Who Makes a Makerspace?
Makerspace Governance in Toronto, Ontario, and London, Ontario

By

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ABSTRACT

As Makerspaces have emerged under different names, including Hackerspaces, Hacklabs and FabLabs, research has studied the meaning and impacts of their practices. This thesis investigates how Makerspace's activities are the product of complex governance networks using observation and semi-structured interviews of eight Makerspaces in Toronto, Ontario, and London, Ontario. The study found that the investigated Makerspaces' governance networks were comprised of a wide variety of actors, ranging from non-human actors (noise, space, fumes, and tools) to formal governing institutions. The study also found that the municipal governments involved in the process were involved in a steering and guiding capacity to influence Makerspaces to move toward economic development priorities, but did not exercise their regulatory power in any observed cases. These findings highlight that research on Makerspaces should consider moving beyond practices and toward how spaces are governed in unique contexts, as the practices of Makerspaces are dependent on their governance network.

CHAPTER 1: INTRODUCTION

A wide variety of physical spaces are emerging worldwide to facilitate the building of things with shared tools. These spaces have come under many names in the past – including Hackerspaces, HackLabs, FabLabs, and Makerspaces.. These spaces have emerged in great numbers over the past four to five years: at the time of writing, there are at least 470 self-identified Makerspaces, Hackerspaces, or FabLabs, worldwide according to Makerspace.com, a Makerspace directory. (Makerspace.com, 2016)

Existing research on Makerspaces, Hackerspaces, and FabLabs has focused on these spaces' definitions, practices, and impacts; but few have investigated to how these spaces are managed. The question of how Makerspaces are governed is important because, as these spaces are emerging in cities around the world, attention must be paid to how they are run, and what factors are motivating each space. This thesis aims to fill this gap through analyzing how a set of Makerspaces are governed – that is, how the physical, social, and institutional frameworks surrounding the spaces intervene to influence the practices of their participants. Grounded in interview and observation data from eight different Makerspaces in Toronto, Canada, and London, Ontario, this investigation aims to produce a model for Makerspace governance in this geographic context.

The analysis is guided by three major research questions:

1. Which actors play a role in the urban governance system that manages each of the Makerspaces?
2. What is the formal role of the municipality (The City of Toronto) in the urban governance system of Makerspaces?
3. How are practices and values of Makerspaces influenced by their governance structure?

Peer-reviewed research on Makerspace governance has focused narrowly on Hackerspaces, a category of Makerspace that focuses on electronics production \ (Capdevila, 2013). The existing research by Kostakis et al. (2014) on the governance of Hackerspaces argues that these spaces apply Commons Based Peer Production (CBPP) governance models that were originally emerged in digital communities, into physical spaces. This research builds on Kostakis et. al. (2014) by analyzing the governance networks for variety of Makerspaces, Hackerspaces and FabLabs, emphasizing formal governance institutions and non-human actor's importance in these governance networks.

In order to build a foundation for the investigation, this essay's literature review will build a working definition of Makerspace, consider the meaning of governance, and then introduce CBPP in greater detail alongside the Creative Cities and Innovation Infrastructures literature which influences emerging Makerspaces and FabLabs. Next, it will briefly introduce the investigation's methodology, which is a mixed-methods approach that incorporates Actor Network Theory, content analysis, semi-structured interviews, and observation.

Using the foundation derived from the literature review, the Results section will investigate each of the study's research questions. First, it will identify what actors are involved in the governance of the studied Makerspaces building the argument that each space is governed by a complex governance network comprised of actors from a variety of sectors. Second, it will highlight that the State played a steering and guiding role in the governance of Makerspaces by guiding them towards Creative Cities priorities; Last, it will analyze these findings together to build a model of how governance influences the practices of Makerspaces.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

There are three small but emerging bodies of work that explores different aspects of Makerspaces. First, a variety of authors explore the definitions and histories of specific 'categories' of Makerspaces, including Hackerspaces, HackLabs, and Fablabs. Second, the largest body of work on Makerspaces explores the practices of spaces in specific contexts, with many paying particular attention to the role of Makerspaces in Education and Libraries. Last, a handful articles explore the role of governance in Makerspaces. To build a foundation for my analysis, this section will overview these bodies of literature, and then introduce the two governance models (CBPP and Creative Cities governance networks) which have been directly referenced as impacting Makerspaces' governance.

2.1 Defining Makerspace

Defining makerspace is challenging due to a constantly evolving landscape of spaces, who deploy different terms to describe their activities with little consistency. Defining makerspace is Elucidating what sets a Makerspace apart from a Hackerspace, or what sets a Hacklab apart from a FabLab is challenging for three reasons. First, as Moilanen (2012) argues, new and different communities are constantly emerging, deploying a huge variety of terms to define themselves. Second, since every space is different in practice, the characteristics of each space will vary widely, undermining the consistency of each term. Last, the trend itself is very new: whereas the first Hackerspaces and Hacklabs emerged in Europe during the 1990s (Maxigas, 2012) and FabLabs have emerged since the early 2000s, the term Makerspaces have only become

popularized over the past four to five years (Figure 1). In the context of hundreds of new spaces emerging that focus on 'making' and Do-It-Yourself practices, "a shared understanding of how to use the different descriptions and names of the movement is still missing" (Moilanen, 2014). This section will analyze the variety of definitions deployed to understand these spaces, and approach a definition of what makes constitutes a "Makerspace" for the purpose of this study, coming to the conclusion that while there is significant variation between the different categories of spaces (Hackerspaces and Hacklabs, Makerspaces, FabLabs), they have enough in common that the term Makerspace can be used to describe the categories collectively.
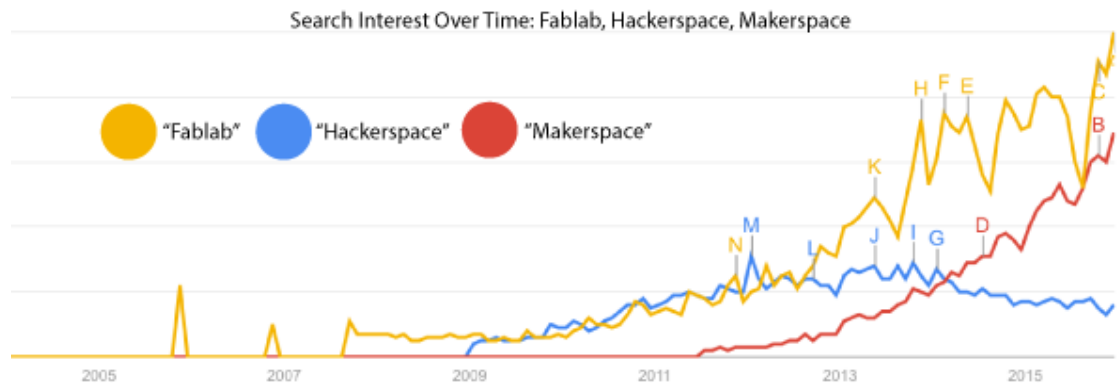
Figure 1: Search interest for "Fablab" "hackerspace and "Makerspace" over time. Y-Axis shows use of each term relative to all Google search traffic. (Source: Google Trends)

2.1.1. Hackerspaces and Hacklabs

Hackerspaces are seen as physical manifestations of the techno-libertarian and commons-centric ideology frequently found on online 'hacker' communities. Capdevila (2013) defines Hackerspaces as "workspaces which operate on the principles of hacker ethics," including a peer-to-peer approach and a collective attitude. Hackerspaces manage their spaces with the same web-based tools as their digital counterparts: Hackerspace.org, a wiki maintained by the Hackerspace community, defines a hackerspaces by

emphasizing that they are physical spaces where people interested in technology can meet and 'tinker' on projects:

> Community-operated physical places, where people share their interest in
> tinkering with technology, meet and work on their projects, and learn from
> each other. (Hackerspaces.org, 2015)

As Colegrove (2013) highlights, Hackerspaces often focus on physical hacking, usage of microcontrollers and Open Source Hardware. These author's arguments indicate that Hackerspaces are focused on tinkering with technology, versus developing specific commercial or artistic projects.

There is a significant amount of history and ideology tied up in Hackerspace terminology. Maxigas (2012) demonstrates in his article *Hacklabs and hackerspaces – tracing two genealogies*. Maxigas makes a distinction between *Hacklabs* and *Hackerspaces*. Hackerspaces are connected with the larger history of the *hacker movement,* exhibiting the liberal or techno-libertarian ideological orientation observed by Coleman and Golub (2008) in the online hacker community. Hacklabs, on the other hand, can be traced back to the anti-capitalist *autonomous* squatter movements of the 1970s. Maxigas showed Hacklabs emerged after the rise of neoliberalism between 1995-2005, with the stated aim of reducing barriers of access to technology and communications infrastructure. Hacklabs "grew out of the needs and aspirations of squatters and media activists", (Maxigas, 2013: p.4) taking on an anti-capitalist character. This distinction has largely erased over time, however, as Maxigas states: "at the moment the terms "Hacklab" and "Hackerspace" are used largely synonymously" (Maxigas, 2012). This history and variance in ideology complicates our understanding of Hackerspace, opening

the door for variance in individual space's motivation and governance, especially for spaces with longer histories.

2.1.2 FabLabs (Fabrication laboratories)

FabLabs provide technologies that enable participants to develop products and ideas (Gershenfeld, 2005). FabLabs emerged after the 1990s-era Hacklabs described by Maxigas (2012), but before Hackerspaces and Makerspaces. FabLabs are conventionally traced back to MIT professor Dr. Neil Gershenfeld and the establishment of the MIT Center for Bits and Atoms in the mid-2000s (Benton et al., 2013). FabLabs are often sponsored by academic institutions, for example the Stanford Learning Fab Lab, Champaign-Urbana Community Fab Lab, and the Michigan State University Creativity Exploratory (Benton et al. 2013). Because of their attachment to particular institutions, the governance of FabLabs may be more restrictive than other kinds of Makerspaces, given that their funding and practices are governed by a more complex network of actors; further, Gershenfeld's conception of FabLabs as being about 'developing products and ideas' establishes that the spaces are motivated by sparking entrepreneurship and innovation.

2.1.2 Makerspaces

Maxigas (2012) highlights Hackerspaces' connection to existing communities, stating that FabLabs and Makerspaces share a "family resemblance" to Hackerspaces but "have been founded by actors of the formal educational system or commercial sector" (ibid. 2012). Colegrove's (2013) article *Libraries as Makerspace?* focuses on the emergence of Makerspaces and their potential application in libraries. In line with other authors who study Makerspaces specifically, his focus is on benefits of these spaces as a

policy option to spark neoliberal innovation and entrepreneurialism (Benton et al., 2013; Good, 2013; Moorefield, 2015; Anderson, 2013). Colegrove describes Makerspaces as a "continuum of activity" that includes elements from FabLabs, Hackerspaces, and *co-working* spaces. Makerspaces are the most recent class of DIY spaces to emerge, and can include a wide variety of internal governance systems, including for-profit corporations. For instance, Techshop, a for-profit chain of Makerspaces, claims its first location – opened in 2006 in Menlo Park, California– was the "first open-access shop of its kind" and with locations spread across the United States, Techshop today calls itself "the largest and most influential Makerspace in the world." (Hatch, 2013; 4) Yet non-profit and community-run spaces are regularly emerging and calling themselves Makerspaces. (Pinto, 2015)

2.1.4 Convergence towards a Collective Term

Eric Van Holm writes in his (2014) paper *What are Makerspaces, Hackerspaces, and Fab Labs?* that although each of the three types of spaces have their own histories, they have converged into similar structures and uses. Van Holm highlights that "researchers are divided on whether to treat the three concepts as distinct or synonymous." In his literature review, Van Holm cites authors that treat these varying types as synonymous (Moilanen, 2012; Colegrove, 2013) and others who treat them as independent (Maxigas, 2012). Because Van Holm aims to measure whether the term Makerspaces accurately defines Hackerspaces, and Fab Labs, for the purposes of the article Van Holm uses the term acronym MHFLs in the interim. Van Holm used a content analysis of the three main online directories for MHFLs (Hackerspace.org, Makerspace.com, FabLab.io), coming up with a sample of self-identified MHFLs. Van

Holm approached the data by analyzing whether the spaces self-identified in their mission statement as a Fab Lab (43 spaces), Hackerspaces (130 spaces), Makerspaces (256), or two or more types (9 space). His content analysis showed that there was little substantial variation between the terms Makerspaces and Hackerspaces used to describe themselves, while he found that FabLabs were similar in practices to the other two types but were much more likely to be connected to students and educational institutions. Following his analysis, Van Holm arrived at a general definition of Makerspaces:

> At present, Makerspaces, hackerspaces, and FabLabs are shown to be workshops that are open to the community as members. They typically offer equipment-allowing work with metal, wood, fabrication, and arts and crafts and are open to individuals looking to work with any of those tools. They may be specifically focused towards businesses generation, although not necessarily closed off from hobbyists without professional pursuit (Van Holm, 2014: 15).

It is also relevant to highlight that this definition defines a Makerspace as a workshop which is open to the public, but does not require the space to be permanent. Given Holm's evidence of convergence in practices, this paper will use this broad definition of Makerspace, to encompass Makerspaces, Hackerspaces, FabLabs, and Hacklabs.

Holm's research highlights that the practices of individual spaces have enough in common that the collective term Makerspace can encompass all spaces, but this does not mean that all spaces have the same practices and governance models. On the contrary, this paper will demonstrate that what there is significant variations in what Makerspaces do, and that this variation follows from how they are governed.

2.2 Makerspace Practices and Impacts

Beyond definitional papers, there are other two large bodies of peer-reviewed literature on Makerspaces. This literature investigates the practices and impacts of Makerspaces from two major perspectives: First, there is a significant variety of papers form Library and Information Science that analyze the importance of Makerspaces in libraries and educational institutions; Second, there are a variety of authors who chart the practices of different Makerspaces in the social and cultural contexts.

The peer-reviewed literature on Makerspaces from Library and Information Sciences emphasizes that Makerspaces and FabLabs hold potential to 'revolutionize' education and provide new uses for Libraries in the information age. As Sheridan et. al. (2014; p.529) state, there is a "dearth of empirical research on Makerspaces" in the context of education and libraries. This field of research largely lauds Makerspaces for their potential, arguing that in the context of growing use of e-books, Makerspaces can "dramatically enhance traditional library offerings, revitalizing the library as a center of learning" (Colegrove, 2013; p.2). As Bowler (2014; p.1) argues, this revitalization follows from the Makerspaces potential to "move the library environment from a space for consumption to a place of creation." Other authors highlight the challenges in implementing Makerspaces in libraries, as Slatter and Howard (2013; p.275) argue, "Makerspaces can seem an expensive indulgence" in the context of "reduced funding and uncertain budgets." While the literature on Library and Information Science is well developed, its narrow focus on Makerspaces or FabLabs run by institutions means that the models it develops are of little use to this study, given that the investigated Makerspaces come from a variety of governance models; further, the research itself is not

critical of Makerspaces, often taking for granted that a Makerspace will be accompanied with social benefits. The Library and Information Science field is the most developed of any body of work on Makerspaces, although a variety of other authors analyze the practices of Makerspaces in particular contexts.

Authors who focus on the practice of Makerspaces, Hackerspaces, and FabLabs often aim to question the meaning of these activities in broader cultural contexts. For instance, there is a surprisingly varied body of literature that studies the practices of Asian Makerspaces, with papers exploring China's Hackerspace community (Lindtner and Li, 2012), the connection between Makerspaces and Chinese industrial production (Lindtner, 2014), the existing Maker practices of elderly electronics hackers (Sun et al., 2015), the emergence of Makerspaces in Chinese libraries (Shu et al., 2014), and the paradoxes of culture that emerge within the practices of Asian Hackerspaces (Kera, 2012). Yet there are articles who study the practices of Makerspaces in other geographic contexts: for example, Sperling et. al. (2015; p.406) maps the locations of FabLabs in Latin America to "draw the cultural, social and economic context" of their activities. These articles situate the activities of Makerspaces into broader critical contexts, and often build connections to Cultural Studies and anthropology. While these articles offer compelling accounts of the meaning of Makers and Makerspaces in different contexts, they are nonetheless of limited use to my study as they do not delve into the governance or management of spaces themselves.

Overall, the research on the practices and impacts of Makerspaces is well developed and growing. But there is a lack of articles that analyze the actual running of Makerspaces, going further than *what they do* by asking *why they do it* and *how they do*

it. Kostakis et al. (2014) is the only article that focuses Governance in Makerspaces, and as such it will be investigated in detail later in the literature review. But first, In the absence of a variety of work on Makerspace Governance, it is important that this review builds an understanding of governance looks like in broader fields.

2.3 Governance and Makerspace

2.3.1 Defining Governance

A wide range of literature has emerged to describe the variety of usages and meanings of *governance*. (Colebatch, 2009: Stoker, 1998) The traditional, dictionary definition is: "a synonym for *government*" – yet the term has evolved to new meanings as the practice of governing has become less central and more complex. International relations scholars use *governance* to describe how states' interactions formed regimes of rule that had no governmental body (Colebatch, 2009). Rhodes (1997) applied *governance* to the analysis of national government in his argument that the UK was moving from *government* to *governance* in which:

> The state becomes a collection of interorganizational networks made up of
> governmental and societal actors with no sovereign actor able to steer or
> regulate.

The term had taken such a wide meaning as more scholars and institutions deployed it in different contexts, that some authors have called it an "empty signifier" with little analytical use (Colebatch, 2009). Stoker (1998; 18) provided a sturdier definition by identifying five complementary, key aspects of *governance* in use, rather than a single definition:

1. Governance refers to a set of institutions and actors that are drawn from but

also beyond government
2. Governance identifies the blurring of boundaries and responsibilities for tackling social and economic issues
3. Governance identifies the power dependence involved in the relationships between institutions involved in collective action
4. Governance is about autonomous self-governing networks of actors
5. Governance recognizes the capacity to get things done which does not rest on the power of government to command or use its authority. It sees government as able to use new tools and techniques to steer and guide.

Stoker's list builds a map for what governance will looks like in a spatial and temporal context, and it will provide a useful framework for what Governance should look like in Makerspaces. In Stoker's understanding of governance, Makerspaces will be governed by actors of networks from a variety of sectors, both governmental and non-governmental. Makerspaces' will be motivated by providing benefits to society, as part of the "blurring of boundaries and responsibilities" for tackling social issues. Where government is involved, it will use its authority to steer and guide Makerspace's activities instead of directly intervening; simply put, Makerspaces will not wait for government action, instead, they will act while government attempts to steer their action in particular directions (Ibid.). Last, Stoker's recognition that "governance is about autonomous self-governing networks of actors" is in line with this study's use of Actor Network Theory as a theoretical and practical foundation of its Methodology (See Chapter 6). The following section will overview two significant models for the governance of Makerspaces.

2.3.2 Relevant Governance Models

Given that this thesis aims to explore what actors converge to regulate the practices of Makerspaces in Toronto, analyze to what extent the State is involved in the process, and investigate how governance restricts the activities of the space – it is imperative to explore particular governance models have intervened in past spaces. The existing literature on Makerspaces has demonstrated that these spaces come from two

separate governance traditions; either the Commons-Based Peer Production system of governance first deployed in online communities, or the more centralized governance found in entrepreneurial city policies motivated by pursuing economic growth, Innovation, and Entrepreneurialism.

2.3.2.1 Governance Model: F/OSS and Commons Based Peer Production (CBPP)

Kostakis et al. 's (2014) article *Production and governance in hackerspaces: A manifestation of Commons-based peer production in the physical realm?* Aimed to deploy the Commons Based Peer Production (CBPP) literature in a discussion of Hackerspaces. Kostakis et al. (*ibid.*) described CBPP as theory emphasizing the hybrid modes of governance and altruistic motivations exhibited in online communities. In governance, CBPP ideally emphasizes a meritocracy with consensus-oriented governance mechanisms and communal shareholding of property (*ibid.*). Their practices supposedly contrast from market-based businesses in that they are focused on for-benefit rather than for-profit projects (Bauwens, 2005). Kostakis et al. (ibid.) argue that for-profit motivations are not absent from CBPP projects entirely; rather incentives like learning, communication, and experience are put ahead of profit. Using Bauwens (2005) and Benkler (2006), Kostakis et al. (ibid.) identifies 'key aspects' of CBPP, with the aim of testing their studied hackerspaces against these criteria. Their study builds a strong connection between Hackerspaces and the governance systems usually found in digital CBPP projects. Thus they, they highlight that CBPP offers a possible way to frame my research in that the governance of Makerspaces (especially self-identified Hackerspaces) may have connections to the governance practices and motivations of online communities.

Kostakis et al. (*ibid.*) tested the applicability of his characterization of CBPP in physical Hackerspaces. Kostakis et al. (2014) used 23 semi-structured interviews with a sample of those involved in Hackerspaces around the world, and the publically available survey data on the composition of Makerspaces from Moilanen (2012). First, Kostakis et al. (2014) found that hackerspaces exhibit *intrinsic* positive motivation in the sense that "money remains a peripheral concept only" according to interviews and Moilanen's data. Kostakis et al. (2014)'s interviews emphasized two sets of motivations: (1) the social desire for hackers to have a 'third place' for social interaction the Oldenburg (1997) sense; and (2) the altruistic motivation of 'making the world a better place' through working on commons-oriented projects.

Second, Kostakis et al. (ibid.) found that the traditional CBPP characteristic of *openness* applied to Hackerspaces in a limited sense. The study participants stressed the importance of openness in their spaces, with one participant stating that:

> The barrier to entry [in Hackerspace projects] is to hack on stuff or help out
> with whatever needs to be done…that barrier isn't a door; it's a social thing
> (Kostakis et al. 2014; p.8)

Kostakis et al. (ibid.) defined openness as a kind of negative liberty; the observed hackers were not preventing anyone from participating directly, yet they were not encouraging full participation in positive sense either. They accept the above statement that there are few barriers as evidence of hackerspaces being *actually open* to a wide variety of persons, although we should remain critical of the accessibility of Hackerspaces, given that 90 percent of Moilanen's (2012) survey respondents were male and 64 percent of respondents had a completed a post-secondary degree. Kostakis et al. (2014) noted that

openness was limited in the sense that the space itself was closed most days of the week to non-members, which is unlike digital CBPP projects that are available ("open") online.

Third, the CBPP characteristics of *collaboration and sharing* were found in the interviews. Kostakis names the "Do-ocracy" decision making system cited by six out of seven participants as evidence of *collaboration* in the spaces: such a system puts power in the hands of people with the motivation to 'do things' and collaborate with others afterwards. Kostakis et al. (ibid.) did not go in depth in any case about how decisions are made or how such a system worked in practice. In terms of sharing, Kostakis et al. (ibid.) did find evidence that some hackerspaces were committed to sharing projects with Commons-based licenses and favored people working on collective projects over personal ones. (10)

Fourth, Kostakis et al. (ibid.) found evidence of CBPP's commitment to *cooperative, bottom-up innovation,* as participants cited a wide variety of 'innovative' hardware and software produced by hackerspaces. Kostakis et al. (ibid.; p.11) established that, similar to CBPP movement, hackerspaces show "the underestimated power of meaningful human cooperation."

Fifth, Kostakis et al. (ibid.) showed that *community accountability, communal validation, and autonomy* were present in hackerspaces. Participants cited trust and accountability as important "pillars" of hackerspaces' operation, with the several hackerspaces stating that they only had two stated rules:

> 1. Be excellent to each other
>
> 2. Do not behave in a way that makes us make more rules. (Kostakis et. al., 2014; p.11)

What is interesting is that Kostakis et al. (2014) uses the above minimal rules to demonstrate that hackerspaces are instances of CBPP, in spite of Kelty's (2009) evidence that Wikipedia and other CBPP projects' rely on agreed upon norms and rules to maintain order.

Kostakis et al. (2014) does provide some good evidence that Hackerspaces exhibit aspects of CBPP, yet their application of CBPP does not fully account for the complexity observed in online communities who make use of the governance model. CBPP is defined as a socio-technical system that uses the Internet to facilitate collaboration between many (sometimes hundreds or thousands) people "to provide information, knowledge, or cultural goods without relying on either market pricing or managerial hierarchies to coordinate their common enterprise" (*Benkler and Nissenbaum, 2006;* 394). Its proponents argue that CBPP has two significant components, Decentralization and Social Cues and Motivations. CBPP communities are decentralized in the sense that they give authority to a great number of agents rather than a central organizer. CBPP communities are also motivated by "by social cues and motivations, rather than prices or commands, to motivate and coordinate the action of participating agents." (Benkler and Nissenbaum, 2006; 400)

The CBPP narrative that governing power is decentralized in some sense obscures the actual complex governance institutions, legal mechanisms, and controversies involved in actual F/OSS and collaborative processes. As described by Coleman (2009) and Kelty (2008), F/OSS projects often include apply a great deal of formal governance institutions and legal regulations on participants. For instance, whereas the Benkler and Nissenbaum (2006) posit that that power is decentralized to users in CBPP, actual

authority to govern open-source software development is often held by a "benevolent dictator for life" (or BDFL), as is the case with Linus Torvalds, the founder of Linux. As described by Malcolm (2008) and contrary to the narrative of CBPP, "the Linux kernel development process is neither anarchistic nor consensual: if Torvalds does not like a patch, it does not go in the kernel." (Malcolm, 2008; 217)

2.3.2 Governance Model: Creative Cities

This essay proposes that the governance of Makerspaces is a complex process involving myriad actors, and while Hackerspaces view their actions as a physical manifestation of the CBPP tradition, there is substantial evidence that more recent Makerspaces are the product of urban governance networks, which are connected to pursuing the Entrepreneurial City.

As David Harvey (2005) argues in his chapter *Neoliberalism on Trial,* the process of Neoliberalization's primary accomplishment has been to "redistribute, rather than to generate, wealth and income" (Harvey, 2005; 159). Harvey points to the discourse of *accumulation by dispossession* as neoliberalization's set of methods for this redistribution. Neoliberalization and *accumulation by dispossession* involves the privatization and commodification of previously public assets, *financialization* and deregulation, the management and manipulation of crises, and *State redistributions of capital* from the lower to upper classes which are often masked as *privatization* schemes. (Harvey, 2005; p.160-165) Harvey states that Neoliberalization consists of the "Commodification of Everything" in which all things are turned into things with that can have rents extracted from, including intangible ideas like originality, authenticity, and uniqueness, which "were never actually produced as commodities." (Harvey, 2005; 166)

The growth of for-profit Makerspaces in North America and Europe can, in some cases, be seen as part of the process of commodification and neoliberalization. Whereas FabLabs, Hackerspaces and Hacklabs were focused on tinkering, the provision of common resources, and the development of open-source hardware, emerging Makerspaces are often focused on the development of entrepreneurship and innovation (Benton, 2013). Makerspaces' capital-focused orientations commodify the practices of the previous spaces, deploying collaboration and open-source ideals for the growth of capital. Some authors cite the importance of Makerspaces as *innovation infrastructures* that enable individuals to create things for consumption (Roberto, 2014), an idea that frames Makerspaces as a part of Neoliberal urban strategies that are oriented towards developing the Creative Class as defined by Florida (1990).

Florida's (1990) notion of the Creative Class and the significance of attracting it in the Neoliberal city (Harvey, 2005) has become very a significant, although critiqued, force in planning discussions. Critiques of Florida's Creative Class can enrich our understanding of how Makerspace policy may be deployed in the city and the importance of *governance* networks in the process. As Jamie Peck argues in his (2005, 766) article *Struggling with the Creative Class,* entrepreneurial urban strategies associated with the Creative Class are simply another flavor of *fast policy* that empowers "unstable networks of urban elites" to form "new regimes of local governance around the aggressive pursuit of growth focused development agendas". As Leitner (1990) argues, cities' entrepreneurial economic development policies are accompanied by the formation of distinctive institutional arrangements and practices, such as: public or quasi-public development agencies, the issuance of industrial revenue bonds, equity financing, and the

distinctive geographical predisposition towards the downtown. Leitner (1990) shows that local context matters in the process: the health of the local economy, the nature of local political cultures, and the willingness for groups to collaborate, all play a significant role in shaping institutions and their success.

While some Makerspaces, particularly Hackerspaces, arise from the CBPP governance tradition that emphasizes decentralized governance and social motivations, some Makerspaces are created by Creative Cities governance networks, as part of broader innovation infrastructures as defined by Roberto (2014). The following section will explore literature which demonstrates this connection between Creative Cities urban governance networks and Makerspaces that have emerged in the past five to ten years.

The literature on Creative Class can situate the citizens and policymakers' interest in Makerspace as part of broader pursuit for the Creative City image and the creation of innovation infrastructures. In the policy proposal *Makerspaces: Supporting an Entrepreneurial System,* Benton et al. (2013) demonstrate how Makerspaces are connected with urban policies associated with encouraging entrepreneurship and creativity. The report, prepared by researchers from Michigan State University's Center for Community and Economic Development for the City of East Lansing and the East Lansing Public Library, aims to encourage the creation of a public library based system of Makerspaces. The report uses similar language to Florida (2005) and other proponents of the creative cities strategy. It states that Makerspaces are part of "building an entrepreneurial ecosystem based on talent, innovation, and creativity that fosters a vibrant local community" (p.3).

Given the Benton et al. (2013) report's focus on encouraging local policy actors to actually build a Makerspace, it emphasizes the required external and internal governance networks, membership fees, partners, space, equipment, safety aspects, and insurance in ways not seen in academic literature on DIY spaces. Benton et al. (ibid.) detail the these requirements show that the creation of a space involves much more than a group of individuals coming together in a do-ocracy:

First, the Makerspace needs legal status and governance: the authors show that most Makerspaces are non-profit organizations governed by elected boards, with the minority being incorporated for-profit companies or nested within existing organizations (e.g., universities, public libraries, museums)

Second, Benton et. al. highlight that Makerspaces need membership fees and or funding: while membership fees often serve as the primary income source for a space though different membership levels or sliding-scale pricing, some spaces res to attempt to encourage more participants. Some spaces receive grants or donations.

Third, Benton et. al. highlight that Makerspaces need physical space and equipment. The authors state that the "majority of Makerspaces start small" in terms of space and equipment – yet many can grow into large spaces with a variety of expensive tools. Many spaces reviewed by the authors reported challenges finding "adequate and affordable space" (p.11) to accommodate their wide variety of tools and requirements.

Fourth, the authors indicate that Makerspaces (should) abide by safety standards. While safety standards are overlooked by other authors, Benton et. al. state that for "particularly dangerous or expensive equipment, prior knowledge or training within the Makerspace is required" (p.11). Makerspaces have had issues with building codes and

fire systems in the past. For instance, MakeIt Labs, a Hackerspace in Nashua, was closed after opening in 2011 by the local government for lack of building permits and improper ventilation in a welding area. (Brooks, 2011) Along these lines, liability insurance policies are needed for Makerspaces, and waiver forms for participants are suggested by Benton et. al.

Fifth, the authors found that startup capital is needed to found a makerspace, but startup costs are dependent on what the space wishes to offer. The startup capital can range from simple equipment expenses, but "could include personnel and mentor costs, space built-out tools and materials, and others."(p.28)

Sixth, given that Benton et al. (ibid.) are writing from the perspective of a library-based Makerspace, they recognize that there are sources of expertise and equipment outside the founding institution: they state that the local library should form partnerships with local makers, innovation centres and academic institutions. The authors argue "local governments need to be efficient in allocating limited resources and avoid duplicating efforts already taking place in the region" (p.28). They suggest tapping into the local maker community to provide workshops and experience.

The Benton et al. report (ibid.) cites three major implementation challenges for library-based Makerspaces; First, noise and physical damage were identified as a major concern, given that "Makerspaces by their purpose have noisier and messier activities that are vastly different than a quiet public library setting." (p. 29) Benton et al. (ibid.) cite several design measures deployed by other libraries to reduce noise the impact of noise in their Makerspaces, including insulated glass spaces, insulated flooring, and separation of Maker activities from the main library space. Second, stakeholder's support

was identified as a significant issue, with the authors recommending that "all staff and the Board of Directors" should to be consulted by the project's initiators (Benton et al., 2013; page 30). Third, staff training was identified as a concern for the library, with the authors citing staff members' concerns at other library Makerspaces "about having to learn new skills in addition to their own responsibilities" (p.30).

I focus on the Benton et al. (2013) report because it highlights the wide range of issues in space governance that can emerge in the founding and management of a Makerspace within a governance network that involves formal institutions. The central aim of this paper is to demonstrate that the way these issues are handled matters. The research previously introduced cites social and organizational issues, but there is lack of in-depth academic research that takes the role of governance seriously.

2.5 Conclusion

A variety of significant ideas have emerged through this literature review: First, there are a wide variety of spaces (Hackerspaces, Hacklabs, FabLabs) with their own histories and motivations but have nonetheless converged into similar enough practices that the collective term Makerspaces is sufficiently descriptive. Second, a growing body of literature focuses on Makerspaces practices and potential, but there is a significant lack of literature exploring governance questions in Makerspaces; Third, Makerspaces, especially self-identified Hackerspaces, have adopted the governance model of CBPP, which emphasizes decentralization and social-benefit motivation; Fourth, emergent Makerspaces focused on fostering Entrepreneurship and Innovation instead of intrinsic tinkering are the product of Creative Cities governance networks, and can be seen as part of broader Innovation Infrastructures in the context of the neoliberal city.

CHAPTER 3: METHODOLOGY

The aim of this study is to analyze variance in governance networks and practices in Makerspaces in a particular urban context. I selected a place that had a wide variety of Makerspaces with both long and short histories. Toronto, Canada has nine spaces that self-identify as entities related to Makerspaces: Hackerspaces (Hacklab T.O., Site3), Makerspaces (Toronto Tool Library, MakeWorks, Toronto Reference Library, Ultimate Workshop, MakerKids, STEAMLabs, The Shop, Repair Café), and DIYBio Labs (DIYBio Toronto). Fieldwork for this study was conducted in July and August 2015 in Toronto, Canada and its surrounding region. My research methodology deployed a qualitative mixed-methods approach that included a content analysis of Makerspaces' websites and documents, observation of Makerspaces, and semi-structured interviews with members of Makerspaces and Makerspace organizers. This methodology is built from a foundation of John Law's (2009) understanding of Actor Network Theory (ANT) and Dankert (2010)'s guide for using ANT as a method.

3.1 Actor Network Theory

As Law (2009) discusses in his chapter *Actor Network Theory and material semiotics,* Actor Network Theory (ANT) is "not a theory," because theories by definition provide a lens to "explain why something happens" (Law 2009; 141). Instead, ANT *describes* rather than *explains* networks of relations between actors.

ANT leaves room for a huge variety of actors to be considered, including: "objects, subjects, human beings, machines, animals, "nature," ideas, organizations, inequalities, scale and sizes, and geographical arrangements" (Law 2009; 141). ANT focuses on tracing the connections (networks) between these actors.

Law (2009) states that ANT is best understood as a "disparate family of material-semiotic tools, sensibilities, and methods of analysis." Yet seminal texts on ANT (Law, 2009; Latour, 1995) emphasize theoretical definitions to the detriment of exact methods and tools for ANT. Dankert (2010) provided a brief but useful guide for introducing ANT into my field research methodology. Dankert (2010; p.6) suggests that the researcher begin by "exploring and unraveling" a single actor network, in my case the Maker Community in Toronto, through analyzing documents and interviewing actors in the network. Second, observations are important to hear the actors involved and see the traces left behind by actors, in my case, observing individual Makerspaces.

3.2 Content Analysis

In line with Law (2009) and Dankert (2010), I analyzed websites and documents related to Toronto's Makerspaces, which are immutable mobiles that describe different groups and actor networks. I searched for evidence of groups, translations and connections between actors in the websites of the studied Makerspaces, the public Google Group 'Canadian Creative Spaces', as well as local government documents, spaces' policy documents and Wikis where available. Ordinarily, content analysis "classifies textual material, reducing it to more relevant, manageable bits of data" (Weber, 1990; p.5). As such, a coding and note taking system was deployed to trace the observed networks for future analysis.

3.3 Observation

Kearns (2010) simplifies participant observation for geographers as "strategically placing oneself in places where systematic understandings of place are most likely to arise." As such, I observed six of the studied Makerspaces on their open-house nights or

opening hours to better understand these spaces and their actor networks; whether or not I observed was dependent on whether the space welcomed the observation (Table 1). My aim was to gain understandings of the actors in the network and how they govern each other, while attempting to minimize the effect I was having on the space. Two conferences were also observed, Maker Festival and MakeChange, both in July 2015.

Table 1- List of Observations

Category	Observation #	Sectorial Type	Makerspace Name	Event Observed
Hackerspace	1	Non-Profit	Site.3 Co.Laboratory	Open House
	2	Non-Profit	UnLab	Open House
	3	Non-Profit	HackLab.TO	Open House
Makerspace	5	Non-Profit	Toronto Tool Library	Open House
FabLab	6	Government	Digital Innovation Hub – Toronto Reference Library Location	Opening hours
Conference	7	Non-Profit	Maker Festival	Conference
	8	Non-Profit	MakeChange	Conference

3.4 Semi-Structured Interviews

I used semi-structured interviews to gain insight into the actor's governance network and provide background information on a space's motivation. Some of the interview questions are intentionally open- ended to allow complex answers that follow from the participant's experiences; whereas others request information that would be difficult to find through any other source. My aim in the interviews was to have enough structure that I can answer my research questions by uncovering governance networks, while still allowing for responses that I did not anticipate. There are two sets of questions:

one for makers and space organizers, and another for city staff and funders, to ensure that

I am asking the right kinds of questions to each participant. The interview guides can be

found in Appendix A and B.

Table 2 – List of Respondents

Category of Makerspace	Respondent #	Sectorial Type	Makerspace Name	Position
Hackerspace	1	Non-Profit	Site.3 Co.Laboratory	Former Board Member
	2	Non-Profit	UnLab	Executive Director
	3	Non-Profit	HackLab.TO	Executive Director
Makerspace	4	For-Profit	The Shop	Co-Founder
	5	For-Profit	MakerKids	Staff
	6	Non-Profit	Toronto Tool Library	Board Member
	7	Non-Profit	Repair Café Toronto	Co Founders
FabLab	9	Government	Digital Innovation Hub – Toronto Reference Library Location	Project Leader

CHAPTER 4: RESULTS

Through a process of interviews, observations and document review, I found considerable evidence that the practice of managing Makerspaces involves complex, multinodal governance networks that involve the State, discourses of Do-ocracy, Non-Human Actors and formal governance structures. This chapter will first introduce the eight Makerspaces and then move to demonstrating that each of the aforementioned factors is significant in governing Makerspaces.

4.1 Context – Makerspaces Studied and Space Motivation

The eight Makerspaces consist of a range of the Toronto area's Makerspaces, including for-profit, non-profit, government run, and informal spaces. Interviews were conducted with at least one current or former organizer of each space, and, where possible, spaces were visited on their open-house nights to conduct observation of the space.

Site.3 Co.Laboratory identifies as a "member-run space for Makers in downtown Toronto" (Site.3.ca, 2016). Located on Toronto's West end in a 2000 square foot, industrially zoned, building, it contains tools, metalworking, woodworking, Lasercutting, 3D Printing, and electronics-workstations. A registered non-profit, Site.3 had a wide variety of members, but the main focus of the space was creating public art projects.

UnLab identifies as "London, Ontario's own Makerspace" and is formally governed by its parent incorporated non-profit, UnLondon. The UnLab offers a 3D Printer, woodworking tools, and networking servers. It describes itself as "a place where artists, makers, and techies converge so they can gather, create, and improve." (Unlab.ca/about)

HackLab.TO is located in Toronto's Parkdale neighborhood, and consists of a wide variety of tools, including: Lasercutters, 3D Printers, a darkroom for developing photographs, electronics workstations, a DIYBio Lab, and amateur radio tools. The space identifies as Toronto's first Hackerspace, is governed formally by a non-profit corporation, and sees its membership as including " artists, computer programmers, web designers, and hardware hackers" (Hacklab.to/about).

Repair Café is an event where volunteers assist the public in fixing broken items. Run by a collective team with little formal governance structure, Repair Café holds events about once a month in different locations around Toronto.

The Shop is a for-profit makerspace which offers woodworking and ceramics tools (i.e., pottery wheels, kilns). The Shop offers workshops and includes a store where members can sell their handmade goods.

MakerKids is a for-profit makerspace for kids. It offers workshops, after-school programs, and summer camps on open-source electronics, videogame design, and robotics.

Digital Innovation Hub Toronto Reference Library is one of three FabLab-like spaces run by the Toronto Libraries. It contains 3D printers, a book printing machine, open-source electronics kits, and computer workstations.

Toronto Tool Library runs a system of 'libraries for tools,' but also a full Makerspace in Toronto's East end containing 3D printers, an open-source Lasercutter, and a full woodworking shop. The Tool Library and its makerspace are a project of a larger non-profit corporation, the Institute For a Resource Based Economy (IRBE).

4.2 Observed Governance Actors

This section will explore the study's first research question, analyzing what actors are involved in the governance networks of Makerspaces. First, it will investigate how Hackerspaces use a common language of Do-ocracy to describe their governance, characterizing their actions as being controlled by 'those who do things' versus 'those who don't.' Second, it will explore potential challenges, which emerged in the practice of Do-ocracy, challenging this discourse by highlighting the intervening role of *space*. Third, it will discuss the importance of non-human actors in the governance networks.

4.2.1 Do-ocracy

Two spaces, Hacklab.TO and Site3, identified Do-ocracy as the central governing principle for their spaces. As described in the literature review, the concept is common throughout many Hackerspaces, and is translated into new contexts through Hackerspace.org and other policy artifacts. To review, "Do-ocracy" governing models assume that the power to influence things should be in the hands of those who 'do' versus those who don't. Eric Boyd, Executive Director of HackLab.TO described Do-ocracy in a way that emphasizes those who used things ought to be the ones who make decisions about them: "If you're actively using things, you have a lot of say in terms of how things are used, displayed, and stored, and so on" (Respondent 3). Hillary Predko, former board member of Site.3, described that Do-ocracy is "very central to the way it [the space] functions," describing that "things happen or don't happen" based on people "stepping up" (Respondent 1). The concept emerged within HackLab's tool purchasing process: minor tools are purchased by individual members and donated to the space; whereas, major tool purchases are funded through an established crowd funding process among

members. The process begins with an individual member researching the tool, then sending an email to the space's members stating how much it costs and why the space needs it. Then others contribute money to purchase the tool for common use, and finally the initial member purchases the tool and is reimbursed by other members. This purchasing system had funded many of HackLab's purchases, including their laser-cutter and milling machine.

Do-ocracy was also implicitly described by an organizer for the Toronto Tool Library as a model for their space through emphasizing that members had freedom to change –or improve- the space as they saw fit, a process that he said begins with an email list. "There is a desire to help the space as their own woodshop essentially," and members often "spontaneously build there together" to change the space as needed (Respondent 6).

4.2.2 Challenges to Do-ocracy

Although Do-ocracy was cited as a governance model for spaces, significant challenges emerge in the practice of the deploying Do-ocracy in practice. Three participants discussed their experiences with Do-ocracy, two of which had stated their spaces still used the concept. The other's space had departed from it entirely.

Do-ocracy was explicitly referred to as leading to a tragedy of the commons by one respondent. If the main rule is to 'do things' within the space, the results are that "a lot of things being left around, people leaving materials out, tools breaking and not being replaced" (Respondent 1), Interestingly, Respondent 1 also argued that the extent of these adverse effects led to more members not addressing the common-good: "If things keep

getting left out, then why are you going to put away your project if nobody else is doing that?"

In some ways, the tragedy of the commons addresses a common theme throughout all the participant's interviews: rules and norms are needed to mitigate each individual's impact on the space, as seen in the CBPP literature.

One community Makerspace's Executive Director described how his experiences with Do-ocracy had led to nothing getting done. To describe how Do-ocracy had failed to work in his space, he deployed the metaphor of the *Bike Shed*, another common term in hackerspaces:

> A bike shed is where someone decides to build a bike shed, and then everyone starts talking about what colour it should be, and no one ever makes up their mind, so the bike shed never gets made (Respondent 2).

He felt that bike sheds metaphor emerged within his space under Do-ocracy because ultimately, people are encouraged to act independently, but their independent actions end up interfering with each other:

> One person will do something, but that ends up causing someone else to be annoyed, and rather than just doing their own thing, they end up wasting bandwidth with that (trying to address the other's action) (Respondent 2),

As such, he chose to move his space toward a more centralized decision-making process. This will be explored later in the paper in Section 4.4.1.

Hacklab.TO continues to describe its governance model as a Do-ocracy, although it has implemented controls on individuals' actions to influence common spaces. One such control is its room steward program, wherein members are appointed to be

"responsible for the orderliness and planning of a room" (Respondent 2). According to Boyd, the necessity for room stewards followed from conflicts over how spaces were organized and maintained: they are responsible for cleaning the room but also for coordinating the process of reorganizing the space. As he describes, the room stewards have a significant say in the organization of space:

> But these people still have a major say in the space; if you want to make a major change to the way the room works, that person should be involved because often several layouts have been tried in the past, and if you just reorganize it, you might just be trying something that's been already tried but just didn't work. (Respondent 2)

The room steward example highlights that unmediated independent 'doing' has not always been successful for Makerspaces, and as such mechanisms have had to be created to limit the do-ocracy.

4.2.3 Role of Non-Human actors in Space Governance

These above experiences reflect that physical space and non-human actors play a significant role in governing Makerspaces. All study participants described some way in which the limitations or potential of their space, or the status of particular objects, had affected their activities. Decentralized governance models such as Do-ocracy assume that human actors can and should impose their will upon common space infinitely without it impeding others ability to do the same. There is substantial evidence that the agency of space and objects undermines this and as such calls to question the effectiveness of the Do-ocracy model. Although mundane or ordinary, the characteristics of the space and non-human actors cannot be ignored.

Five participants cited noise as a limiting factor on their space's activities. Respondent 6 from the Toronto Tool Library stated that their members have 24-hour access to the space but, given their location in a mixed-use (Commercial/Residential) building, their neighbors have complained in the past about particularly noisy tools. Consequently, the space has established rules prohibiting the use of the wood planer beyond 9 pm. As well, all doors must be closed while running the tool. Second, the organizer of a makerspace that shares a unit with a co-working office stated that when the new Coworking office had few tenants, "we could do whatever we wanted" (Respondent 4). Since the Coworking office was now nearly full at the time of interviewing, she stated that, "sometimes when we do run our woodshop it's noisy. We've got some complains, but we were here first, and people know what they're getting into when they're coming into the space" (Respondent 4). It is important to note, however, that their space's woodshop now only runs outside of working hours. Further, the TPL's DIH is sited within ordinary TPL branches. As such, noise limits their tools to basic 3D Printers. HackLab.TO were told by their building manager that they should not "make large booming or grinding noises in the shop during business hours" given that the other tenants in the building include a legal aid office and recording studios – although, the spaces' director highlighted that this limitation is not a substantial issue, given that "most of our members have day jobs" (Respondent 3).

Ventilation also limited spaces' activities. Lasercutters, seen as a key component of any FabLab (Gershenfeld citation), were cited by three Makerspaces as being particularly problematic. The UnLab's Executive Director highlighted that his space's lack of ventilation caused his Lasercutter to "put out a chemical smell" when it cut

certain materials, and as such the use of the tool was limited in their current space (Respondent 2). DIH's project leader also identified ventilation as a key reason why their space only included 3D Printers and not a laser cutter, stating that "we try to be up to date with our offerings, but we're limited by the space itself" (Respondent 8).

Respondents from three Makerspaces cited open flame, sparks and metalworking as activities that their spaces prevented. The Shop had planned to be a metalworking, woodworking, and ceramics space but their organizer stated that metalwork was "limited partially by the space – metal and wood are not really a good mix," and as such the space was put on a path which was more arts and crafts focused (Respondent 4). Further, HackLab.TO (Respondent 3) stated that open flame was prohibited in their space, as it may trigger the building's fire suppression system. Similar to the aforementioned issue with Lasercutting, UnLondon cited metalworking and welding as prohibited from their current Hackerspace (Respondent 2).

Conflicts over noise, ventilation, and tools caused Makerspaces to split in two physical spaces. UnLondon's Executive Director described how their Hackerspace, the UnLab, at first combined a media production studio with woodworking tools and 3D Printers, a mix that in his view, did not work effectively because "It's hard for a business to start, especially in digital media, in the same space where someone is trying to use a band saw or drill press. Practically, the noise level gave us the ability to do only one or the other" (Respondent 2). UnLondon founded a second space in 2014 to house digital media tools, and is aiming to open a space for woodworking and metalworking in the future.

Site.3 Co.Laboratory also emerged from conflicts rooted in the limitations of space, noise, and ventilation. According to interview participants, the space was founded by former members of HackLab.TO in 2013 who wanted a makerspace that could handle metalworking, noisier tools, and larger works of art (Respondents 1, 2, 3). The first Hacklab.TO space was located in Toronto's Kensington Market neighborhood, and was mainly focused on electronics and additive manufacturing technologies. One person I interviewed (Respondent 1) discussed how Site.3's founding members worked in the film industry, and wanted larger space to work on personal projects related in prop building, costumes, and special effects. They found a space located within an alleyway with industrial zoning, no access to running water, and large French doors that would accommodate the easy movement of larger works, and tools. Figure 2 shows the space itself, which is well suited to accommodate a very wide variety of activities.
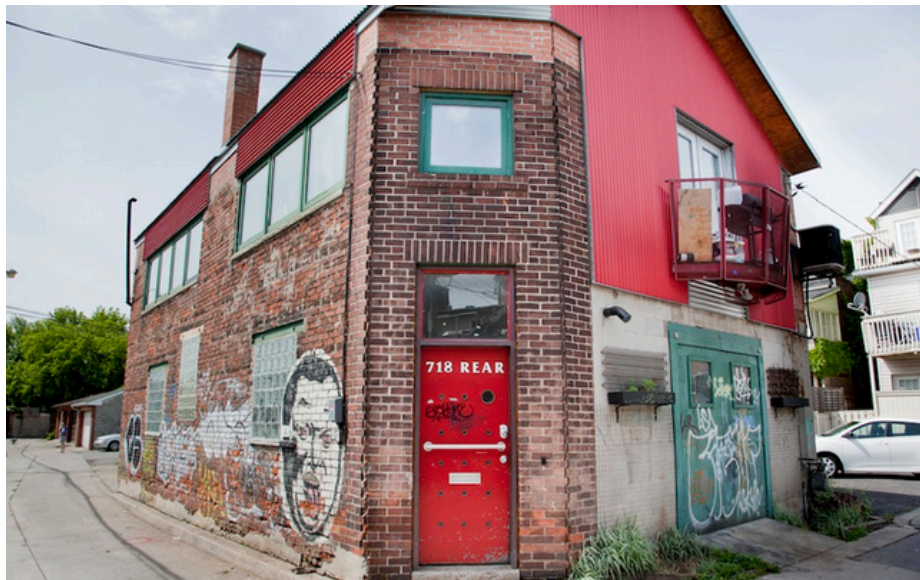
Figure 2: Site.3 Co.Laboratory (Source: Makerfestival.ca)

The case of Site.3 is compelling because it demonstrates the scale and variety of projects that emerge in when a space is not substantially limited in terms of noise and activity. For

example, Site.3's members formed Site.3 Fire Arts; a collective with uses the shop to produce large-scale pyrotechnic projects for Burning Man and other public art exhibitions. Their projects include Riskee Ball, a pyrotechnic version of Skee Ball (Figure 3)

Figure 1: Site.3 Fire Arts' Riskee Ball (Source: Neil Girling, 2013; https://flic.kr/p/fDLF2F)

When asked about the division between HackLab.TO and Site.3, those involved with both spaces understood that the division between spaces based on use made sense to them – the separation allowed each space to focus on its efforts without them interfering.

4.3 Governance Structures

Document review found that each Makerspace's *governance network* is comprised of a variety of actors opposed to centralized institutions. The

aforementioned informal and non-human actors are significant, but each space is also impacted by its formal governance institutions. Table 1 shows the legal status, governance system and head of space (if available) for each of the cases. All but one of the spaces investigated had a formal governing entity, be it a nonprofit board, for-profit corporation, or connection to local government. I found that there was a substantial amount of variance between the responsibilities of each spaces formal governing entity, even between spaces with the same legal status. In this section I will first discuss the legal status of each case and investigate what involvement, if any, their Makerspace members or participants play within the governance of their space.

	Legal Status	Formal Governance System	Board's Responsibilities	Head of Space	Member Involvement in Governance
Site.3	Nonprofit Corporation	Board of Directors	Oversees the actions of the physical space, handles finances and government documents	Executive Director	Board is comprised of full-time members; space is run by members through 'Do-ocracy'
UnLondon	Nonprofit Corporation	Board of Directors	Oversees the organization's spaces, workshops, other initiatives	"Executive Director" - Titus Ferguson	UnLab Member Committee
Repair Café	"Community group" - No Status	8 person organizing team	Plans Repair Café Events	N/A	N/A
HacklabTO	Nonprofit Corporation	Board of Directors	"Only to interface with the government and solve problems related to finances"	Executive Director	Do-ocracy
The Shop	Private Corporation	Co-Founders		Co-Founders	Volunteer Shop Supervisors
MakerKids	Private Corporation	CEO and 2 Full-Time Staff		CEO	"Kidvisory Board
Digital Innovation Hub	Public Entity	Toronto Public Library Board	Oversee & Fund the space	Project Leader & Branch Head of Library	Minimal
Toronto Tool Library	Project within a Nonprofit Corporation	Larger nonprofit's Board of Directors	Manages the Toronto Tool	Executive Director	Do-ocracy

Table 3: List of Formal Governance Structures for the investigated spaces

A board of directors that consists of five elected positions governs HackLab.TO. Their executive director stressed that their board exists primarily to interact with government (i.e., the City of Toronto Entrepreneurship Development and the Federal Government for non-profit status) and handle the physical space's finances, and that "In our ideal world, board meetings are about 10 minutes long, and consist of saying 'Hacklab is great" (Respondent 3). Once one moves beyond review of the organization's website to interviews, the board's responsibilities to the government are more time-consuming and complex. These include filing forms related to their non-profit status when there is a change in officers of their board of directors or address, a process that Boyd characterized as "tedious" and "unbelievably punishing for small things" (Respondent 3). Second, the board ensures that "taxes get done, the rent checks, and utilities get paid" (Respondent 3). The board is also responsible for overseeing its dispute resolution mechanism and anti-harassment policy for members (and creating new policies when necessary). In spite of these responsibilities, Boyd stated that the spaces' board is "not supposed to be involved in the actual governance of the space itself and how members operate" (Respondent 3).

In terms of formal institutions, which enable member involvement in governing space, HackLab.TO's executive director described at least four units in the governance network. The first is Do-ocracy, which he described as the in-personal natural leadership that emerges. Second, there is an email list where "larger things can be hashed out or discussed" (Respondent 3). Third, there are quarterly members meetings, which Boyd described where larger discussions "can happen in person," and changes tot the official Bylaws can be made (Respondent 3). Fourth, the aforementioned room steward program gives members substantial power over the organization of the space, given their ability to control what goes into their respective room.

The Toronto Tool Library's Makerspace does not have its own formal governance structure. Instead it is run by a larger non-profit institution, the Institute For a Resource Based Economy (IRBE), which has its own board of directors comprised of officers from a variety of backgrounds. IRBE runs the Tool Library lending locations and workshops, with the stated mission of working at the "intersection of economics and the environment by challenging people's perceptions of ownership and our relationship to the Earth's resources" (website citation). IRBE's board of directors, executive director, and president hold the formal governing power for the Tool Library's Makerspace, but as described earlier, they allow paying Makerspace Members within to make improvements to their physical Makerspace as they see fit. The result is a space that is dynamic and always improving, and the respondent from the Toronto Tool Library reported no issues with this practice (Respondent 6).

UnLondon's Makerspace, the UnLab, is one of two physical spaces that the nonprofit runs. As a registered nonprofit, UnLondon is formally governed by a board of directors, but the Makerspace's executive director wields a substantial amount of power of the board and the makerspace. The executive director's formal power in the governance system stems from his reaction to perceived stagnation and mismanagement of the space. Two years after Ferguson and two others founded the space in 2010; he and another co-founder resigned their board seats after new jobs left them with little time to run the space. Ferguson stated that, "he didn't have as much time to devote to the organization" (Respondent 2). In his view he "watched while the organization really didn't do anything, either in the UnLab as a space, or as a broad organization or nonprofit" (*ibid*.). Ferguson returned to the organization in 2012, and, citing what he saw as missed opportunities and wasted potential, asked the board to consider bringing him on as executive director in 2013. A representative of the board stated he/she was "not quite sure why

they needed that (an Executive Director)" (Respondent 2) and gave Ferguson the title of Chief Maker of the space instead. After what he characterized as a period of potential mismanagement of the board and "not well thought out" partnerships, Ferguson discovered that "we'd never properly transitioned the board from the original founding board, to the new one" (Respondent 2). As a result, he and the other two co-founders were legally still the only officers for the nonprofit corporation, and he took the opportunity to regain control over the organization:

> Now this sums up a whole lot of time, but I asked for the existing boards resignation; I said, "You don't actually have to, because you're not actually a board, but I'd like to receive all your resignations and we will start anew." And, uh, some of them willingly need, others not so willingly, but it didn't matter because they were slowly killing the organization (Respondent 2).

What is compelling about this process is it demonstrates that formal rules and governance regimes can have substantial effects on the motivation for the space, as the respondent was able to move the space in a new direction through regaining control of the space's formal governance. While this was playing out, the members of the UnLab, as Ferguson described, had been focusing on sharing projects and ideas, but "the space had turned slowly into just a clubhouse," and in his view, "there wasn't as much work being done" (Respondent 2). As such, when he regained control over the organization and reappointed a board that supported his vision for the space, he also introduced a committee for active members of the UnLab to make decisions about the space. However, the governance system was set up in a manner that prevents either actor (either the board of directors or the UnLab committee) from making decisions about the space independently of the other actor, "it is (The UnLab committee) chaired by a member of the

board, so there's a dialog. It's not like decisions are being made independently by either group without collaboration" (Respondent 2).

Also playing out within the governance network of the UnLab is a tension between *tinkering* and commons-motivated making with more *capital focused* or *entrepreneurial* making. Ferguson and the new board are interested in projects being "birthed, iterated, and launched, out of the space," whereas the current members of the space perhaps wished for a space to tinker with electronics for fun in their spare time (Respondent 2). Given the extent of control Ferguson has on the organization, it would not be a stretch to compare his actions to other leaders of CBPP initiatives that run their initiatives as a *Benevolent Dictators for Life (BDFLs).*

Site.3 is governed by a board of directors, but the board has more specific responsibilities than the members in other spaces. The board is comprised of full-time members who take on positions including Shop Operations (who is in charge of shop cleanup and maintenance), Treasurer (who handles the space's finance), and communications (who takes care of the space's social media and email list) (Respondent 1). While this system of governance involves members in a meaningful capacity, the unpaid nature of the positions means there is a tension between taking on dedicated responsibilities and being compensated for your time, as Respondent 1 indicated that she found her role as Shop Operations manager as "pretty taxing on me to take on a large role that was unpaid." The Site.3 board governed the space ultimately, yet the space has an emergent character that demonstrates the space's formal structure places few limits on the practices of the spaces members (Observation 1).

Two of the spaces investigated (The Shop and MakerKids) were for-profit entities. I heard through interviews that their governance networks were more centralized and less complex than non-profit boards. First, they each had only a few decision-makers who had clear roles and

responsibilities. Second, the centralized decision making power led to more *scripted* kinds of interaction. Third, they both gave members of their organizations--makers--some limited decision-making power within the space.

Both spaces had centralized governance networks comprised of a few actors. The Shop is run by two co-founders who own and run the business. MakerKids formal governance network is comprised of a chief executive officer, who is the owner of the business, and two full-time staff who assist in running the operation. Both Makerspaces had more scripted programming than the other makerspace cases. The Shop had certain open hours for their members but lacked the 24-hours access of other Makerspaces. The Shop put more emphasis on workshops and classes than other spaces. MakerKids, billed as a makerspace for children, mainly relies on workshops and summer camps to engage kids in the practice of making. Whereas MakerKids previously ran a regular OpenMake night for kids; the staff found it difficult to assist kids who were working on radically different projects at the same time so it ended the practice. At the time of interviewing, a MakerKids staff member stated that OpenMake would be replaced with themed project nights (Respondent 5).

Both MakerKids and The Shop had opportunities for certain active members to involved in the management of their spaces. The Shop allowed two members to oversee their woodshop's open hours and help with the management of the shop, in exchange for free memberships to the space. MakerKids found ways of involving their makers in the practice of governing as well, through a "Kidvisory Board" of active members; the staff I interviewed valued their feedback. One maker commented:

> We went to them saying 'what do you think would be a good use for this stuff' and that
>
> kind of thing. And some of them have great ideas, other ones have said we have said 'let's

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make a dumbwaiter that goes down to Pizza Pizza. But we do have kids who give really

positive feedback (Respondent 5).

Ultimately, both cases of makers being involved in for-profit spaces gave makers limited power to implement changes independently; whereas it gave them a role in the consultation process, unlike some of the non-profit spaces they wielded little actual power.

The TPL DIH also had a centralized governance network, which was more complex and multinodal than the other observed models. The Project Leader I interviewed described additional levels of governance actors in the institution. First, TPL's board approved the FabLab's founding and holds ultimate authority for what tools it owns, what workshops and services it offers. Second, an affiliated non-profit, TPL Foundation, partially funds the space. Third, a Digital Content and Innovation Steering Committee, which is part of the Toronto Public Library, makes recommendations to the TPL Board about how the space should be run. Fourth, TPL has branch heads and managers, who run each branch and supervise each of the DIHs. Finally, a project leader supervises the paid staff in the Digital Innovation Hub, who are a "mix of digital design technicians and librarians" (Respondent 8). This governance system is significant because actual makers were minimally involved in the process. The initiative was governed as any other library service offering. Implications?

One organization, Repair Café Toronto, had no legal status or formalized governing structure. Structurally, an eight-person 'organizing team' governed the initiative. An associated non-profit board (Skills for Change) acts as their partner when the initiative applies for funding. Repair Café does not operate a consistent physical space, but rather sets up a space in a different location each month. Therefore, who participates in governing their activities depends on the organizations that partner with them to run each event. Implications?

4.4 The State's Role in Makerspace Governance

My third research question pertains to what formal role the municipalities (The City of Toronto and the City of London) have in each of the investigated Makerspaces' governance systems. Stoker (1998) understood *governance* to include a set of institutions from both inside and outside formal government, and part of my task was to chart which government actors had become involved in the governance of Toronto's Makerspaces. I found that all but two of the Makerspaces described their relationship with the city to be either 'minimal' or 'non-existent'. Indeed, Makerspaces were generally satisfied with the lack of interaction with the local government. When the city did get involved in the *governance networks* of the Maker Community, it was used a set of policy tools to "steer and guide" the Maker Community instead of using its regulatory power to restrict Makerspaces, again echoing Stoker's (1998) understanding of governance.

When asked about their interaction with the City of Toronto, six of eight Makerspace organizers interviewed described a lack of interaction with both policy actors and regulatory actors. A Board Member of the Toronto Tool Library, said he had briefly met the mayor, John Tory, but that "[in terms of] Regulatory people, we haven't met anyone." (Respondent 6) Further, when the same respondent was asked if he thought the City is acting to discourage or encouraging Makerspaces, he stated, "I would say no action at all." (Respondent 6) This position that the local government was not involved in governing their activities was echoed by other participants, including a former board member of Site3, who stated "we've mostly existed pretty apart from governmental bodies. For better or for worse"(Respondent 1).

Part of this lack of interaction was rooted in a lack of awareness of Makerspaces on the

part of city staff. One co-founder of The Shop, a Makerspace opened in 2013, stated: "When we got started, nobody really knew what a Makerspace was, and as such there was really no classification for it. So we didn't really need anything [in terms of permits or regulation], we slipped under the radar." The Executive Director of UnLondon reiterated the same sentiment about city policymakers from London, Ontario's municipal government, describing that, whereas the local government has lent their space legitimacy by partnering with them to run events, the policymakers were "probably still confused as to what goes on in the UnLab" (Respondent 2).

As we have seen in the literature review, other states have intervened in their Makerspaces by either directly supporting the emergence of Makerspaces or regulating them through deploying building codes and safety regulations. As one participant stated, "I'm not really faced with restrictions despite how public it is…this is where are really lucky" (Respondent 2). The same participant described that a Makerspace his organization partnered with in Calgary was faced with "tons of building and safety inspectors" after they were interviewed by local media in 2013 (Ibid.).   A member of the makerspace (Protospace), which was inspected, described the situation on an online message board:

> He [the city inspector] saw 4 partially-working welders gathering dust by the bay
>
> door, and a laser cutter with ventilation we added ourselves to an existing roof
>
> vent... and then mandated $40,000 worth of professional HVAC be done or we'd be
>
> locked out. We got the bill down to $17,000. (Freund, 2015; para. 8)

According to the spaces' organizers, this inspection was rooted in the assumption that the Makerspace was a professional shop – with the four welders assumed to be running at the same time for 24 hours/day, despite that in practice the welders "only see an hour a month of tinkering use" (Ibid.). Regardless, the presence of the welders caused the space to become permanently

labeled as a professional shop: when the organizers asked the inspector if they could simply get rid of the welders, the inspector replied by stating that "now that he's seen them, we're now a welding shop and need to meet spec." (Ibid.) Given that Protospace had only a $1000 surplus from their last budget that year, the HVAC installation could have been potentially devastating without a fundraising effort. Since then, Protospace stated that they are "possibly the first Hackerspace in Canada to undergo an inspection by our city," and has recovered from the costs that resulted from the inspection. Whereas none of the Makerspaces studied in this project have undergone inspections from city regulators, it is important to note that regulatory movement in this area is possible in the future; while the state was not involved in regulating individual spaces, it was involved in the governance of space in a steering and guiding role.

4.4.1 Motivations for the State's Engagement in Makerspace

Instead of using its authority to restrict Makers' activities, the City of Toronto has been involved in *steering and guiding* the Maker Community towards certain economic priorities, by giving legitimacy to spaces, indirectly founding new spaces, and sponsoring maker events. This is in line with what the literature review anticipated with regards to urban governance Creative Cities policy. Whereas spaces feel as though they have minimal involvement with the municipal government - there is significant evidence that the certain municipal actors are formally and actively interested in the Maker Community, at least insofar as Making relates to discourses of *innovation and entrepreneurship*.

The Toronto government's Entrepreneurship Services department sponsored Maker Festival 2015, a weekend-long event that aimed to celebrate Toronto's Maker Community, according to one of its Co-Founders (Respondent 2). The sponsorship came through its Manager

of Entrepreneurship Services, who contacted the team. Further sponsorships were described by the two privately run spaces, which had engaged directly with the city (UnLondon and The Shop). UnLondon received funding for new services and programming from the City of London, and when asked about what the city's motivation was in funding their space, he stated that:

> They see the potential for attracting, retaining, and training, the future workforce, be they Millenials or genX, we work on them wanting to be in London. They see the innovation that goes on, and maybe taking some of the experiments that we have going on, and apply them to the projects they are doing (Respondent 2).

In this case, references to 'innovation' and 'attracting, retaining, and training' people who fit within the narrative of a creative cities framework, make it clear that the City of London's support of UnLondon follows from their broader community economic development priorities to become a creative city. This was reiterated in the City's support of an emerging for-profit makerspace, The Shop; a city agency dedicated to supporting small business (Enterprise Toronto) assisted with the space through a small grant.

The Toronto Public Library (TPL) is the most involved of any municipally agency in the Maker community, and their efforts can be seen as the municipal government indirectly supporting Makerspaces. TPL runs three FabLabs in library locations, allows Maker Festival to use its central branch as a venue, and runs workshops related to maker skills.

When asked about the TPL's efforts, respondents from the Digital Innovation Hub and other Makerspaces thought that it was important to consider the TPL as a distinct actor from the City of Toronto, but substantial evidence indicated that they were still motivated by creative cities policies. Ab Velasco, the Project Leader for the Toronto Reference Library Digital

Innovation Hub (DIH), the FabLab run by the TPL, elucidated that, while funded largely by the City, TPL is guided by its own board and decision-makers. The DIH initiative is rooted in TPL's 2012-2015 strategic plan. This identified "create" as one of four 'themes' for TPL's DIH strategy and called for TPL to "integrate new and emerging technologies into virtual library services, and make them available anywhere/anytime" (Toronto Public Library, 2012). Velasco stated "our space was developed independently from the city," (Respondent 9) although he recognized that TPL's efforts aligned with the broader priorities of the city.

There is considerable evidence that TPL was motivated by economic priorities and creative cities theory when it decided to support making through the DIH and partnerships with incubators and Makerspaces. TPL's strategic plan deploys a discourse of *innovation* and *entrepreneurship,* stating that their efforts "position Torontonians to succeed in a global knowledge economy" (Toronto Public Library, 2012; 30). Further, the report directly quotes Florida's (2005) *The Flight of the Creative Class* when discussing its 'create' priority, declaring "We are entering the creative age because the key factor propelling us forward is the rise of creativity as the primary mover of our economy" (Florida, 2005; p.26).

This attachment to creativity as part of community economic development also stretches into how TPL actors view the rest of the maker community, with Velasco characterizing Toronto's Makerspaces as a "grassroots approach to people learning technology skills and their entrepreneurial and employability skills" (Respondent 8).

4.1.2 Makerspace Involvement With the State

I have already discussed the state's direct or indirect involvement with Makerspaces. Echoing Stoker's (1998; 18) emphasis on *governance* identifying "the blurring of boundaries for tackling social and economic issues," Makerspaces are becoming involved in the practice of

creating and implementing social policies, that is issues traditionally reserved for state actors. Two organizations, Repair Café and UnLondon, were involved in the policy creation process within their municipalities. Repair Café's organizers stated in an interview that they were involved in the drafting of the City's Waste Management Strategy, and spoke in front of the Toronto Public Works and Infrastructure Committee in September of 2015. Repair Café's organizers stated that they wished to share their ideas about how their activities can assist in the reduction of Toronto's waste, and how their involvement at local events reduced the overall waste. Further, UnLondon generated revenue from consulting with libraries and municipalities who wished to found Makerspaces.

CHAPTER 5: ANALYSIS AND CONCLUSION

This thesis' first research question sought to identify which actors were involved in the governance of Makerspaces:

1. Which actors play a role in the urban governance system that manages each of the Makerspaces?

In response, the Chapter 4 of the thesis identified a variety of possible actors who are involved in the governance networks of Makerspaces: First, discourses of "Do-ocracy" were significant in three spaces, portraying their governance system as non-existent outside of their members desire to 'do'. Second, Do-ocracy was shown to be an oversimplification of those spaces' governance systems, given those spaces actually had much more multi-nodal systems than the term portrays. Third, it is imperative that any understanding of makerspace governance take into account the significant role of non-human actors in the process: noise, ventilation, and tools all affected observed Makerspaces. Fourth, the formal governance structures and formal status greatly impacted each of the observed spaces by enabling or restricting member involvement in the management of the spaces, emphasizing particular activities, and funding certain tools and equipment.

The thesis's second research question highlights the role of the state in the governance system for Makerspaces:

2. What is the formal role of the municipalities (The City of Toronto and The City of London) in the urban governance networks of Makerspaces?

In response, Section 4.4 analyzed how actors from within government participated in the governance of Makerspaces. The results indicated that both municipal governments action was to steer and guide Makerspaces subtly toward economic development priorities; while this

interaction was not recognized by six of eight Makerspaces themselves. Second, neither municipality made use of its regulatory capacity to enforce building codes and safety bylaws onto the affected spaces, although respondents reported other Canadian spaces being affected by regulation. Third, where the state was involved, it used its power to fund Maker-related events and the Toronto Public Library's Makerspaces, but did so from a Creative-Cities motivated policy which saw the events as part of broader priorities of economic growth and Entrepreneurial urban development. Finally, two of the studied organizations engaged in developing policies with local governments, either through consulting with cities or developing policies related to their activities.

The Thesis' last research question investigates how the pieces fit together; that is, how these governance networks actually affect the practices of Makerspaces:

3. How are practices and values of Makerspaces influenced by their governance structure?

In response, I created a model that brings together the insights from the previous two questions, with the aim of developing an understanding of how governance can affect the practices of Makerspaces:
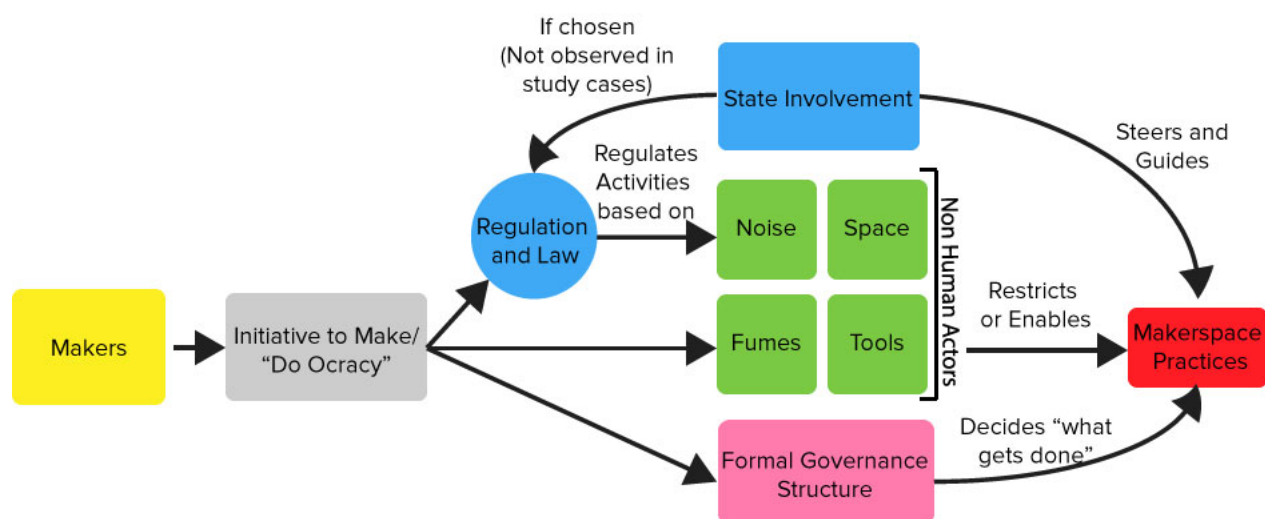
Figure 4: System model for Makerspace Governance

The process begins with the initiative to make – which, as highlighted in section 4.2.1, can be seen as the discourse of "Do-Ocracy" that permeates some Makerspaces. This intention is mediated by a wide variety of other actors in the network and governance factors. First, the State can choose to Makerspaces through building codes and regulations restricts the actions of particular makers by making use of legal tools to prevent them from using certain tools in their space, based on their noise, fumes, and safety requirements, which has occurred in some cases in Canada but was not observed in the studied Makerspaces. Second, Maker's intention to build something in a Makerspace is impacted by the non-human actors of noise, space, fumes, and tools regardless of government regulation, as they were demonstrated to have an impact on each of the observed Makerspaces. Third, Formal Governance structure mediates the action of Makerspace Members by deciding 'what gets done' – be it what tools to purchase, what activities to emphasize, or what policies should be implemented in the space. Finally, where the State was involved, as mentioned in the previous paragraph, it was involved in a steering and guiding capacity to influence Makers towards certain economic-development priorities.

This thesis' findings highlight that myriad actors affect the governance of Makerspaces, including documents, non-human actors (noise, fumes, space, tools), and formal governance structures. Further, while the state wields substantial power to intervene in Makerspaces by applying building codes, safety regulations and bylaws to Makerspaces, they did not exercise this power in any of the investigated spaces; instead, they took on subtle steering and guiding roles in the governance network to influence Makerspaces to fit with broader economic development priorities. This research suggests that governance networks should be considered when studying particular Makerspace practices, as a wide variety of actors are engaged in the process of mediating the intention of a Maker to build something in a space.

Appendix A: Interview Guide

Questions for organizers of spaces / Makers
1) **Research Question 1:** *Which actors play a role in the urban governance system that manages each of the Makerspaces, and what are their responsibilities?*
   a) What does your space do?

   b) How did your space emerge? That is, what do you know about how your space was founded.

   c) Why did your space emerge?

   d) What organizations are involved in the formal, internal governance of your space?

   e) What is your internal governance structure? (Board, Executive, etc.)

   f) Who funds your space?

   g) What role do participants/makers in your space play in the management of the space?

   h) Who else is involved in the running and governing of the space?

2) **Research Question 2:** *What are the types of formal and informal relations between actors within each space's system of urban governance?*
   a) Who else restricts your space?

b) What can't you do in your space?

c) Do funders have a set of conditions for how you use their money?

d) What are some significant **external** conflicts that have arose in the practice of organizing your Makerspace?

e) Has your space changed over time? Why?

3) **Research Question 3:** *What is the City of Toronto's role in each Makerspace's system of urban governance?*
   a) Who at the City of Toronto has influenced your space?

   b) Would you consider your organization's relationship to the city to be a good one? Why or why not?

   c) In your opinion, do you think the City of Toronto is encouraging or discouraging Makerspaces? How so?

4) **Misc:**

   a) Who else should I interview?

Appendix B: Observation Guide
Observation Notes Sheet - Governance of Toronto's Makerspaces

Space Name:	Date/Time:

Values
Is there visible evidence of the politics/motivations for the space?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Governance
Is the management of the space visible? How?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

What tools are in the space? (*Count each*)

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

What projects are being worked on?
Are there economic projects? (Projects that are clearly commercial products)

_____
_____
_____
_____
_____
_____

Are there artistic projects?

_____
_____
_____
_____

Are they political projects?

_____
_____
_____
_____
_____

Neither/other/not clear?

_____
_____
_____
_____
_____

Who is in the space?

_____
_____
_____
_____
_____
_____

Are people working together?

_____
_____
_____
_____
_____
_____

Works Cited

Arnstein, S. R. (1969). A ladder of citizen participation. *Journal of the American Institute of planners, 35*(4), 216-224.

Arzu, R., Avant, D., Bogoevski, A., Caven, D., Daniel, A., Fisher, C., . . . Nunes, G. (2011). Sustainable Entrepreneurial Economic Development (Summer 2011) IPRO 350.

Aurora, V. (2010). It's not just Noirin. Retrieved from http://blog.valerieaurora.org/2010/11/08/its-not-just-noirin/

Ausareny, J., Kera, D., Druga, S., & Reshef, Y. (2014). *Open source hardware (OSHW) supporting interaction between traditional crafts and emergent science: wayang kulit over microfluidic interfaces.* Paper presented at the SIGGRAPH Asia 2014 Designing Tools For Crafting Interactive Artifacts.

Backhaus, K. Social Networks and New Venture Creation within Fab Labs: A Conceptual Framework.

Bardzell, J. J. J. (2014). *"Now that's definitely a proper hack": Self-made tools in hackerspaces.*

Bean, J. J. J. (2014). Making: Movement or brand? *Interactions, 21*(1), 26-27.

Benkler, Y., & Nissenbaum, H. (2006). Commons-based Peer Production and Virtue*. *Journal of Political Philosophy, 14*(4), 394-419.

Benton, C., Mullins, L., Shelley, K., & Dempsey, T. (2013). Makerspaces, Supporting an Entrepreneurial System *2013 Co-Learning Plan Series*. East Lansing, MI: City of East Lansing & East Lansing Public Library.

Bianchini, M., Arquilla, V., Maffei, S., & Carelli, A. FabLand:'Making'digital/analog distributed urban production ecosystems.

Boontharm, D. (2015). Creative Milieux of Fashion and Reuse in Tokyo, Bangkok and Singapore. *Journal of Urban Design, 20*(1), 75-92.

Bowler, L. (2014). Creativity through" maker" experiences and design thinking in the education of librarians. *Knowledge Quest, 42*(5), 58.

Brahms, L., & Crowley, K. Making Sense of Making: Defining Learning Practices in MAKE Magazine1.

Brooks, D. (2011). MakeIt Labs, the new 'hackerpace' in Nashua, closed by the city for permits, other issues. *Nashua Telegraph*. Retrieved from http://www.nashuatelegraph.com/news/943138-196/makeit-labs-the-new-hackerspace-in- nashua.html

Canada, C. S. f. (2015). Backgrounder: Policy Adoption in Canada and the US.

Capdevila, I. (2013). Typologies of Localized Spaces of Collaborative Innovation. *Available at SSRN 2414402*.

Capdevila, I. I. I. (2015). How Can City Labs Enhance the Citizens Motivation in Different Types of Innovation Activities? *Lecture Notes in Computer Science, 8852*, 64-71.

Cass, S. (2015). China's maker scene is exploding [rapid growth in maker spaces may herald a tech renaissance]. *Spectrum, IEEE, 52*(8), 27-27.

Cohendet, P., Grandadam, D., & Simon, L. (2010). The anatomy of the creative city. *Industry and innovation, 17*(1), 91-111.

Colebatch, H. K. (2009). Governance as a conceptual development in the analysis of policy. *Critical policy studies, 3*(1), 58-67.

Colegrove, T. (2013). Editorial board thoughts: libraries as makerspace? *Information Technology and Libraries (Online), 32*(1), 2.

Coleman, E. G., & Golub, A. (2008). Hacker practice Moral genres and the cultural articulation of

liberalism. *Anthropological Theory, 8*(3), 255-277.

Coleman, G. (2009). Code is speech: Legal tinkering, expertise, and protest among free and open source software developers. *Cultural Anthropology, 24*(3), 420-454.

Dankert, R. (2010). Using Actor-Network Theory (ANT) doing research. *Publicaties vanaf.*

Dear, M., & Flusty, S. (1998). Postmodern urbanism. *Annals of the Association of American geographers, 88*(1), 50-72.

Dunn, K. (2010). Interviewing. In I. Hain (Ed.), *Qualitative Methods in Human Geography* (pp. 101-128). Oxford: Oxford University Press.

Florida, R. (2005). *Cities and the creative class*: Routledge.

Florida, R. L. (2005). *The flight of the creative class*: Harper Business New York.

Flowerdew, R., & Martin, D. (2005). *Methods in human geography: a guide for students doing a research project*: Pearson Education.

Freund, M. (2015). Creative Spaces.ca. Retrieved from https://groups.google.com/forum/#!searchin/canadiancreativespaces/saw$204$20partially-working$20welders/canadiancreativespaces/A9YKNkZrRIY/E57tDClGREMJ

Gershenfeld, N. (2005). Fab.

Glott, R., Schmidt, P., & Ghosh, R. (2010). Wikipedia survey–overview of results. *United Nations University: Collaborative Creativity Group*.

Good, T. (2013). Three Makerspace Models That Work. *American Libraries, 44*(1/2), 45-47.

Greco, J. (2014). Making Way for Makers. *Planning, February 2014*.

Greimas, A. J., Courtés, J., Crist, L., & Patte, D. (1982). *Semiotics and language: An analytical dictionary*: Cambridge Univ Press.

Hackerspaces.org. (2015). What is a Hackerspace? , from https://wiki.hackerspaces.org/Hackerspaces

Harvey, D. (1989). *The condition of postmodernity* (Vol. 14): Blackwell Oxford.

Harvey, D. (1995). Globalization in question. *Rethinking marxism, 8*(4), 1-17.

Hatch, M. (2014). *The maker movement manifesto*: McGraw-Hill Education.

Herring, S. C. (1996). *Computer-mediated communication: Linguistic, social, and cross-cultural perspectives* (Vol. 39): John Benjamins Publishing.

Holm, V., & Joseph, E. (2015). What are Makerspaces, Hackerspaces, and Fab Labs? *Hackerspaces, and Fab Labs*.

Kearns, A., & Paddison, R. (2000). New challenges for urban governance. *Urban Studies, 37*(5-6), 845-850.

Keiner, M., & Kim, A. (2007). Transnational city networks for sustainability. *European Planning Studies, 15*(10), 1369-1395.

Kera, D. (2011). Entrepreneurs, Squatters, and Low-Tech Artisans: Models of Citizen Science Between EU, Asia, and US. *ISEA 2011 Instambul*.

Kostakis, V., & Bauwens, M. (2014). *Network society and future scenarios for a collaborative economy*: Palgrave Macmillan.

Kostakis, V., Niaros, V., & Giotitsas, C. (2014). Production and governance in hackerspaces: A manifestation of Commons-based peer production in the physical realm? *International Journal of Cultural Studies*, 1367877913519310.

Kuznetsov, S., & Paulos, E. (2010). *Rise of the expert amateur: DIY projects, communities, and cultures*. Paper presented at the Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries.

Lande, M., & Jordan, S. (2014). *Making it together, locally: A making community learning ecology in the Southwest USA*. Paper presented at the Frontiers in Education Conference (FIE), 2014 IEEE.

Latour, B. (2005). Reassembling the social-an introduction to actor-network-theory. *Reassembling the Social-An Introduction to Actor-Network-Theory, by Bruno Latour, pp. 316. Foreword by Bruno Latour. Oxford University Press, Sep 2005. ISBN-10: 0199256047. ISBN-13: 9780199256044, 1.*

Law, J. (1992). Notes on the theory of the actor-network: Ordering, strategy, and heterogeneity. *Systems practice, 5*(4), 379-393.

Law, J. (2009). Actor network theory and material semiotics. *The new Blackwell companion to social theory*, 141-158.

Leitner, H. (1990). Cities in pursuit of economic growth: The local state as entrepreneur. *Political Geography Quarterly, 9*(2), 146-170.

Lindtner, S. (2014). Hackerspaces and the Internet of Things in China: How makers are reinventing industrial production, innovation, and the self. *China Information, 28*(2), 145-167.

Lindtner, S., Greenspan, A., & Li, D. (2015). Designed in Shenzhen: Shanzhai Manufacturing and Maker Entrepreneurs. *Aarhus Series on Human Centered Computing, 1*(1), 12.

Lindtner, S., Hertz, G. D., & Dourish, P. (2014). *Emerging sites of HCI innovation: hackerspaces, hardware startups & incubators.* Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.

Loertscher, D. V. (2012). Maker spaces and the learning commons. *Teacher Librarian, 40*(1), 45.

Malcolm, J. (2008). *Multi-stakeholder governance and the Internet Governance Forum*: Terminus Press.

Maxigas. (2013). Hacklabs and hackerspaces – tracing two genealogies. *Journal of Peer Production*.

Moilanen, J. (2012). Emerging hackerspaces–Peer-production generation *Open Source Systems: Long-Term Sustainability* (pp. 94-111): Springer.

Moorefield-Lang, H. (2015). Change in the Making: Makerspaces and the Ever-Changing Landscape of Libraries. *TechTrends, 59*(3), 107-112. doi: 10.1007/s11528-015-0860-z

Murdoch, J. (1998). The spaces of actor-network theory. *Geoforum, 29*(4), 357-374. doi: http://dx.doi.org/10.1016/S0016-7185(98)00011-6

Neuendorf, K. A. (2002). *The content analysis guidebook* (Vol. 300): Sage Publications Thousand Oaks, CA.

Niaros, V. (forthcoming). Introducing a taxonomy of the "smart city": Towards a commons-oriented approach?

Peck, J. (2005). Struggling with the creative class. *International journal of urban and regional research, 29*(4), 740-770.

Pinto, L. (2015). Putting the critical (back) into makerspaces *The Monitor*. Ottawa: Canadian Centre for Policy Alternatives.

Raymond, E. (1999). The cathedral and the bazaar. *Knowledge, Technology & Policy, 12*(3), 23-49.

Reagle, J. (2012). "Free as in sexist?" Free culture and the gender gap. *First Monday, 18*(1).

Schrock, A. R. (2014). "Education in Disguise": Culture of a Hacker and Maker Space. *InterActions: UCLA Journal of Education and Information Studies, 10*(1).

Sheridan, K., Halverson, E. R., Litts, B., Brahms, L., Jacobs-Priebe, L., & Owens, T. (2014). Learning in the making: A comparative case study of three makerspaces. *Harvard Educational Review, 84*(4), 505-531.

Sheridan, K. M., Halverson, E. R., Litts, B. K., Brahms, L., Jacobs-Priebe, L., & Owens, T. (2014). Learning in the making: A comparative case study of three makerspaces. *Harvard Educational Review, 84*(4), 505-531.

Shirley, N. (2010). A Hell of a Time Retrieved from http://blog.nerdchic.net/archives/418

Smith, A. (2015, 4 April). Tooling Up: Civic visions, FabLabs, and grassroots activism. *The Guardian*.

Smith, A., Hielscher, S., Dickel, S., Soderberg, J., & van Oost, E. (2013). Grassroots digital fabrication

and makerspaces: Reconfiguring, relocating and recalibrating innovation?

Sperling, D. M., Herrera, P. C., & Scheeren, R. (2015). Migratory Movements of Homo Faber: Mapping Fab Labs in Latin America *Computer-Aided Architectural Design Futures. The Next City-New Technologies and the Future of the Built Environment* (pp. 405-421): Springer.

Stangler, D., & Maxwell, K. (2012). DIY producer society. *innovations, 7*(3), 3-10.

Stoker, G. (1998). Governance as theory: five propositions. *International social science journal, 50*(155), 17-28.

Sun, Y., Lindtner, S., Ding, X., Lu, T., & Gu, N. (2015). *Reliving the Past & Making a Harmonious Society Today: A Study of Elderly Electronic Hackers in China.* Paper presented at the Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing.

Tobin, C. (2014). Made in Washington: Encouraging Local Industries. *Strategies and Programs.* Retrieved March 26, 2015, from http://mrsc.org/Home/Stay-Informed/MRSC-Insight/March-2014/Made-in-Washington-Encouraging-Local-Industries.aspx

Toronto Public Library. (2012). Read. Learn. Create. Deliver. *Strategic Plan 2012-2015*. Toronto: Toronto Public Library.

Tozun, N. (2014). Throwing light on the millions without electricity. Retrieved from http://www.weforum.org/agenda/2015/12/throwing-light-on-the-millions-without-electricity

Wajcman, J. (2010). Feminist theories of technology. *Cambridge journal of economics, 34*(1), 143-152.

Weber, R. (1990). *Basic content analysis*: Sage.