Making translations, translating Making: Actor-networks, spatialities, and forms of Makers' work in Turin

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Shared spaces dedicated to digital fabrication such as Fablabs and Makerspaces, together with co-working spaces and start-ups incubators, are said to contribute to the sociospatial reconfiguration of work in digital urban economies characterised by sharing practices and self-organization. However, part of the academic literature on the topic partially reproduces the representations of Makers provided by the mainstream discourse developed by tech-gurus and consultants, which understand them as entrepreneurial innovators. Moreover, when Making is analysed as a new form of work, its spatial dimensions are identified either in the city or in the organisation in which Makers gather, considering both as bounded containers. To offer a more nuanced conceptualisation of Makers' work and arguing that Making as a new, heterogeneous form of value production entails different spatialities, the paper claims for analyses that start from a practical, relational, and more-than-human understanding of what Makers do. Drawing on a recent post-structuralist strand in economic geography and mobilising an Actor-Network sensibility, the article claims for an

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approach to the study of Makers and Fablabs as economic phenomena that goes beyond understanding them as part of a new urban infrastructure of workplaces targeting self-organised, entrepreneurial, yet collaborative individuals in the age of digital capitalism. Through the ethnographic study of a community of Makers that gather around the main Fablab of the post-industrial Italian city Turin, the paper shows how heterogeneous actor-networks translate Making as a form of value production in multiple and contingent ways, in which the distinction between production and reproduction is variously challenged.

Introduction

Multiple, unrelated factors have triggered relevant transformations in how urban economies are done, leading to new configurations whose main traits could be identified in an increasing reliance on sharing practices and digital technologies, together with the spreading of various forms of autonomous production of value. These transformations have led to the rising of new urban sociospatial configurations of work, characterised by heterogeneous and hybrid practices and spaces of production. Fablabs are usually considered a clear example of this phenomenon since they are shared workshops where either professionals or amateurs can use digital fabrication machines to produce physical artefacts.

The first Fablab opened in 2001 at Boston MIT, out of a course named 'How to make (almost) everything' taught by Neil Gershenfeld, professor of computer science and digital fabrication. Gershenfeld and other consultants and entrepreneurs (Anderson 2012; Dougherty 2012; Hatch 2013) gave birth to the discourse that frames Fablabs as examples of innovative, creative, and entrepreneurial forms of production (Schmidt 2019). Policymakers at all levels then drew upon this discourse to identify in the new phenomenon the path towards a future of work and production increasingly characterised by digital technologies, entrepreneurial attitudes, collaboration, and 'openness'.

Indeed, the distinctive trait of Fablabs consists in being 'open workshops' (Lange and Bürkner 2018b; Schmidt 2019) accessible to everyone disregarding their skills and jobs, under the payment of a small fee. Members can access digital fabrication machines and benefit of a knowledge exchange with other Makers. Makers are people variously engaged in a high-tech version of DIY (do-it-yourself) who employ machines such as 3D printers, CNC milling machines, Arduino microcontrollers, and laser-cutters to autonomously produce customised artefacts. A further pivotal element is the sharing dimension, evident from Makers' reliance on various online tools and practices that connect a global community of peers committed to openness. The use of capital letters for 'Makers' and 'Making' throughout the article aims to stress that the present contribution engages specifically with forms of autonomous production of

artefacts that present all the above-mentioned features and that are tied to the global network of Fablabs.

Recently, the phenomenon has sparked the interest of urban scholars and economic geographers, who have identified 'the space of Makers' with the city *per se* and adopted a rather homogeneous image of Making as a new form of work that emerges from the mainstream discourse on Makers as innovators. However, this literature has failed to fully acknowledge the fact that Making is 'varied in definition and form' (Johns and Hall 2020, 2), since it usually reproduces the discourse according to which Makers are workers within creative urban economies.

The present article aims at responding to the urgent call for a critical engagement with Makers and their spaces recently made within economic geography (Johns and Hall 2020; Lange and Bürkner 2016; Schmidt 2019), driving attention to the *doing* of Making and the spatialities of socio-technical arrangements of Making and Makers' practices. To do that, the paper draws both from the understanding of agency as distributed among human and non-human entities proposed by Actor-Network Theory (ANT) and from the relational and practice-based approaches recently flourishing in a post-structuralist stream of economic geography. Notably, in line with the perspective of this Special Feature, the contribution takes into full account the ambiguous nature of Makers' work, in which production is performed in hybrid spaces, by means of digital technologies, and passes through multiple practices that belong to the sphere of social life. Indeed, Makers' work emerges as a powerful example of the multiple ways in which, in the Post-Fordist era, social life itself becomes productive and the division between production of value within capitalism and social reproduction has become increasingly untenable (Weeks 2007).

The paper is organised as follows. After an introduction on the rising of Makers and the spreading of Fablabs and Makerspaces, the first section focuses on how the phenomenon has been investigated through urban and spatial analytical lenses. The review of the literature highlights, on the one hand, an overreliance on self-descriptions and mainstream discourse on Makers and, on the other, a paucity of empirical studies that engage with the study of Maker scenes in contexts different from the ones of highly creative cities. Thus, the need for an investigation of the relation between the social practice of Making and its spatial dimensions that stays open to the heterogeneity and contingency of Making as work is identified. Turin is then introduced as a suitable case study for alternative theoretical and methodological perspectives on Makers to be explored. The following sections therefore suggest an alternative theoretical approach and introduce the methodology of this research and the case study. The discussion of the empirical findings unpacks how Making emerges (or not) as work in multiple, non-exclusive ways that depend on the enrolment of heterogeneous entities in different actor-networks, entailing both productive and social reproductive labour.

Makers: new workers in new spaces?

During the last decade, new forms of work and production have been impacting the sociospatial transformation of cities. Increasing digitalisation that enforces new working practices (Richardson 2017; Richardson and Bissell 2019; Schmidt 2019), the spreading of collaboration (Richardson 2015), a reliance on forms

of self-organisation (Ritzer and Jurgenson 2010), and the shift of patterns of knowledge circulation towards increasing openness (Ettlinger 2014) have brought to the fore spatiotemporal configurations of economic activities alternative to the ones of traditional organisations, namely factories and offices.

Most scholars assume that the city is the most relevant spatial dimension of the phenomenon, which shows 'a somewhat natural link to urban contexts' (Schmidt 2019, 8). These studies usually consider Makers as part of a univocal shift in contemporary urban economies (Armondi and Bruzzese 2017; Armondi and Di Vita 2017; Capdevila 2018), seen as largely characterised by the transformations impressed by digital capitalism, in which the creation of digital contents and information sharing are at the core of value production (Fuchs 2010). Moreover, spaces for Making are seen as innovative for their capacity to offer shared access to both material and immaterial assets needed by a large plethora of self-entrepreneurial subjects who have become increasingly precarious and casualised after the 2008 economic crisis and try to cope with their difficulties by relying on collaboration (D'Ovidio and Rabbiosi 2017; Mariotti, Pacchi, and Di Vita 2017; Merkel 2019; Vicari, Colleoni, and D'Ovidio 2015).

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The first empirical studies on Makers and Fablabs as urban phenomena looked at these organisations as either examples of a re-urbanization of manufacturing (Bianchini and Maffei 2013; Doussard et al. 2017; Maffei and Bianchini 2014) or as part of the increasing diffusion of co-working spaces as urban settings for highly knowledge-based activities (Gandini 2015). Merkel's (2015) multi-sited study on co-working spaces in London, Berlin, and New York explicitly links these organisations to creative and cultural workers, and the same juxtaposition between the two types of organisation is usually made in the literature on Milan's Maker scene (Chiappini and Törnberg 2018). Other studies focus on the embeddedness of Makerspaces and Fablabs into urban policy strategies for economic development, such as in the case of Barcelona's smart city agenda and the project of converting the city into a self-sufficient one thanks to Fablabs' distributed production (March and Ribera-Fumaz 2016). The relevance of the policy dimension is evident also in Gaeiras (2017) work on Lisbon, where the municipality implemented an economic development strategy that sees Fablabs as part of an infrastructure to boost entrepreneurship and innovation, and in Fiorentino's (2018) framing of Makers as part of a 'start-up urbanism' in her study on the Rome Maker Faire. Investigating the specificity of Taiwan's Maker scene, Lin (2019) discusses the relationship between local communities of Makers and the global Maker Movement, highlighting how bottom-up subcultural initiatives and top-down public strategies entangle one with another in producing context-specific performances and tensions. The same global-local relationship is explored by Capdevila (2018), who draws on the case of Barcelona to conceptualise dynamics of knowledge circulation among Makers as made of 'local buzzes' and 'global pipelines'.

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Studies on the urban and spatial dimensions of Makers as economic phenomena rarely engage with the topic through the alternative but still homogeneous understanding of Makers as revolutionary subjects within commons-based peer-production ecosystems (for an exception, see Lange and Bürkner 2018a; 2018b). This particular version of the discourse on Makers portrays them as bearers of anti-capitalist economic practices, due to the alleged

liberatory, democratic, and horizontal nature of Making (Ratto and Boler 2014; Rifkin 2011; Troxler and Maxigas 2014).

The literatures that emphasise the urban dimension of Makers offer a much-needed spatial lens through which to look at a phenomenon described by the mainstream literature as one in which geography does not play a role because of its heavy reliance on communities of peers connected through online open platforms. However, they fall short in providing nuanced accounts of Makers, and various flaws could be highlighted. First, research that looks at the relationship between Fablabs and their urban contexts conceptualises the city as a bounded container, a theoretical pitfall that emerges from the mobilisation of spatial proximity as explanatory category to understand the innovative potential of Making, thus falling short in establishing 'a critical perspective on the locale, in particular on urban localities, as a point of conceptualisation where older myths of proximity are increasingly challenged' (Bürkner and Lange 2020, 67). Second, they are over reliant on either the understanding of Makers provided by mainstream literature or self-descriptions and categorizations mainly coming from Fablabs' managers (Schmidt 2019). Third, much of the literature does not question 'the binary framings of such spaces [...], as either discursively charged sites of entrepreneurial design innovation on the one hand or anti-capitalist networked spaces on the other' (Smith 2020, 594). Fourth, those few studies that mobilise micro-level spatial perspectives treat 'makerspaces and Fablabs as homogeneous in scope and operation, and [are] insensitive to the everyday place-based practices upon which they are based' (Johns and Hall 2020, 6). Finally, there is a problematic relationship between the empirics and the theoretical conclusions reached by most of the works that stress the urban dimension of Making, since they usually focus on cities that are renowned as creative meccas, thus generalising some features of Makers and Fablabs that seem to be idiosyncratic of the ecosystem in which they are inserted. The present contribution aims, on the one hand, to provide evidence on the topic that is not focused on global cities and, on the other, to offer an alternative conceptualisation of the sociospatial reconfiguration of work brought into being by Makers. An original understanding of Makers work will emerge from a focus on the practices and sociomaterial arrangements that enact Making as work in multiple ways, which variously question the distinction between productive and reproductive labour and their spaces.

Making in a city in crisis. The case of Turin

As seen before, within urban studies and economic geography the discourse over Makers frequently overlaps with the investigation of the transformations that work is undergoing in typical examples of creative cities. These urban settings are characterised by policy efforts aiming to foster innovative and creative urban economies where self-entrepreneurialism, digital technologies, and collaboration have become distinctive features of the work of knowledge professionals. Adopting this analytical lens to unpack Makers and Fablabs as urban phenomena, the Italian case usually studied is indeed Milan, due to its status of 'knowledge-based economy city, with a strong degree of innovation in production activities and new workplaces' (Armondi and Bruzzese 2017, 33). The relevance of Milan for the study of Makers through an urban lens lies also in the fact that local policymakers have supported and funded the opening of these

organisations, understanding them as new workplaces similar to coworking spaces (Chiappini and Törnberg 2018; see also, D'Ovidio and Rabbiosi 2017; Vicari, Colleoni, and D'Ovidio 2015).

However, a long tradition in urban studies has warned against the risk of building theories on empirical evidence coming from global cities whose features are considered as the norm (Robinson 2002). Moreover, in these analyses, Makerspaces are treated as 'new productive centralities' in innovative urban economies (Chiappini and Törnberg 2018, 78), thus precisely fostering homogeneous views of these organisations that hinder an understanding of *which* diverse forms of value are produced *through* them. This latter understanding, however, is a needed one, especially when local policymakers consider investing public money in these organisations, identified as crucial infrastructures to support urban economic development and innovative forms of work.

If we want to decouple urban and geographical theory on the forms and spatialities of Makers' work and the contextual specificities of empirical investigations, research needs to focus on alternative cases. In this respect, Turin is well-suited to explore Makers' work since neither the local Fablab is well embedded in Turin's production ecosystem nor is Turin's urban economy a particularly significant example with regards to features such as knowledge-orientation, innovative capacity, and creativity.

Indeed, the city has been experiencing a relentless decline since the 1980s, when its economy, hyper-specialized on manufacturing, was shocked by the global crisis of Fordism, forcing the city to implement long-term strategies to overcome the economic transformation. Since the 1990s and especially during the 2000s, the city embarked on various branding strategies through which it tried to represent itself as creative, cultural, and international (Vanolo 2015a; 2015b). More recently, further strategies for economic recovery were informed by the 'smart city' and 'start-up city' narratives, pivoting on the crucial role of technology and innovation (Rossi et al. 2015).

However, the longed-for relaunch of the urban economy based on a progressive enfranchisement from the industrial sector is still yet to come (Vanolo 2008). The passage towards a knowledge-based and service-oriented economy was never accomplished, and recent figures on the growth of start-ups, creative industries, and forms of micro-entrepreneurialism suggest that Turin is not an emblematic example of an urban economy massively characterised by those transformations in the spaces and forms of work typical of digital capitalism (Centro Einaudi 2020). Moreover, the 2008 economic downturn was experienced as a second major economic shock after the one of the 1980s, exacerbating the recession that Turin was undergoing, especially with regards to a manufacturing industry that was still the most important economic sector for the city albeit its ongoing difficulties in accomplishing a restructuring process (González et al. 2018).

Practices and relations: reconceptualizing forms and spaces of Makers' work

The above-mentioned shortcomings in the urban and geographical literature on Makers and the ostensible low significance of Turin as an example of new forms

of urban work in digital capitalism call for alternative conceptualizations of the sociospatial reconfiguration of work that this phenomenon brings into being. Thus, the present article will turn to some arguments that have recently made a plea to go beyond understandings of Fablabs and Makers as homogeneous subjects of increasingly digitalised, collaborative, and innovative urban economies, looking instead at individual acts of Making and specific socio-technical arrangements as analytical starting points (Bürkner and Lange 2020).

Aiming to conceptually engage with the heterogeneous and ambiguous nature of Makers' practices and to overcome 'the paucity of empirical ethnographic research' (Johns and Hall 2020, 6), the article does not adopt an essentialised understanding of urban economies. To pursue this goal, Making as work is decoupled both from the city as a bounded Euclidean spatial entity and from the physical boundaries of a Fablab, getting rid also of categorizations that seem to respond more to an eagerness of defining who a Maker is rather than looking at what Makers do.

Therefore, the focus shifts to the spatialities of Makers' *practices*, at the same time without losing sight of Making as collaborative, digitally mediated forms of value production (Johns and Hall 2020; Schmidt 2019; Smith 2020).[1] An investigation of Making as work that passes through a focus on practices pivots on questions asking *how* Making emerges as work, that is, *how* the practices of Makers translate into the production of value and which forms of value are contingently produced. This approach leaves open the possibility that Making would eventually either not translate into a form of work within the framework of capitalist economy or would emerge as entanglement of a clearly identifiable production of artefacts and more ambiguous forms of reproductive labour that entail the creation of social bonds through communication, sharing, leisure practices, or the use of private, intimate spaces.

The concepts of production and reproduction are at the core of feminist studies which aim to provide a broader understanding of what counts as work. In these analyses, work is no longer locked up inside the boundaries of capitalist economy. Rather, it is identified with 'activities that produce goods and services for oneself and others' (Reid-Musson et al. 2020, 1459), regardless of both the places in which it is performed and the profit obtained. This conceptualisation is particularly useful for looking at work in the Post-Fordist era, characterised by an enmeshment of productive and reproductive labour that passes through a double mechanism. On the one hand, there is an 'increasing integration of what were imagined as the separate locations of production and reproduction' (Weeks 2007, 238) and the fact that specific activities constitute unpaid work is no longer sufficient to put the latter under the label of 'reproduction'. Indeed, we face important socioeconomic transformations of the realm of unpaid work, which currently is not only populated by traditional reproductive labour such as caring, cooking, and bearing children, but is also reconfigured by a new 'post-waged work regime' that comprehends also 'sharing economies, [...] prosumer activities and open-source projects' (Van Dyk 2018, 528–529). On the other hand, 'processes of production today increasingly integrate the labours of the hand, brain, and heart as more jobs require workers to use their knowledge, affects, capacities for cooperation and communicative skills' (Weeks 2007, 238). For these reasons, the distinction between production and reproduction could

be better reconceptualised as distinction between work and life itself (Weeks 2007), thus comprehending everything that usually falls outside the boundaries of capitalist production, such as consumption practices, leisure, and, more generally, practices of sociality.

The blurring of these boundaries is an interesting analytical focus for the investigation of Makers and Fablabs too. Indeed, as will be shown, the production of artefacts by Makers involves practices that characterise non-economic forms of interaction, such as being friendly, learning collectively, building trust, and being part of a community. These are all activities that are usually seen as reproductive of social relations and bonds, thus deemed unproductive within capitalist economies.

The feminist endeavour to redefine work has been recently joined by a post-structuralist strand of cultural economic geography that looks at the *doing* of labour (cf. Cockayne 2016; 2019; Richardson 2015; 2017; Richardson and Bissell 2019), aiming at offering an anti-essentialist approach to the study of the spatialities of new forms of work in contemporary economies characterised by high degrees of digitalisation and increasing informality. The irreducible heterogeneity, multiplicity, and ambiguous nature of digital-based sharing economies has fed research that tries to offer innovative conceptualizations of core economic notions, in the attempt 'to hold open the question of what the economy is' (Richardson 2015, 122). This literature pushes towards questioning economic concepts and categorizations, looking instead at how discourses and practices are performative of economic objects in contingent ways.

A reconceptualization of work through an engagement with *practices* is a much-needed effort also in the analysis of the world of Makers, made of 'informal, amateurish, hobbyist, semi-professional and small-scale entrepreneurial activities, spurred by digital communication and a commons-based sharing of knowledge' (Bürkner and Lange 2020, 56). Still, those few contributions in geography and urban studies that urge to look at Makers' practices fall short in going beyond an understanding of practice as the act of a human being whose capacities and will are independent from the tools employed and the site in which that practice takes place (cf. Johns and Hall 2020; Smith 2020). On the contrary, the present contribution will stress that *doing* labour emerges as a 'site-specific co-mingling of humans and technologies' (Richardson and Bissell 2019, 281), thus understanding agency as distributed across human and non-human entities.

This understanding of agency is typical of Actor-Network Theory, which adopts a relational ontology that sees the social as made of actor-networks, that is, complex associations among heterogeneous entities (Latour 1987; 2005). Enduring relations between entities are established through processes of *translation* (Callon 1986a; 1986b), that is 'the processes of enrolling heterogeneous actants into an actor-network' (Müller 2015, 70) that assign roles to the entities involved, the kind of association existing among them, and the agency capacity of the actor-network. Looking at translations allows unpacking the relations behind social objects usually treated as 'black boxes' (Callon 1986b), due to the invisibilization of their internal functioning and the work needed to make them. According to ANT, each social phenomenon results from the contingent,

always provisional ordering of sociomaterial networks which are enacted in multiple ways.

Moreover, its understanding of space as topological, relational, and practiced (Murdoch 1998; 2006; Müller 2015) makes ANT particularly useful to understand how new sociospatial configurations of economic phenomena come into being, This is especially true when the latter correspond to increasingly ad-hoc, projectified, unstable, and eventful organisational forms (Müller 2015), as in the case of Makers. This approach allows also to go beyond the dualistic interpretation of the main spatial dimension of Makers as either the one of proximity that is said to characterise Fablabs as urban organisations, or the interconnection made possible through global communities.

Drawing from these insights, the article gets rid of a conceptualisation of the city as a mere container of new urban economies of which Makers are part, conceiving it instead as the entanglement of multiple *sites* (Farías 2010) that either enable or prevent the enactment of Making as work in various and contingent ways. Indeed, looking at the actor-networks that translate Making into different forms of value production is 'a means of describing the multiplicity of processes through which formations like 'value' or 'work' are differently brought into being, held stable, are ruptured through new socio-material agencies and are reassembled' (McFarlane 2011, 378).

Methodology and case study

The empirical data hereby discussed come from an 18-month ethnographic research on the Makers scene gravitating around Fablab Torino, started in November 2016. As anticipated, Fablab Torino was selected because of its local relevance, being the first Fablab opened in Turin and the city's only one to be officially recognised by the global community of Fablabs.

Fablab Torino is an association, whose board is elected on a two-year basis. At the time the fieldwork was conducted, the association counted approximately 200 members, who were mainly men, aged from 30 to 70. However, during my fieldwork, I used to meet no more than 30 people, mainly during the community nights, and few shared projects were going on (cf. Johns and Hall 2020). The space is provided with digital fabrication machines, such as laser-cutters, CNC milling machines, 3D printers, various Arduino boards, and a robotic arm. The access to machines is regulated through paid membership and a system of credits. Workshops are organised to teach members how to use the machines. There are three internal communities whose participants share an interest in some specific machines or topics.

Similar to other researchers on Makers' practices (Johns and Hall 2020; Smith 2020), I used a mixed-method approach. Participant and non-participant observations were conducted three times per week, usually during the afternoon and the night, as the Fablab is open to the public from 4pm. Observation was supported by 36 semi-structured interviews with regular members of the Fablab, founders and managers (both current and former ones).

A further important methodological tool consisted in 'netnographic' explorations (Smith 2020) that I conducted through members' chats occurring

on an instant messaging platform used not only to pass useful information on the lab but also to share knowledge on machines and techniques, while chatting about daily lives. The observation of what happened in the chats allowed me to go beyond the apparent lack of activity at the Fablab, following the practices beyond the physical space of the organisation, which consequently appeared 'as a nodal point of momentary contact' (Johns and Hall 2020, 25). Additionally, the paper builds on secondary data such as online projects' documentation and websites. For all participants, pseudonyms were used.

How do Makers work? Practices and actor-networks of value production

> In Turin, in a twentieth century ex-foundry, there's a place in which people fabricate the work of tomorrow. It's Fablab Torino, an association and a space of encounter, production, and creativity linked to the world of digital fabrication. (Facebook Post of Labour Consultants Association, September 2017)

> 'There are no projects [...] it has become a hangout where every now and then on Wednesday night there are 2-3 persons who chat, look at some websites, go eat pizza ... it's not very productive.' (Interview with Vincenzo, Fablab Torino Maker, November 2017)

> 'The values of [my co-working space] are future, innovation, and work. This is the reason why we and the founders of the Fablab met. [...] Now, there's a bunch of retirees tinkering with 3D printers ... which is ok, but it has no added value.' (Interview with the manager of the co-working space, October 2017)

As argued earlier in the second section, the heterogeneity and ambiguous nature of Makers' practices ask for an anti-essentialist understanding of Making and its spatialities. This is especially true when we face a case study in which the workplace nature of the investigated organisation and its embeddedness in the urban economy are questioned by participants themselves, as the opening fieldnotes show. In the following sections, the identification of the actor-networks that constitute Fablab Torino and that sustain Makers' practices allow, first, to unpack how the organisation has progressively lost its ties with Turin's innovative and entrepreneurial work ecosystem; second, to understand how Making emerges as entrepreneurial work in digital capitalism; and, third, to show that alternative actor-networks translate Making into post-capitalist value production, post-work, or simple leisure. Thus, through a focus on how Making is enrolled in different actor-networks, the article shows how the boundaries between 'work and life' (Weeks 2007) are negotiated in heterogeneous, contingent, and situated ways. In this way, the analysis embraces Smith's claim to look at Makers' practices not only in terms of their relationship to the capitalist regime of accumulation, but also with reference to social reproduction, considering the latter 'a product of a diversity of non-market gifts, volunteer work, commons, cooperative forms of production, criminal economies and much more' (Smith 2020, 596).

Lost in translation? Making space for new forms of work

The first explicit signal of a Maker culture in Turin was the opening of the first Italian Fablab, Fablab Italia, inaugurated during a national event held in Turin in 2011. Its opening was a joint operation made by the director of the tech-magazine *Wired Italia* and the CEO of Arduino, a company born in a small town close to Turin and producing the single-board microcontroller renowned among Makers. They decided to use a Fablab as an example of 'the future of work', as the part of the exhibition devoted to it was entitled. Thanks to the positive reactions received, the following year, the organisation became permanent and was renamed Fablab Torino. Since then, it has been hosted for free by a co-working space situated in a liminal part of the city, together with a start-up that used to have strong ties with Arduino. However, the origins of the Italian Maker culture could be traced back to other experiences, highly distant from the world of innovation.

> 'In 2008, me and Paolo started organising these events in Milan [...] We kind of imported this event called Dorkbot, which was born in 2000 in New York, [where] local digital artists showed their creations [...] I think the Makers' world in Italy has intersected frequently with the kind of people who used to hang out at squatted spaces.' (Interview with CEO of Arduino, December 2017)

Still, at the beginning of Fablab Torino's history, the organisation was welcomed as an example of innovation and young entrepreneurialism, and the City discursively invested in it as a gateway to the future of work and the further implementation of a smart city. In 2013, the City's platform Torino Social Innovation and the local Smart City agenda identified the Fablab as part of the urban ecosystem of young and creative entrepreneurs.

However, in the following years the relationship between the Fablab and local policymakers became progressively scantier due also to the fact that the next managers of the association wanted the Fablab to be an autonomous and apolitical organisation, and a place nurturing a form of alternative economy. The City's support was limited to a sponsorship for the local Maker Faire.

But other internal factors contributed to destabilise the smooth translation of Fablab Torino into an innovative workplace within a digital and collaborative urban economy.

> 'People at the Fablab wanted to open their own Maker shop within it! So, I said to [the Fablab manager]: this is crazy! We put the money in that, we bought the machines, people pay just a symbolic fee, and they want to be our competitors? So, we had a meeting and then [...] I withdrew my funding from the space.' (Interview with CEO of Arduino, December 2017)

The withdrawal of the company's funding elicited issues of economic sustainability for the Fablab, provoking a progressive leak of the most active members and difficulties in maintaining the machines. Moreover, a new, competitive discourse developed by some Italian designers started circulating, framing Makers as just 'digital craftsmen' and connecting them to the field of professional designers.

Concluding, the ongoing reduction of the relations between the Fablab and, on the one hand, Turin's political administration and, on the other, the local entrepreneurial ecosystem jeopardised the stabilisation of the actor-network. The entanglements with different discourses on Makers, together with the mutated material conditions, constituted further disturbing factors. All these elements progressively undermined the translation of the Fablab into an organisation that could be properly identified with an innovative workplace; to the point that even the manager of the co-working space and some early members were sceptical about the potential of the organisation to be one of the drivers for a new urban economy, as the opening quotes show.

Making as entrepreneurial work in digital capitalism

> 'The aim of Kickstarter is precisely to build a community of backers, people that back your project. We constantly interact with them, make friendly videos, and so on [...] The pieces [of the artefact] – except for the electronic box, which is produced in China but is assembled here, in Caluso – are produced by mechanical companies nearby Turin. And the storehouse is Maurizio's basement!' (Interview with member of a Maker start-up, April 2017)

During the first years of activity of Fablab Torino, this group of Design students entered the organisation to learn how to use digital fabrication machines to make their first prototype. The prototype was successfully produced, and then exhibited at the Maker Faire, winning the first prize. The interest raised in the project during the fair allowed the group to become one of the start-ups of Turin's main business incubator.

In the story of this student-team evolution into a Maker start-up, the Fablab plays an important role in the provision of the needed machinery, but the translation of Making into a form of value production in the age of digital capitalism is made possible mainly through the entanglement with the incubator and the crowdfunding platform.

On the one hand, the incubator enrolled the group of Makers into an actor-network imbued with ideas of entrepreneurship, self-employment, and innovation. The institution provided them not only with a shared workplace but also with consultancy activities and enrolment into an urban network of innovative companies, investors, research centres, and industry associations.

On the other, the specific kind of technology constituted by the crowdfunding platform Kickstarter and the sharing practices elicited by it form with the project an actor-network that not only enables the production of value but ties the latter to the sphere of reproduction. Indeed, being friendly, constantly interacting with the community, but also giving the right rewards to the backers represent the basic communicative and relational features demanded by the platform. Work is here made invisible by the mobilisation of communicative practices and affective relations that reproduce those community relationships crucial to translate Making into a source of profit. Thus, the actor-network is held together by the enactment of affect as a distributed force (Müller and Schurr 2016) through which distant others—i.e. the backers – are mobilised and enrolled in a socio-technical arrangement that translates Makers' practices into a

form of affective labour in digital capitalism through which feelings are socially engineered for the purpose of profit (Weeks 2007; see also Cockayne 2016).

The crowdfunding platform has inscribed within it the way in which practices of knowledge sharing are contingently enacted and translated into the production of economic value within digital capitalist economies. Making is performed as open innovation and value co-production through a device – i.e. the platform – through which the (re)production of social bonds and community is essential to become a Maker start-up. Indeed, the first project was released with an open-source license, a non-human intermediary that allowed it to turn the activity of Making into a for-profit business, yet enabling the community of backers who first received the prototype to tinker with it, eventually improving the object. Indeed, to be on Kickstarter, the project must be shared with others, '*since the aim of Kickstarter is to build a community, to have people that back your project, not clients*'. The participation of these people in the project was then rewarded by a gift, another platform-enforced compelling practice that blurs the boundaries between the production of value on the market and non-capitalist forms of economic exchange. Indeed, while the first prototype remained open source, once the crowdfunding goal was reached, the Maker start-up was able to boost its production, becoming a company and selling on the market the industrialised version of it.

The spatiality of this form of Maker work entails not simply the Fablab. On the one hand, the crowdfunding platform enables 'temporary processes of scaling' (Bürkner and Lange 2020, 55) through which Making as production of value within digital capitalism goes beyond the local dimension and unfolds through the enrolment of a global community. On the other, the passage from prototypes to products ready for the market is enabled by the enrolment of the artefact and the practices of Making into the actor-networks that constitute sites belonging to Turin's start-up ecosystem, such as the incubator, and others connected to the manufacturing fabric of the city.

However, it also entails the blurring of the boundaries between sites of production and the private, intimate dimension of households, when houses are used not only to store the products but also to host a typical start-up pitch night. Indeed, when reproduction can no longer be considered as pertaining to some sort of 'outside' since practices usually deemed unproductive now produce value – such as good communicative skills and hosting abilities –, the intimate geography of home is bound to fall too (Weeks 2007).

> Valeria has organised a meeting at her place for tonight, inviting a guy she met at the Maker Faire. She says his work on biohacking fascinated her and, since she has started experimenting with biomaterial too with her group, she wants him to brief them what he knows. [...] She has set up the living room as a sort of meeting room: there is a projector, some prototypes and pieces of materials scattered on the dining table, beers, and chips for the small audience. She explains to me: '[Our prototype for the fair] is one of those projects [that you use] to start and see how to work together in a domain which is not the one of waged work, to lay the foundations for collaboration. Having won at the Mini Maker Faire the Fablab membership cards, we have converted them in this micro-budget ... [...] It's like from one game to another.' (June 2018)

However, Valeria's first contact with Fablab Torino was not successful. As she explains,

> the members were too geek and I hadn't enough experience at that time. I was discouraged ... Then, I decided to start over, learning how to use a 3D printer, which is much easier. The following year, I took a course on digital fabrication applied to the textile industry in a Fablab in Milan and now I'm trying to make a business out of it.

For her, Fablab Torino failed in providing the appropriate context for business, a socio-technical arrangement able to translate Making into a for profit activity. Indeed, besides the geek attitude of many members, 'when you go there, there's no one welcoming you, it's cold, and most of the time the machines are broken'. The lack of the proper hosting capacity expected in collaborative workplaces (Merkel 2015) and the fact that non-human actants – i.e. the machines – do not align with the network since they do not play the role given to them undermine the capacity of the Fablab to function as a reliable node in Turin's innovation ecosystem.

Instead, the textile class she took in Milan is part of an expensive digital fabrication academy launched by the global network of Fablabs, which gave her the basic skills not only to use the machines but also to design a high-level project. But the use of 3D printers and biomaterials such as teabags and seaweeds in her projects was determinant. Notably, the commingling between beginners in DIY digital fabrication and these easier tools favours the translation of Making into what she defines '*a rustic bootstrapping, a housewife-kind of entrepreneurialism*', since it both speeds up the process of trial and error that lies at the core of start-up entrepreneurialism and cuts the costs.

The translation of DIY experimentation with digital fabrication into the first seeds of an entrepreneurial activity is thus distributed across multiple sites. The practices learnt in a Milanese Fablab that is enrolled in the entrepreneurially oriented global academy of Makers are replicated in another site – Valeria's house –, performing the enmeshment between intimate spaces, times, and activities with the ones belonging to the sphere of production in capitalist economies, thanks also to a playful attitude. Indeed, Valeria's living room is translated into a site where the research and development phase that is at the core of the fabrication of a prototype emerges through the constitution of a network that enables the performance of entrepreneurial practices which involve relations of informal sociality. The displacement of tools such as projectors and 3D printers into a private house enables to perform practices typical of start-ups ecosystems, such as doing a pitch or engaging in forms of 'compulsory sociality' (Gandini 2016, 136) that turn social life into a source of profit, such as networking.

Making as DIY and digital sharing: between leisure, post-work, and post-capitalism

> Tonight, Carlo has brought a vacuum that he has recently hacked. 'I've created a bot so that I can have stats and control it via Telegram [through] the buttons *start, stats, schedule, stop*'. [...] Bruno: 'Why don't you add a PCB on it?', Carlo: 'Yes, I could, but not on top, it wouldn't pass under the sofa'. (October 2017)

The blurring of the boundaries between production and consumption not only have been considered a crucial element of Maker cultures and digital-enabled practices more generally, but they are also pivotal for a broader reconceptualization of production that questions the productive sphere as a clearly identifiable and bounded one. The customisation of a product described in the vignette exemplifies this transformation with regards to high-tech DIY activities. Here, use value is produced as amusement by means of an open-source software for home automation that allows Giancarlo to meet his needs while engaging in an entertaining activity. Indeed, the fact that, on the one hand, the software has an easy interface and, on the other, there is an online community of people contributing ready-made codes that could be copy pasted facilitate the engagement with the customisation of products as leisure activity. The community night at the Fablab in which he shows his project and involves other members on that is the sociomaterial arrangement that allows practices of sharing to be performed as part of Making. However, this actor-network does not comprehend any device that would translate these social relations into the production of economic value in digital capitalism, keeping Making as a leisure activity. Still, the practices constituting leisure as reproduction of the labour power emerge here as highly similar to the ones involved in the production of valuable artefacts (Scholz 2012).

While in this case Making is translated into the customisation of a product only for personal use and for fun, other arrangements could enact in different ways the blurring of the boundaries between consumption as leisure activity and the autonomous production of an object.

> 'I drew from a project from the US, called USB typewriter. It's a kit to convert a typewriter into a USB keyboard, with the stuff you need and the instructions. But I wanted to make a typewriter that was a portable laptop, and I was also fascinated by the steampunk aesthetics. I'm an engineer and a game developer, so it was pretty easy. At the Maker Faire, they asked me if there would be a serial production of it and how much it cost, but I'm not interested. I believe in open-source, I'll release the instructions on my blog. The fair was just a narcissistic moment'. (Interview with Gabriele, December 2017)

For Gabriele, the skills in software engineering and electronics acquired through university studies and the experience on tutorials and open-source documentation gained as a game developer allowed him to engage with DIY digital fabrication at a very high level, despite the project was just for fun. Still, the availability of open, step-by-step instructions and the ready-made kit were determinants, favouring the enrolment of all the other entities – Gabriele's previous skills, typewriter, laptop screen, software –, thanks to the capacity to guide the fabrication process. The connection of DIY digital fabrication with the steampunk aesthetics was facilitated by the fact that Turin had a strong community of steampunk lovers, who organise a dedicated fair which was then embedded into the Torino Maker Faire, enacting the characterisation of DIY artefacts with a steampunk style as Makers' production in all respects.

Part of the artistic value added to Gabriele's project passes through the Fablab's laser-cutter, needed to fabricate the wooden case for the typewriter to

become portable, but the sharing part is confined mainly to online practices. The practice of digital sharing performed by him – both when he downloads the kit and when he shares the instructions of his version of the typewriter – enact a form of distributed value creation through commons-based peer-production (Benkler 2006). On the one hand, the kit is a paid one, a product that is bought and consumed. On the other, the practice of sharing on the blog the improvements introduced corresponds to the enactment of a post-work style, through which 'individuals are enrolled as workers through their participation in processes of ('informational') communications circulation' (Richardson 2017, 1). Thus, the enmeshment of productive and unproductive practices is contingently produced by rendering invisible processes of value production through digital sharing.

However, the open-source ethos and the use of digital tools for sharing that refer to the open-source culture could also lead to enacting Making as a post-capitalist practice (Smith 2020).

> Tonight, Pietro and Fulvio are hacking a joystick, recovered by Fulvio from an old console abandoned in his bedroom. They are drawing circuits on the blackboard. Pietro: '... and it goes like that: the [sound technician] says to me that during the 70s, there used to be a company producing this stuff but that now is super-vintage. Well, I think there are still some people interested! [...] We can make a small box, an easy software, four outputs, the joystick ... maybe changing the PCB ... And that's all, without investing money! Just to make a prototype to test at Cavallerizza [N/A a squatted space turned into a centre for independent cultural production].' (October 2017)

Pietro, the founder of the Fablab community devoted to electronic music experimentation, used to have a post-punk group during the 1980s. Now, with the community, he tinkers with DIY devices for electronic music, using analogic materials, but also Arduino and other digital tools. They usually gather at the Fablab during the night, when the co-working space has already closed, making any relations with the entrepreneurial activities of the co-workers foreclosed.

On the contrary, the artefacts produced are entangled with sites that belong to Turin's geography of independent cultural production and leftist political activism, such as Cavallerizza and other squatted spaces. Indeed, Turin is among the Italian cities with the highest number of squatted spaces, a legacy of the leftist and anarchist political movements that flourished as part of the class struggles that occurred during Fordism (Berzano and Gallini 2000). These experiences gave birth to a politicised popular music production characterised by DIY and autonomous organisation (Bottà 2015), which is enrolled in the enactment of Making as post-capitalist practices.

The translation of Making into a post-capitalist productive activity that holds political value is enabled also by digital tools to share projects' design and codes. As most of the projects realised by this group, the joystick one was shared through Github, a platform for open-source software that the community employs since it *'embodies our political and ethical values, the idea of sharing in a free and open way'*. Indeed, for the community, Making is part of their activities as militants, cultivating 'decommodified practices of repair and recuperation' (Smith 2020, 599). Since in this case Makers' practices are sustained by

actor-networks that constitute the community's militancy and do not entangle with for profit activities, the blurring of the boundaries between the production of a physical artefact and the reproduction of social relations translates it into a form of post-capitalist production that entails new forms of urban sociability (see Introduction to this Special Feature).

Thus, these Makers' practices 'perform new forms of economic 'being-in-common'' (Smith 2020, 595), which transcend wage labour and capitalist enterprise, thanks also through their entanglement with the urban assemblage that characterises Turin as a vibrant city for alternative cultural production and leftist political activism.

Conclusions

Makers and Fablabs are considered sociospatial reconfigurations of work and production with a strong urban characterisation. The present paper is situated within recent geographical and urban scholarship on the topic, identifying in much of the existing literature both a problematic reliance on an essentialised notion of both cities and space, and the mobilisation of homogenising definitions of Makers. These flaws are caused by an overreliance on cases study in which the characterisation of Makers as entrepreneurial workers and innovators is idiosyncratic to the peculiarities of digital and knowledge-based urban economies. The ethnographic study of the Maker scene pivoting on Fablab Torino has provided empirical data from a city – Turin – that does not belong to the group of 'usual suspects' generally employed to substantiate urban research on the topic.

To offer alternative and more nuanced interpretations while preserving a focus on the spatial dimension of Makers and Fablabs as part of a reconfiguration of work and production, I have looked at *how* Making as work emerges. From a theoretical point of view, the analysis draws from recent post-structuralist economic geography scholarship that urges for anti-essentialist understandings of work and its spatialities. Indeed, 'work, broadly conceived, can direct scholarly inquiry toward activities that may be paid or unpaid, and occur within or across spheres of production and reproduction through processes unfolding outside formal workplaces like factories and offices' (Reid-Musson et al. 2020, 1459).

The article adds to this approach the relational, practical, and processual ontology of ANT, shifting the attention towards the sociomaterial practices that constitute Making as a form of agency distributed among networks of humans and non-humans, which eventually translate it into different forms of work. Moreover, the paper gets rid of Euclidean interpretations of the city and a monolithic understanding of urban economies. Rather, it reconceptualises the relationship between space, city, and Makers as one in which the city is variously entangled with assemblages of Making through different urban sites that take part in enacting Making in multiple ways, albeit the relational understanding of space broadens the scope of the spatial dimension of Making.

In the discussion of the empirical findings, ANT has enabled acknowledgement of how multiple factors took part in preventing the stabilisation of an actor-network that automatically translates the Fablab into a collaborative workplace and a space of innovation within a new urban economy. Despite its origins

framed Fablab Torino as one of Turin's sites where the future of work could be explored, competing discourses and the resistance of some actants to be enrolled in the network destabilised the translation process.

Then, the focus on the sociomaterial practices of Makers, the actor-networks sustaining them, and the topological space constituted by the heterogeneous relations involved has allowed the unpacking of the multiple and contingent ways through which Making emerges as work and the boundaries between production and reproduction are blurred. Entrepreneurial forms of work, leisure, post-work, and post-capitalist production are the contingent outcomes of network relations that operate at different, multiscalar sites, in which they are entangled with other urban assemblages that constitute Turin as a distinguishable context 'by both historical traces and emergent agencies' (McFarlane 2011, 380). At the same time, these multiple forms in which Making is (or is not) enacted as work rely on sociotechnical networks through which the production of material artefacts and immaterial contents is enmeshed with social reproduction in contingent ways. Indeed, Making as entrepreneurial work entails communicative practices and forms of sociality as crucial components of start-up businesses, enmeshing intimate spaces such as houses. However, the digital form of DIY performed by Makers could be also sustained by actor-networks that challenge the distinction between production and reproduction, work and life in different ways. Rather than enacting capitalist forms of value production, different arrangements could translate the digital DIY and sharing practices at the core of Making into the performance of leisure activities, post-capitalist practices, or more blurred forms of post-work.

Concluding, the reliance on DIY digital fabrication, sharing practices, the 'openness' ethos, and the use of a Fablab are neither sufficient conditions to consider Makers as a homogeneous category nor automatically correspond to a univocal transformation of the relationship between cities and work in digital capitalism. On the contrary, understanding Making as a contingent product of heterogeneous actor-networks allows us to conceive Makers' work and its spatialities in multiple, nonexclusive ways, thus 'opening the black box' (Latour 1987) that makes invisible the ambiguous, fragmented, and hybrid nature of new sociospatial reconfigurations of economic activities.

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Note

1 Indeed, works in human geography have mobilised practice theories to understand Making as a form of creative and autonomous material fabrication, but they fell short in paying attention to what is considered at the core of the innovative potential of Making in the sociospatial configuration of value production – that is, digitalization, collaboration, and openness (Carr and Gibson 2016, 2017; Grodach 2017).

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