerspaces in

relation to the activities happening in their space, which is critical to their sense of community. Likewise, Soja defines thirdspaces as both real and imagined space, the way that people actually live in and experience urban space. Therefore, conceptualising makerspaces as thirdspaces provided a standpoint for their spatial context and the making activities forming the spaces with their communities (see Figure 94). Today, new models are emerging for production, whereby conceptualising makerspaces as thirdspaces will contribute to more flexibly, effective, and meaningful ways to address a rapidly changing and economically challenging world. Moreover, in the context of a makerspace, when the community contributes to the makerspace's design, this process can significantly improve the making experience.

Figure 92: Layers from maker to the world



Source: Drawing by the author

My third finding is related to finding one in regard to the description of the identities of makerspaces. Now that I have examined how the cases of this dissertation work and how they interact with the research themes, I would like to

propose alternatives for the “makerspace identity” that enhance the discussion. These alternatives allow me to articulate makerspaces in another way by proposing an examination of their community, particular spatial productions by the programme, and projects, products or ideas taking place on site. These identities, while they most readily apply to my cases, can also be used to explore other makerspaces structured by their own realities. The term ‘identity’ can be defined through perception and expression based on experiences and viewpoints. As Schlesinger says,

> all identities are constituted within a system of social relations and require the reciprocal recognition of others. Identity...is not to be considered a ‘thing’ but rather a ‘system of relations and representations’ (1987, p.236).

As a result, I will present a sequence of highlights from my research in an effort to imagine the identities hidden behind the makerspaces. The following makerspace identities are:

- a community with an entrepreneurial mindset in the city
- a collaborative environment empowering innovators
- a community-led workshop with an online visibility
- an open-access factory for everyone to co-create
- a hub for cross-disciplinary studios with a social network

My goal in presenting these identities is to draw attention to the makerspaces' complex characteristics and the ecosystems that surround them. These identities include names and processes that can be altered or challenged, and can be utilised hypothetically (for instance, to determine how a makerspace community is engaged) and empirically, to be implemented in future scenarios (for instance, when exploring why a makerspace may have all the requirements for tools, but without the final outcome of making).

CONCLUSION

"As we make, place or alter things,
so they, in some measure,
make, place or alter us."
Dant, 1998, p.78

This dissertation has focused on the analysis of makerspaces as an emergent social phenomenon in constant evolution. There is increasing popular attention and academic studies about makerspaces, which define them from different points of view. London is a significant location for makerspaces research due to its unique position as a global city and a hub of improvement and creativity. As a city with a global economy, it attracts a diverse range of people and cultures, positioning London as a location to study the social and economic influence of making and makerspaces. Additionally, London has a lively and growing makerspace community, which provides ample opportunities for research and observation. By studying makerspaces in London, this research can produce knowledge that is relevant to other cities around the world and can be generalisable to other contexts.

I have argued for a more nuanced understanding of makerspaces as a continuum from an individualistic nature to a collaborative ethos, with numerous expressions of the aforementioned trilogy (community, space, production) at its core. Consistent with these presumptions, the dissertation's central research question was as follows: how can we explore the impacts of community, space, and production on the characteristics of makerspaces? I employed five case studies and their respective narratives to reach an answer and define what a makerspace is, which I will discuss below. I also provided an interdisciplinary perspective on the topic from various angles, from social theories and organisational approaches to urban studies and architectural discourse.

My research objective was to connect theoretical and empirical research so that makerspaces can be perceived as spaces operating for the makers in the city realm. Nevertheless, there is a malleability to these connections and relations, as witnessed when makers widen their view for making, which fosters new kinds of production-space-community arrangements that challenge the future of makerspaces. I believe my epistemological and methodological framings, while engaging in case study methodology, were sufficiently responsive to each makerspaces' particular characteristics and necessities.

The core of this thesis consisted of five case studies. I demonstrated how the observations and semi-structured interviews were used to gather information. I looked into how makerspaces defined their maker communities and established connections to the surrounding neighbourhood, as well as how the spatial configuration of a makerspace empowers makers to produce. In the case of the Makerversity, I tried to understand how the community of entrepreneurs 'make' under a cultural institution in the heart of London. To my surprise, I discovered that the key factors that fostered this community were not the physical space or tools available, but rather the support provided by both peers and the administration of the Makerversity at Somerset House Studios. At the Blackhorse Workshop, I encountered a makerspace in continual flux, which had learned to shape-shift to survive. The maker community was open to the neighbourhood, and the context of the makerspace encourages making in the community. At SLMS, I witnessed a hub for like-minded makers from diverse backgrounds coming together, asking questions and learning from each other. I was impressed by the architectural space - a railway arch occupied by tools, and having an effective online platform for its makers. This makerspace was organising maker faires for the local community to connect people from all age groups around the neighbourhood. In the Warehouse, a deliberately non-hybridised space was produced as a public space, depending on the facilitators and users who imagined it. The Warehouse really enriched my definition of what a makerspace could be despite its limitations, such as being characterised by free and open access for the people in a specific neighbourhood

and the formal spatial design. On the other hand, the makers at Sugarhouse Studios mainly work in their own studios, while being aware of the work being created in the other studios. The outcomes in these studios were very diverse, as well as the makers, from furniture to sound designs.

When I first started working on this dissertation, my primary aim was to develop a definition of a makerspace. However, as I progressed through the literature review and empirical case studies, I came to realise that, in its own way, each makerspace was already drawn up by the community and the setting in which it existed. I examined the makerspaces, and this led to three main reflections. First, makerspaces positioned 'making' at their heart as a physical space that developed specific social relationships within their community. Second, makerspaces can become, and later challenge, 'thirdspaces' by fostering more innovative, meaningful and collaborative productions of space. Third, I have argued that makerspaces are defined through 'identities,' which are constituted within a system of social relations. Therefore, a makerspace can be "a community with an entrepreneurial mindset in the city", "a collaborative environment empowering innovators", "a community-led workshop with online visibility", "an open-access factory for everyone to co-create" or "a hub for cross-disciplinary studios with a social network". I believe these reflections revealed an interdisciplinary standpoint on makerspaces, as I included theories and my observations through architecture discourse and social sciences. This means that the interactions they facilitate between different kinds of actors (from makers to administrative staff) take the form of reiterative or recursive practices, the interactions of which lead to new identities.

The contribution of this research can be seen in several ways. It offers a deeper understanding of makerspaces, their formation, and the social and spatial practices associated with them. This can benefit designers, space planners, and space professionals, who can use this knowledge to create better and more inclusive spaces. This research sheds light on the community-building potential of makerspaces. It provides insights into how makerspaces can act as social and cultural hubs, fostering creativity, innovation, and community engagement. The

findings of this research can be particularly useful for community groups, policymakers, and practitioners looking to create and support community-based spaces. Additionally, this research offers a critical perspective on the role of makerspaces in urban development. By highlighting the challenges and tensions that can arise in the process of creating and sustaining makerspaces, this research contributes to the wider debates around urban planning, social justice, and spatial equity. Overall, this dissertation offers an interdisciplinary perspective on makerspaces and their potential as a tool for community building and spatial transformation.

I will now elaborate on this reflection and conclude the dissertation by articulating my core assumptions regarding the wider impact of makerspaces. By doing this, I intend to build a base for discussions in various frameworks. When I look at what I have argued in general, a makerspace definition is highly unique to its own context. Makerspaces represent a process which has been influenced by many movements, from the Arts and Crafts to DIY, grassroots hacker traditions to technological developments, and yet all the while operating independently of them. The ways in which I observed makerspaces, articulated by the multiple narratives involved in them, and the effects of these articulations on their subjectivities, illustrated how the sense of community at makerspaces is a social construction woven out of many layers of spatial design and production factors.

Accordingly, physical space has been a parameter, opening new doors for upcoming makerspaces. I have discussed four of these spaces located in existing buildings in the case studies; a cultural-historical building (Makerversity) to a warehouse (The Warehouse), from an abandoned school and its facilities (Sugarhouse Studios) to railway arches (SLMS). This means, as we have seen in makerspaces or other typologies[140], such as museums or commercial buildings, in

[140] There are many examples to consider in using old buildings for making, arts and design or other commercial functions. The Rog Center in Ljubljana, Slovenia, transformed from the industrial heritage of The Rog factory and serves as a public space for fabrication, applied arts and design. Tate Modern and the Battersea Power Station in London, UK, were transformed from power plants into museums and commercial and mixed-use development. the Kohlenwäsche in Essen, Germany, was repurposed into a cultural destination with an exhibition space, and creative studios. the Gazhane, in Istanbul, Turkey, was repurposed from an old gas house

the future, there is potential for more makerspaces to be transformed as in the other repurposed buildings.

There will always be direct connections between the maker community and the physical space, such as the idea that a shared sense of belonging can spark new ideas or make prototyping easier. I also found that indirect connections, such as collaborations or democratised fabrication, can stimulate novel innovation in the making process, or connect makers to one another. Therefore, it needs to be emphasised that the important role of makerspaces in the world of capitalism with their focus on production. The materials, the value chain, even the skills and techniques by makers, and indeed the technology itself can transform the perception of capitalism as makers learn from each other and teach the wider community.

Makerspaces have the potential to promote entrepreneurship and innovation, which can, in turn, have a positive impact on economic growth and job creation. Additionally, many makerspaces operate under a collaborative, open-access model, which can foster a sense of community and shared ownership among members. This can lead to a more equitable distribution of resources and opportunities, which may align with the principles of sustainable capitalism (Ikerd, 2005). However, it is important to note that makerspaces alone will not solve all capitalism-related issues. They may provide opportunities for individuals and small businesses to innovate and grow, but they do not address larger systemic issues, such as income inequality and the concentration of wealth and power in the hands of a few. Additionally, makerspaces rely on a capitalist system to function and can be subject to the same challenges and pressures as any other business. In summary, while makerspaces can play a positive role in fostering innovation and community, it is important to consider their limitations in terms of addressing larger issues related to the impacts of capitalism.

into a museum, offering artistic and cultural education spaces, exhibition halls, theatre and concert halls, a library and a bookshop.

This dissertation has provided several theoretical contributions to various fields. While there have been numerous studies on the specific field of makerspaces, which I have outlined in Chapter 1, these studies are not linked to each other and do not present a bigger picture regarding the entire system of 'making' environments. Therefore, I have contributed to the literature in the form of an interdisciplinary and systemic investigation dealing with reality through alternative modes of expression and new ways of looking at makerspace phenomena. With this dissertation, I am not suggesting a novel theory for the future of the makerspace, but instead providing a framework for tendencies and possibilities based on community, spatial design and production.

As a matter of course, there are limitations, gaps, and shortcomings. Establishing a collection of cases and these data deals with extraneous fields and topics concerning the matter at hand. Therefore, while focusing on these particular cases and semi-structured interviews, there might be focus groups to explore the makers' experiences regarding a different context. There might also be an argument that the selected cases are among London makerspaces, whereas the literature and the other research to touch upon have given a general view of the research. Nevertheless, the absence of other cultural contexts should be admitted as another study limitation. The dissertation is also based on a broad community, space and production trilogy. Furthermore, this frame mainly searches to assemble a definition for makerspaces; it could guide the future of makerspaces regarding spatial design. Despite all, space issues are critical; as I will mention, future studies will sustain the makerspaces functional programme and spatial design to make new arrangements for old buildings.

Considering the limitations of my current work, I would like to end this thesis by highlighting the potential for future research. This dissertation's trilogy can guide research into various topics, depending on the current developments in the field. Making is a growing field, and looking for new tools and methodologies, including Virtual Reality, robotics, big data, digital scholarship centres, and biology. We will

see progress in these topics in makerspaces as well as digital fabrication, programming, craft, and electronics.

I would like to comprehend makerspaces from a global perspective and relate them to themes with the help of the city of London. In doing so, I hope to lay the groundwork for further research at other makerspaces in other cities, countries, as well as the digital world. This could help present new parameters since my focus was to highlight communities and physical space and emphasise their relations with production in their unique context. I would also do more related research to explore the economic values of makerspaces production. Moreover, further studies are needed on makerspaces' social, economic and environmental impact and their potential to promote sustainable practices and the circular economy.

This dissertation has contributed to rethinking makerspaces and provides a critical review of the status, literature, and up-to-date insights from the makers and makerspace directors. The movements in the fields of art, design, and culture are contributing new approaches to making by widening makerspaces' visions, as well as guiding makers' journeys that are not directional but rather dimensional.

This study has hoped to contribute to understanding the times we live in and the novel intersections between culture, space and technology, which makerspaces find themselves intricately woven in between.

In conclusion, we have always been makers.

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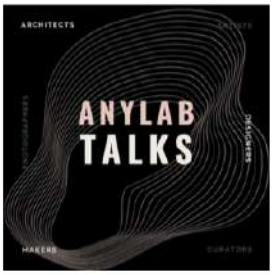
APPENDICES

APPENDIX 1: LIST OF INTERVIEWEES

NAME	MAKERPSPACE	COMPANY	ROLE	PODCAST	INTERVIEW DATE	INTERVIEW TYPE
Nathaniel Petre	MAKERVERSITY	SURFFF	Design Engineer Additive Manufacturing Innovator	SEASON 3 EPISODE 1	Friday, 30 October 2020	ONLINE
Hanson Cheng	MAKERVERSITY	The Tyre Collective	Interdisciplinary Designer Entrepreneur	SEASON 3 EPISODE 2	Wednesday, 11 November 2020	ONLINE
Hugo Richardson	MAKERVERSITY	The Tyre Collective	Thinker Maker	SEASON 3 EPISODE 2	Wednesday, 11 November 2020	ONLINE
Stacie Woolsey	MAKERVERSITY	Make Your Own Masters	Anthropological Future Designer Freelance Design Researcher	SEASON 3 EPISODE 3	Friday, 20 November 2020	ONLINE
Shruti Grover	MAKERVERSITY	Hetco Design	Human Centred Designer Researcher	SEASON 3 EPISODE 4	Tuesday, 24 November 2020	ONLINE
Grace Lister	MAKERVERSITY	Makerversity	Community Associate Researcher, Designer, Writer	N/A	Monday, 11 October 2021	PHYSICAL
Adam Azmy	BLACKHORSE WORKSHOP	Azmy Anything	Furniture Designer Film-Maker	SEASON 3 EPISODE 5	Saturday, 12 December 2020	PHYSICAL
Dermot Jones	SOUTH LONDON MAKERSPACE	SLMS	Director	N/A	Wednesday, 9 December 2020	PHYSICAL
Andres Muniz	THE WAREHOUSE	Participatory City Foundation	The Warehouse Manager Higher Research scientist CAD designer	SEASON 3 EPISODE 6	Thursday, 3 December 2020	ONLINE
Bahar Kaplan	THE WAREHOUSE	Participatory City Foundation	Interior Architect Ripple Road Shop Project Designer	N/A	Tuesday, 12 October 2021	PHYSICAL
Katie Spragg	SUGARHOUSE STUDIOS	Collective Matter	Artist Ceramicist	SEASON 3 EPISODE 7	Friday, 27 November 2020	PHYSICAL
Ikesha Patrick	SUGARHOUSE STUDIOS	ASSEMBLE	Workspace Manager	N/A	Thursday, 7 October 2021	PHYSICAL
Steve Cook	SUGARHOUSE STUDIOS	Workshop East	Co-Founder Maker	SEASON 3 EPISODE 8	Thursday, 7 October 2021	PHYSICAL
Andrew Friend	SUGARHOUSE STUDIOS	Andrew Friend Design	Artist Designer	SEASON 3 EPISODE 9	Thursday, 7 October 2021	PHYSICAL
Emma Leslie	SUGARHOUSE STUDIOS	Emma Leslie Furniture	Designer Furniture Maker	SEASON 3 EPISODE 10	Thursday, 7 October 2021	PHYSICAL
Carl Corbin	SUGARHOUSE STUDIOS	InHouse Records	Sound Designer	N/A	Thursday, 7 October 2021	PHYSICAL

APPENDIX 2: STRUCTURE OF THE SET OF QUESTIONS EXAMPLE



Anylabtalks Podcast / Research Study on Makerspaces

Details
Dec 12, 2020 01:30 PM London

Main Subjects

Personal Journey
- Childhood
- Education
- Film Career

Azmy Anything
- Blackhorse Workshop membership
- Creative process (your inspirations, mediums and materials)
- Dezeen Awards 2020 timber trophies (with Bruce Saunders and Atelier NL)
- Time-Out front cover by your hardwood box
- Recent Collections

On Makerspaces
- A typical studio working day
- Definition of makerspace
- Collaborative process / community / space
- Benefits & missing

Future
- Future of making / makerspaces
- *Regarding the future, what are you optimistic about?*

APPENDIX 3: CONSENT FORM EXAMPLE

İstanbul Bilgi University
LAUREATE INTERNATIONAL UNIVERSITIES

Participant Consent Form

Research project title: Makerspaces and Participation, Case of London
Researcher: Nurgül Yardım Meriçliler, PhD student in Communication Studies, Faculty of Communication, Istanbul Bilgi University, Turkey

Thank you for agreeing to be interviewed as part of the research project. This consent form is necessary for me to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation.

Please answer the following questions by ticking the response that applies

I understand that my participation is voluntary and that I am free to withdraw at any time.
YES NO

I understand that the research will be recorded (audio and/or video).
YES NO

I agree that if the interview is recorded, a transcript of the interview will be produced by the researcher.
YES NO

I agree to the storing of the audio file, transcript, any notes made during and after the interview, and contact information on the researcher's computer which are password protected.
YES NO

I agree that information, opinions and quotes given in the interview can be anonymised or to be quoted directly.
YES NO

I understand that an edited version of the recorded interview will be broadcast on a podcast available to the public at large to listen to or download.
YES NO

I understand that the content of the interview may be used or cited for research and educational purposes, within academic publications and book chapters.
YES NO

I have been able to ask any questions I might have, and I understand that I am free to contact the researcher with any questions I may have in the future.
YES NO

Name of Participant

_____

Signature of Participant	Signature of Researcher
_____	_____
Date	Date
_____	_____

This research has been reviewed and approved by the Istanbul Bilgi University Ethics Board.

APPENDIX 4: LONDON BOROUGH INFORMATION

(Source: https://www.londoncouncils.gov.uk/services/london-european-partnership-transport-lept/about-lept/london-boroughs#28)

Barking and Dagenham

Demographics

Size: 36.11 km^2

Population: 163944 (47.6% male/52.4% female)*

Population Density: 45.4 people per hectare; the 18th most populated of all boroughs*

Age Breakdown: 7.3% 75+, 69.3% 16-74, 23.4% under 16*

Ethnicity Breakdown: 85.2% White, 14.8% BME*

Religion: 68.9% Christian, 15.2% no religion, 15.9% other*

Education: 50 Primary Schools, 11 Secondary Schools, 1 non-mainstream school+

Employment: 56.1 employment rate* #

*National Census 2001 +Barking and Dagenham Council # National Average 2001: 60.6%

Southwark

Demographics

Size: 28.85 km^2

Population: 244,866 (48.9% male/51.1% female)*

Population Density: 84.9 people per hectare; 3rd most densely populated borough*

Age Breakdown: 4.8% 75+, 74.9% 16-74, 20.3% under 16*

Ethnicity Breakdown: 63% White, 37% BME*

Religion: 61.6% Christian, 18.5% no religion, 19.9% other

Education: 53 Primary School, 11 Secondary Schools, seven non-mainstream schools+

Employment : 59.7% employment rate* #

*National Census 2001 +Southwark Council # National Average 2001: 60.6%

Lambeth

Lambeth demographics

Size: 26.84 km^2

Population: 266169 (49.1% male/50.9% female)*

Population Density: 99.2 people per hectare; 5th most densely populated borough*

Age Breakdown: 4% 75+, 77% 16-74, 19% under 16*

Ethnicity Breakdown: 62.4% White, 37.6% BME*

Religion: 58.9% Christian, 21.7% no religion, 19.4% other*

Education: 62 Primary Schools, 14 Secondary Schools,

five non-mainstream schools+

Employment: 61.7% employment rate*#

*National Census 2001 +Lambeth Council # National Average 2001: 60.6%

Waltham Forest

Demographics

Size: 38.78 km^2

Population: 218,341 (46.7% male/51.3% female)*

Population Density: 41 people per hectare; the 13th least populated of all boroughs (joint with Harrow)*

Age Breakdown: 5.7% 75+, 72.8% 16-74, 21.5% under 16*

Ethnicity Breakdown: 64.5% White, 35.5% BME*

Religion: 56.8% Christian, 15.4% no religion, 27.8% other*

Education: 57 primary schools, 16 secondary schools,

eight non-mainstream schools+

Employment: 58.9% employment rate* #

*National Census 2001 + Waltham Forest Council # National Average 2001: 60.6%

Demographics

Size: 22.04 km^2

Population: 181,286 (49% male/51% female)*

Population Density: 84.4 people per hectare; the 9th most populated of all boroughs*

Age Breakdown: 5.7% 75+, 80.8 % 16-74, 13.5% under 16*

Ethnicity Breakdown: 73.2% White, 26.8% BME*

Religion: 55% Christian, 16.2% no religion, 28.8% other*

Education: 41 primary schools, 10 secondary schools, 3 non-mainstream schools+

Employment: 59.2% employment rate* #

*National Census 2001 +WestminsterCouncil # National Average 2001: 60.6%

APPENDIX 5: MATRIX OF CASES

(for the former pages, see Table 2 and Table 3).

	URBAN CONTEXT				
	Postcode	**Context**	**Borough**	**Borough Key Points**	**Access**
MAKERVERSITY	WC2R 1LA	Inner London	City of Westminster	The City of Westminster is a city and borough in Inner London which forms a core part of Central London. The City of Westminster's 2021-2025 Cultural Strategy is the council's commitment over the next five years to ensuring Westminster remains a vibrant, welcoming and inclusive cultural hub.	Underground Bus Bicycle Car River Boat
BLACKHORSE WORKSHOP	E17 6BX	North-East London	Walthamstow / Waltham Forest	In 2019, Waltham Forest was the winner of London Borough of Culture, which celebrates the culture and diversity of London's many boroughs in a way that's collective and community-led.	Overground Underground Bus Bicycle Car
SLMS	SE24 9AJ	South London	Herne Hilll /Lambeth	only 3.3% of the working-age population has no qualifications whatsoever, which is below the proportion of 6.7% across London.	Underground Bus Bicycle Car
THE WAREHOUSE	IG11 0HQ	East London	Barking / Borough of Barking and Dagenham	It has the lowest pay inequality amongst all London boroughs.	Underground Bus Bicycle Car
SUGARHOUSE STUDIOS	SE16 4DJ	South-East London	Bermondsey / Southwark	There is a greater-than-average amount of income deprivation in Southwark, with the average neighbourhood 50% more income deprived than an average neighbourhood in London.	Underground Bus Bicycle

	PHYSICAL SPACE					
	Building Type	**Building Owner**	**Architectural Designer**	**Total Floor Area**	**Floor Number**	**Architectural Programme**
MAKERVERSITY	Historical repurposed building	Somerset House Studios, Somerset House Trust	Something & Son (interior design)	2000 sqm	2	Wood Workshop Digital Workshop Textile Workshop Engineering workshop Assembly space Podcast Studio
BLACKHORSE WORKSHOP	New Building with outdoor space & 8 converted shipping containers	Blackhorse Workshop	ASSEMBLE	400 sqm	2	Wood Workshop Metal Workshop Cafe Parking Area Artist Studios Machine Room Benches
SOUTH LONDON MAKERSPACE	Railway Arches	Landlord	SLMS	200 sqm	1	Clean Area Messy Workshop Dusty Workshop Social Seating Area Washroom Kitchen
THE WAREHOUSE	Warehouse space	Participatory City Foundation	Participatory City Foundation	3300 sqm	3	Shared Spaces Shared Workshops
SUGARHOUSE STUDIOS	Former school's ground floor swimming pool and dance studios	ASSEMBLE	ASSEMBLE	1000 sqm	2	Units Workshops

	PRODUCTION	
	Equipment and Tools	**Disciplines**
MAKERVERSITY	3D Printer, 3D Scanner, Angle Grinder, Bandsaw, Belt Sander, CNC Milling Machine, CNC Router, Disc Sander, Electronics, Engraver, Foam Cutter, Grinder, Heat Press, Heat Press, Laser Cutter, Maker Library, Mannequins, Metal, Metal Chop Saw, Microscope, Milling Machine, Morticer, Oscilloscopes, Overlocker, Pattern Cutting Table, Photo Studio, Pillar Drill / Drill Press, Planer, Plastics, Power Tools, Router, Sander, Scroll Saw, Sewing Machine, Soldering, Sound Studio, Spray Booth, Table Saw, Textiles, Thicknesser, Vacuum Former, Vinyl Cutter, Vinyl Plotter, Wood Lathe	Computing, Digital Fabrication, Electronics, Engineering, Fashion Design, Fine Art, Furniture Design, Metal Work, Photography, Robotics, Textiles and Wood Work
BLACKHORSE WORKSHOP	Woodwork machinery, chop saw bandsaw, pillar drill, disc sander, bobbin sander morticer table saw surface planer thicknesser, lathe, metalwork machinery, MIG welder, TIG welder, plasma cutter, chop saw, linisher polisher, pillar drill, sheet roller, box & pan folder, bench shear, metal bender, angle grinder	Fine Art, Furniture Design, Metal Work, Repair, Sculpture, Textiles and Wood Work
SOUTH LONDON MAKERSPACE	Electronics Benches, 3D Printing area, Textiles Area, Reprographics, Computerised Making and doing rad stuff, screen printing, metal work, Bike Repair Stand and Tools, Wood Working Machines, Hand-Held Powertools, Hand tools, CNC Machine	Electronics work, textiles, metalwork, screen printing, CNC and laser cutting, wood-working
THE WAREHOUSE	3D Printer, Belt Sander, Ceramics, CNC Milling Machine, Computing, Digital Fabrication, Disc Sander, Drying Racks, Electronics, Fabric Table, Heat Press, Heat Press, Hotplate, IMacs, Jet Wash, Jig Saw, Kiln, Laser Cutter, Library, Maker Library, Mannequins, Materials Library, Mitre Trimmer, Overlocker, Pattern Cutting Table, PCs, Photography, Pillar Drill / Drill Press, Plastics, Potters Wheel, Power Tools, Router, Sander, Sewing Machine, Slab Roller, Slip Casting Table, Soldering, Straight Stitch Machine, Table Saw, Textiles, Vacuum Former, Vinyl Cutter, Washing Machine and Wood	Bike Maintenance, Ceramics, Computing, Digital Fabrication, Electronics, Engineering, Fashion Design, Fine Art, Furniture Design, Jewellery, Music & Audio, Photography, Printmaking, Repair, Screen Printing, Sculpture, Textiles and Wood Work
SUGARHOUSE STUDIOS	N/A	Woodwork, music space, metalworking, deks

APPENDIX 6: MAKERS BIBLIOGRAPHY

MAKER PROFILE 1

NATHANIEL PETRE | MAKERVERSITY

Design Engineer
Additive Manufacturing Innovator
Founder *SURFFF*
Founder *Distributed Additive Manufacturing (DAM)*

Nathaniel (Nate) is a post-PhD researcher from the Dyson School of Design Engineering at Imperial College London. After 3D printing the world's first surfboard made from algae, Nate began using plastic ocean waste as a resource for local, agile manufacturing. Over the last two years, he's built the largest 3D printer in the Caribbean as well as pioneering Jamaica's first 3D-printed underwater sculpture park. Nate's projects aim to equip both the community and researchers with the tools to develop a platform for using materials as varied as ocean plastic to bio-fabricated structures in order to sustain an economy and an ecosystem locally. Nate has a non-academic engineering background and a college education from an art school in New York City.

MAKER PROFILE 2

HANSON CHENG | MAKERVERSITY

Interdisciplinary Designer
Entrepreneur
Forbes 30 under 30
Co-Founder and CEO *Tyre Collective*

Hanson is an interdisciplinary designer working across scales of design. From products and speculation to immersive pavilions, his work explores themes of sustainability and technology, health and wellbeing, as well as play and the built environment. He received his MA/MSc with Distinction in Innovation Design Engineering (IDE) at Imperial College London and the Royal College of Art. He holds a Bachelor of Architecture from the Rhode Island School of Design (RISD). His work has won various international awards, been exhibited at the Saatchi Gallery London and has been featured on BBC, Guardian, Forbes, Reuters and The Times.

MAKER PROFILE 3

HUGO RICHARDSON | MAKERVERSITY

Thinker
Maker
Co-Founder and CTO *Tyre Collective*

Hugo graduated in Mechanical Engineering from the University of Bristol and is currently studying for a double master's in Innovation Design Engineering at the Royal College of Art & Imperial College, London. He defines himself as a maker, constantly fiddling, pulling apart and assembling things, with a love and interest in all materials. His roots in engineering and passion for design are constantly colliding, leading him to take an interdisciplinary approach to the complex and nuanced challenges we face.

MAKER PROFILE 4

STACIE WOOLSEY | MAKERVERSITY

Associate lecturer
Speculative designer
Freelance Design Researcher
Founder *Make Your Own Master (MYOM)*

Stacie Woolsey graduated from Kingston School of Art with a bachelor's in graphic design. She is a designer and founder of Make Your Own Masters - a tailor-made Masters programme she created for herself in response to the high costs of university education and "not fitting in" with any particular course. Now a graduate of her very own kind, Stacie is rethinking the education system and opening applications for students to join her on a unique, beneficial and, most of all, affordable master's course.

MAKER PROFILE 5

SHRUTI GROVER | MAKERVERSITY

Human Centred Designer
Researcher
Co-Founder *Pattern Project*
Co-Founder *Hetco Design*

A design engineer, sewist, and human-centred researcher who grew a CNC machining factory from 0 to 30 machines. Has led the conception, research, design and delivery of innovative products and services for companies including BBC, Kings College London, Wellcome Trust, Proteus Digital Health, Chelsea and Westminster Hospital, Ford and the Seoul Design Foundation. Pattern Project produces ready-to-assemble clothing designed by emerging designers. The workshop space provides a window onto the manufacturing process, displaying the orders being cut, trimmed on a cutting machine & British-woven fabric laid to rest on spreading tables.

MAKER PROFILE 6

KATIE SPRAGG | SUGARHOUSE STUDIOS

Artist
Ceramicist
Founding Member *Collective Matter*
Tutor *Royal College of Art*

Katie's catalogue of work includes a piece purchased for the V&A Museum collection, a permanent installation for the Garden Museum and commissions for the British Ceramics Biennale and Sotheby's, as well as numerous private collections and commissions. Her work has been exhibited by the Craft Council in London and Miami, included in the British Council's touring Film Festival and presented at solo shows at Blackwell, Arts and Crafts House, and the Garden Museum. Collective Matter; is an outreach group that pioneers collaborative practice through clay and has developed a Clay for Dementia programme with the Garden Museum. Working with and in response to others and their stories is an important part of her creative practice.

MAKER PROFILE 7

EMMA LESLIE | SUGARHOUSE STUDIOS

Designer
Furniture Maker
Director and Tutor *The New School of Furniture Making*

Emma is a designer and furniture maker. Her varied practice ranges from individual bespoke commissions to her own design work and artist collaborations. Clients include Assemble, ICA, Modern Art Gallery, The Modern House, Giles Reid Architects, Urban Projects Bureaux, McCrum Interior Design and Lyndon Good Architects. Artist collaborations include Jason Bowman, Inheritance Projects, CJ Mahony, David Ben White and Noga Inbar. Emma runs The New School of Furniture Making, teaching evening and weekend courses from her workshop in Bermondsey. She also teaches at The Institute of Making and The Design Museum.

MAKER PROFILE 8

ANDREW FRIEND | SUGARHOUSE STUDIOS

Artist
Designer
Founder *Andrew Friend Design*

Andrew works to explore the experience and the relationship between people, landscape, and their desires. He studies BSc Architecture at Bartlett School of Architecture and MA Design Interactions at the Royal College of Art. Andrew is interested in the extraordinary, fantastic and desirable (or indeed undesirable) experiences and outcomes that may result from these interactions. His work spans a range of media, from narrative and drawings to large-scale physical objects designed to promote, facilitate, and question these experiences, examining relationships between the known and unknown, the real and imagined, in the individual quest to harness the sublime.

MAKER PROFILE 9

STEVE COOK | SUGARHOUSE STUDIOS

Designer
Maker
Co-founder and member *WorkshopEast*

With a background in fine art, Steve moved into antique furniture restoration in Chelsea for 15 years before retraining in furniture making at the Building Crafts College in London. A year as a maker in residence was followed by setting up WorkshopEast, a workshop for up-and-coming makers in London, from where he continued to produce his work.
With commissions from private clients, architects and public bodies, as well as collaborations with artists and fellow furniture makers, the work is always varied. What ties it all together is his aim to make each project truly bespoke. Steve is a QEST scholar and recipient of the Carpenters' Company Prize.

MAKER PROFILE 10

ADAM AZMY | BLACKHORSE WORKSHOP

Senior compositor
Designer
Woodworker
Founder *Azmy Anything*

Adam went on to study Film Production at the Arts Institute of Bournemouth and began a career in visual effects. He is a Director of Visual Effects for the film industry and has worked on a number of high-profile feature films, including Steven Spielberg's War Horse, James Cameron's Avatar, Alfonso Cuaron's Gravity and the Matrix. He is also a furniture maker and runs his own company AzmyAnything. He is an active Blackhorse Member, supporting the Blackhorse team with creating short film projects such as documenting the Kit Kite project, and has extensive experience working with digital manufacturing processes. Adam is one of many Blackhorse Workshop members who are self-taught after he found himself on a different path and changed careers.

MAKER PROFILE 11

DERMOT JONES | SLMS

Project Manager *Camden Fixing Factory for Possible*
Director *SLMS*
Head *Arch Co Tenant Relations*
Volunteer Facilitator

Dermot is leading on Camden Fixing Factory for Possible. He is doing community organising, fixing, volunteer facilitating, and co-design. Dermot is creating a makerspace with transition and sustainability. Dermot is also involved in repair events in Tooting - features in a recent Guardian article on how repair shops are leading a fixing revolution.

MAKER PROFILE 12

ANDRÉS MUÑIZ PINIELLA | THE WAREHOUSE

Industrial Engineer
CAD designer
Co-founder *Richmond Makerlabs*
Manager *The Warehouse*
Asset, Premises & Tech Manager *Participatory City Foundation*

Andres has a degree and masters in Industrial Engineering. He had ten years of experience in the National Physical Laboratory working, among other things, as a Higher Research scientist, CAD designer and Facilities Manager. He had managed his own company Community Interest Company (C4AD), where he was prototyping business to business from a makerspace in Canbury Works and being tech support for other communities. He co-founded a Hackspace called Richmond Makerlabs, which is a member managed community craft workshop. He had ab experience in facilities management, community and team management, project management, data analysis, computer-aided engineering design, reporting to the board level, and research and development.

APPENDIX 7: ETHICS BOARD APPROVAL

Ethics Board Approval is available in the printed version of this dissertation.