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Urban Living Lab: What Is It, and What Is the Matter?

Dexter Du

Department of Real Estate and Planning, University of Reading, UK
Corresponding author: j.du@pgr.reading.ac.uk

The research agenda for urban innovation and experimentation seems to find new momentum in recent times. The recent emergence of Urban Living Lab (ULL) is an example demonstrating such a trend. Against this background, this paper begins with the interest in clarifying what ULL is. Various sources offer many definitions of ULL, but these definitions often contain other ill-defined concepts. This paper questions the ambiguity of temporality and spatiality that is contained by ULL's emphasis on 'real' time and environment. There seems also oversimplification of ULL's origin, which potentially hinders further in-depth investigation into its non-linear and complex emergence. The reflection on the political context indicates that political drivers of ULL may be hidden behind the immediate attention to its definitions and popular perceptions. The wide range of different empirical ULL cases in the UK arguably reflects the ambiguity of its meaning. Therefore, this paper suggests re-thinking about ULL and its emergence. The attempts to summarise and simplify ULL cannot effectively clarify its complexity in nature. Well-constructed questions can take ULL as a promising opportunity to enhance and materialise long-lasting sociological enquiries.

Keywords: Urban Living Lab (ULL), urban experimentation, open innovation, living laboratory

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Introduction

Currently there are increasing pressures for certain kinds of societal transitions (e.g. carbon neutrality, inclusivity, smart growth, etc.), because business as usual is unsustainable. Issues such as climate change and resource scarcity urgently require critical thinking as well as changes of individual lifestyle and collective urban living. Debates about urban innovation and experimentation are particularly relevant to this global background (von Wirth et al., 2019). Furthermore, the discussion about urban experimentation facilitates newly appearing projects which then are accompanied by the popularity of new concepts. One example is Urban Living Lab (ULL), which is the focus of this paper.

Empirically there has appeared a proliferation of ULLs over the past decade or so[1] (Voytenko et al., 2016; Puerari et al., 2018; von Wirth et al., 2019). This emergence and proliferation of 'new' practice and its quick increase of popularity seem eye-catching. Broadly speaking, ULL denotes the kind of initiatives that strives to improve certain urban environment through learning by doing in the very urban environment itself. It embeds experiments in actual situations, compared to using artificially created and controlled conditions. Not only does this concept chime well with the context of urban innovation, but also relevant initiatives in practice are deliberately promoted worldwide by international networks such as the European Network of Living Labs (ENoLL). Several relevant initiatives appeared around 2000 in both Europe and North America (Markopoulos & Rauterberg, 2000). These several early cases seem to have emerged simultaneously from many different places, while its very origin is still inconclusive. This paper will discuss some definitions of ULL in more details, which raises the question concerning temporality. Afterwards, its seemingly settled origin (from MIT, US) will be discussed and questioned. In addition to the prevalent association with the discussion about urban experimentation, this paper will also draw attention to the discussion about knowledge economy and the role of universities in urban politics. What will be found is arguably a non-linear history (perhaps histories) of the conceptual evolution, and complex socio-political embeddedness of the evolving conceptualisation. Some recent empirical examples from the UK will sketch a picture of the consequent variety and diversity in practice. Lastly, it will be argued that more in-depth discussion is needed about the non-linearity and complexity of ULL, asking 'why' in its past and present besides 'how' in its future.

Definitions of Urban Living Lab

Urban living lab appears to be developed in the context of urban innovation and experimentation[2]. This context is consequently often used to construct the definition of ULL. However, the result is not the conclusion of any definition straightforwardly. Instead, it appears difficult to reach any substantial consensus of the definition (Evans et al., 2018)[3]. Any definition turns out inevitably vague because there is too much meaning to convey in one single sentence. It possibly also involves confusion with other concepts in the same context. Therefore, as it will be shown in this section, some questions about temporality and spatiality are still awaiting discussion before the definitions of ULL could be further clarified.

Urban experimentation is configured as the processes through which learning, testing and innovating take place in actual urban space. Instead of confining experiments in conventional scientific labs, urban experimentation embeds scientific processes into the complex and open

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[1] This background statement here will be visited again in the discussion section later.

[2] The next section will show that the context of knowledge production and knowledge economy is also relevant.

[3] Some attempts to move towards such a consensus are made by, for example, Steen and van Bueren, (2017) as well as Chronéer et al. (2019).

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urban dynamics. The result is the creation of urban experimental space. On the one hand, such experimental space has its own boundaries that are drawn based upon the focus and interest of the experimentation initiatives. On the other hand, the boundaries of such experimental space do not intend to physically separate its inside from the outside. The experimental space becomes spatial case studies that attempt to exemplify the wider urban processes, to trial innovative elements within such specific space, and to recognise or stimulate wider urban transformation.

The context of urban experimental space facilitates the configuration of individual local initiatives titled urban laboratories. In their study reviewing urban laboratories, Marvin and Silver (2016) conclude with some categories of such urban laboratories, including Urban Living Labs (ULLs), Urban Transition Labs (UTLs), and Urban Knowledge Arenas (UKAs)[4]. ULL is defined as 'new collaborations devised to design, test and learn from social and technical innovation in real time' (Marvin & Silver, 2016, p. 58). Further, they suggest that ULL 'enrols end users into the innovation process and develops international networks for the transfer of technologies' (Marvin & Silver, 2016, p. 58). Such articulation of ULL aligns well with the context of urban experimental space.

Bulkeley et al. (2016) suggest two focuses that distinct ULL: the focus on knowledge and learning, as well as the explicit place-based focus. Anchored to these two features, 'ULL are sites devised to design, test and learn from innovation in real time in order to respond to particular societal, economic and environmental issues in a given urban space' (Bulkeley et al., 2016). This definition agrees with the definition by Marvin and Silver (2016) in terms of the emphasis on testing and learning knowledge, while it adds the spatial perspective of ULL, which is particularly place-based. This spatial perspective also catches the attention from Evans and Karvonen (2014) who discuss urban laboratories as bounded space. Moreover, this spatial perspective could be underlain by political interest. This will be addressed in the later part of this paper, while at this point a temporal perspective is worth discussing.

What is identically worded yet not explicitly highlighted by both definitions above is a temporal perspective of ULL. Both definitions use the phrase: 'innovation in real time' (Bulkeley et al., 2016; Marvin & Silver, 2016). However, the articulation of this temporal perspective of ULL seems unclear. It is clear that many definitions of ULL signpost the element of being 'real' with incorporating related phrases in the definitions, such as real time, real-life environment, real-life context, and real-world context (Voytenko et al., 2016; Steen & van Bueren, 2017; Puerari et al., 2018). However, only some of these definitions imply the temporal perspective, while others lean towards the spatial perspective. Bulkeley et al. (2016) also acknowledge that only some (not all) of the ULL cases are 'highly instrumented and seek to collect data in real-time' (p.14).

Implicitly, Schliwa and McCormick (2016) address the link between ULL and the perspective of real time data collection and analysis. They claim that two concepts have emerged in parallel from the context of urban innovation and experimentation, which are living labs[5] and smart cities. The empirical initiatives under these two concepts inevitably influence each other. In fact, many living lab projects are simultaneously also smart city projects. Real time data collection and analysis, in relation to ICT and Big Data, sit at the core of smart city initiatives. This real-time perspective arguably could also be fused into living lab initiatives. As mentioned

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[4] One question implied by their own study is to what extent the demarcation between each two of ULL, UTL, and UKA is arbitrary, but discussing this question is not the main concern of this paper.
[5] Living labs and urban living labs are often considered interchangeable, but the nuance between them can also be found in literature, which will be discussed in the next section.

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above, some of the ULLs are highly instrumented for addressing real-time data (Bulkeley et al., 2016).

This interesting observation by Schliwa and McCormick (2016) could suggest that the concept of ULL has not originally emphasised the real-time perspective. Rather, the attention to the real-time perspective is an outcome of ULL being influenced by (or also to some degree confused with) the concept of smart city. This real-time perspective may be further developed into the definitions of ULL, as mentioned above (Bulkelty et al., 2016; Marvin & Silver, 2016). However, currently this perspective seems to remain unclear in the literature discussion about the definition of ULL.

It may be open to debate whether the temporal perspective is important for the definition of ULL. However, as there is the attempt to distinguish ULL from other kinds of innovative initiatives (Bulkelty et al., 2016; Marvin & Silver, 2016), it will be helpful to improve the clarity of the temporal and spatial perspectives in ULL's definitions. Currently, the temporal and spatial perspectives seem to be entangled in the phrases such as real-life environment and real-world context. If ULL's temporality and spatiality could not be more clearly articulated, it would be difficult to understand the distinction of ULL that its definitions intend to achieve. This then potentially impedes meaningful further discussion about ULL.

Origin of Urban Living Lab

In addition to articulating definitions, tracing origins is another approach for clarifying the meaning of a concept. As will be shown in this section, urban living labs and living labs are often considered interchangeable, while ULL may add some 'urban' emphasis to the earlier concept of living lab. There seems a popular opinion that treats Prof. William Mitchell from MIT as the founding father of living lab. However, not only were there similar living labs initiated elsewhere in the world during the same period as the MIT living labs, but there were also earlier cases where living laboratory was already articulated. The simplification of ULL's origin may beset further understanding of its complexity.

Urban living lab is often linked to the earlier concept of living lab (Steen & van Bueren, 2017; Chronéer et al., 2019). Although there is nuance between living lab and urban living lab, this nuance seems often considered trivial. Therefore, the discussion about urban living lab often segues into the discussion about living lab, and vice versa. An article by Steen and van Bueren (2017) briefly acknowledges the difference between living lab and urban living lab, after which it is explicitly stated that the article 'focuses on the living lab phenomenon itself' (p. 26). However, interestingly, the title of that very article is 'the defining characteristics of urban living labs'.

In the context of open innovation, the concept of living lab advocates the approach of taking innovation processes out of the confined scientific labs and placing such processes into real-life environment (Veeckman et al., 2013; Schliwa & McCormick, 2016). In this way, a living lab opens up possible sources of knowledge, ideas, and feedback, which are vital for fostering innovation. Following this rationale, urban living labs are the living labs that are placed in actual urban environment. This could be compared to some early cases of living labs which were placed in real-life home environment. Those cases, such as the Media Lab set up at MIT, initially focused on testing technologies that mainly facilitated activities at home and interacted with users at the scale of domestic living. In contrast, urban living labs are interested in urban living, ranging from the scale of neighbourhoods, to districts, and to the whole city. Some commentators suggest that urban living labs are interested in the issues around urban

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sustainability (Bulkeley et al., 2016; Steen & van Bueren, 2017; Chronéer et al., 2019).

Quite many authors[6] endorse the statement that considers MIT as a pioneer (if not the origin) of practicing living lab with the creation of several living labs in MIT in the early 2000s. Their references are traced to Eriksson et al. (2005): 'The Living Lab concept originates from MIT, Boston, Prof William Mitchell, MediaLab and School of Architecture and city planning.' (p. 4) Moreover, as Eriksson et al. (2005) explicitly claim to offer 'a European approach', their statement is presumably also shared among practitioners, for example, through the European Network of Living Labs (ENoLL). However, this statement about the origin of the living lab concept is questionable based on some other references.

Markopoulos and Rauterberg (2000) reported 'some of the earliest and most influential' (p. 55) living lab projects. These projects (including one from MIT) took place around 2000, and the earliest seemed to be a project operated in 1997 in Vancouver, Canada. Moreover, these projects took place in both Europe and North America, including the Netherlands, Belgium, Canada, and the US (Georgia Tech, University of Colorado, MIT, and Microsoft). In addition to these contemporaneous cases with the MIT cases, there were also examples that had explicitly used the term 'living lab' or 'living laboratory' since the early 1990s (Schuurman, 2015). One example is a 1991 article titled 'introducing students to community operations research by using a city neighbourhood as a living laboratory' (Bajgier et al., 1991).

Bajgier et al. (1991) reflect on a case in which local people are engaged to address local issues such as parking, traffic control, trash control, and signage design. It looks a legitimate example of what is considered as ULL today. Regarding the 'urban' emphasis particularly, it is even a better example than the MIT projects. Although focusing more on students' learning, Bajgier et al. (1991) also provide some articulation of what they term 'living laboratory'.

> 'A major selling point for all concerned parties is that this is a win-win situation for the university and the neighborhood. The university students gain such things as the opportunity to apply problem skills to real problems, the opportunity to learn while performing a real service, and the opportunity to write reports for directly involved individuals. The community gains a new, no-cost resource that offers a neutral forum for conflict resolution and can provide high quality analyses. ... we believe that there are many public arena problems that a university can use as a living laboratory ... such as municipal facilities or sports stadiums.' (Bajgier et al., 1991, pp. 708-9).

This articulation of living laboratory by Bajgier et al. (1991), published almost ten years before the MIT cases, is echoed considerably by the articulation of ULL today. For example, a recent paper co-authored one of the leading authors about this topic presents a similar summary of the potential benefits of ULL.

> 'In a Living Lab, it is essential to harmonise the innovation process amongst stakeholders so that they can benefit from the process in different ways. This can be seen, for example, in how companies can get new and innovative ideas, users can get the innovation they want, researchers can acquire case studies, and public organisations can get increased return on their innovation research investments' (Ersoy & van Bueren, 2020, pp. 96-7).

Moreover, Bajgier et al. (1991) have emphasised throughout their paper the practice of interdisciplinary thinking in problem-solving, which is still an essential point of ULL today. Their

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[6] See, for example, Eriksson et al., 2005; Schumacher & Feurstein, 2008; Dutilleul et al., 2010; Almirall & Wareham, 2011; Schuurman et al., 2011; Franz et al., 2015; Schliwa & McCormick, 2016; Sharp & Salter, 2017; Evans et al., 2018.

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case perhaps lacks the application of any novel technology, as compared to the cases around 2000 (Markopoulos & Rauterberg, 2000). However, as discussed in the previous section and will be shown by the empirical sample later, it is debatable to what extent novel technology is essential for defining ULL.

Therefore, it is unclear why the MIT living labs are given so much credit for being the origin of living lab. The emergence of the concept is more likely to be in a non-linear manner, which should not be over-simplified by pointing to one singular origin. Similarly, programmes such as the European Network of Living labs (ENoLL) and JPI Urban Europe have temporally accelerated and geographically expanded the non-linear proliferation of ULLs since the second half of the 2000s, in both Europe and the rest of the world. Rather than assuming a singular origin a priori, it is worth thinking and researching more carefully about this non-linearity and complexity of ULL's emergence. This is to some degree beyond the scope of this paper, but this concern will be visited again in the discussion section later.

Politics underlying Urban Living Lab

The previous sections have discussed the definition and origin of urban living lab. This section turns to the context (perhaps contexts) of the concept. If the definition and origin of ULL are inconclusive, what could be the forces or mechanisms that maintain the distinctness of ULL? What is found relevant here is the power dynamics in urban governance, and some social challenges that face universities. At the time of possible knowledge economy, universities as the main producers of knowledge adjust their role in urban governance and their relations with citizens, which seems to have significant implication for the practice of ULL. While ULL seems to represent 'open' processes in the context of experimentation and innovation, it should also be considered in the political context which suggests that important urban processes may happen behind closed doors.

The concept of urban experiment, in which ULL is often contextualised, refers to a quadruple helix model of engagement, including science, policy, business and civil society (Bulkeley et al., 2016). This model emphasises the four kinds of stakeholders who participate in the urban experimentation process, which are academia, government, private companies, and the public (Voytenko et al., 2016). This model seems a further development of the public-private-partnership (PPP) in the context of open innovation, which advocates the importance of diverse sources of insights and feedback. Relating to this context, urban experiment is a process in which knowledge is produced through synthesising experience and discussing feedback from largely four areas of expertise. Compared to PPP, the two additional roles of universities and citizens arguably also involve thoughts from additional contexts.

The political power of universities is increasing during the time when science is given a vital role in a range of matters, including public policy making, urban innovation, knowledge economy, and creative industry (Perry, 2006; Addie, 2017). What goes in tandem with the increasing power is the increasing challenge to it. Universities are faced with doubt about and scrutiny of their authority. They need to maintain and strategically strengthen their position by (re-)gaining both trust and interest in the knowledge they produce (Perry, 2006). Knowledge about urban dynamics could be (re-)legitimised through, for example, engaging the public in a transparent and open process of knowledge production (Addie, 2017).

Urban living lab becomes a useful approach for demonstrating the transparency and relevance of knowledge production. By embedding the process of research and analysis in real-life urban environment, ULL not only showcases the outcome of science but also the process of

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producing such scientific outcome. What ULL highlights is the procedural rationality of knowledge production. Through rationalising the research process, knowledge production itself gets formalised. Evans and Karvonen (2014) suggest that the 'emphasis on formalized knowledge production' (p. 415) distinguishes urban laboratories, but what they mean by this phrase is not further explained. A clearer articulation is offered by Ersoy and van Beuren (2020) who contrast formalised knowledge with substantive results. Substantive results are what works in a specific situation, while formalised knowledge is what can be learnt by other similar situations. Bulkeley et al. (2019) may also be indicating this contrast while emphasising the 'interest in learning (rather than, for example, "trying things out")' (p. 319). This contrast is also interested by a group of authors arguing for wider (sustainable) transformation beyond individual ULLs (Bulkeley et al., 2016; 2019; von Wirth et al., 2019).[7] Given the viewpoint of procedural rationality, engaging citizens in ULLs becomes also a process to engage the public in rationalising the process of knowledge production. ULL becomes the platform on which both the production process and the knowledge itself are communicated to the public. It facilitates a translation process which enrols local communities as the allies of universities in the wider dynamics of urban governance. However, the degree of civic engagement in specific cases is worth criticising (Evans & Karvonen, 2014).

The politics of science and knowledge production offers critical viewpoints on understanding urban living lab. The case study by Evans and Karvonen (2014) specifies this political critique in the urban laboratory of Oxford Road Corridor in Manchester, UK. The universities (University of Manchester and Manchester Metropolitan University) are the key stakeholders of this urban laboratory. The spatial boundary of the laboratory is drawn in such a way that protects the universities' authority over the lab. Firstly, the two universities own a large proportion of assets within the boundary of the lab, which physically consolidate the universities' decision-making power. Secondly, surrounding communities which historically bear antagonistic relationship with the universities are avoided by the demarcation of the lab area.

Evans and Karvonen (2014) also raise the critique of the process of knowledge production in the Manchester case. A clear highlight of the Manchester case is the collection of real-time and place-specific data, for instance, monitoring traffic and air pollutants. However, Evans and Karvonen (2014) find it unclear how this data will be used further. The process of data collection is open to the public. For example, the monitoring sensor is introduced and the plan of installing them is accessible. In contrast, what happens to the data after its collection becomes opaque. In other words, the process of knowledge production seems only partially open. Another related question is whether citizens are treated as 'laboratory rats' in the living labs (Evans, 2011). Their participation in ULLs may not render them more powerful in urban politics. Powells and Blake (2016) find it clear that the city is positioned as 'both the main subject and object of experimentation' (p. 147), in which case citizens may be simply 'observed' to facilitate decision-making while they are hardly integrated in the decision-making process.

Therefore, ULL is criticised for facilitating the power of certain interest groups. This then becomes to some extent contradictory to the inclusive image represented by the quadruple helix model which is claimed to be the basis of ULL. Latour's study of Pasteur (1983) articulates how science and society interact to not only produce knowledge but also concentrate power into the knowledge producers. While predating the appearance of living lab, Pasteur's practice arguably showcased the same kind of process[8]. In this case, many local French farms were transformed into field laboratories working together with Pasteur's central laboratory in Paris

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[7] This line of thinking will be visited again in the discussion section later.

[8] Both articles by Latour (1983) and Evans & Karvonen (2014) are titled with the parody: 'give me a laboratory and I will …' As Latour (1983) acknowledges, it is a parody of Archimedes' motto about moving the world with a lever.

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(Latour, 1983). Given the proliferation of ULLs today, it is relevant to ask 'how science colonizes sites beyond the laboratory, creating networks of actors ... and flows of "power" back to the scientist and science' (Allmendinger, 2017, p. 14). Is ULL creating flows of power to universities (more so than to citizens) while producing scientific knowledge?

An Empirical Sample of Urban Living Labs

This section reports a desk-top analysis of the UK-based urban living lab projects. The 33 cases in the UK are used as an empirical sample to observe the practice with the reflection in the previous sections. Similar practice of observation has been made with an international scope (Marvin & Silver, 2016; Keith & Headlam, 2017). However, considering the ambiguity and complexity of ULL, it is useful to re-conduct this practice with a smaller scope of case selection (i.e. within the UK). The 33 cases (see Appendix) are gathered through three international benchmarking organisations endeavouring to register and keep records of the many ULLs, which are European Network of Living Labs (ENoLL), Governance of Urban Sustainability Transitions (GUST), and JPI Urban Europe[9]. What will be shown is diverse kinds of practice that correspond with the ambiguity of ULL as the overarching concept.

Among the listed cases, Newcastle Science Central is the one archetype that is the most relevant to the definitions and critiques which are reviewed in the previous sections. It is a city-centre regeneration site that is designed and constructed as an urban living lab (a ULL from scratch). Leading partners include Newcastle University, Newcastle City Council and private investment and management companies. The architecture incorporates novel technologies so that real-time environmental data (e.g. building energy performance) can be collected, presented[10], and analysed. The site sits in the city centre and accommodates several faculty buildings of Newcastle University. Citizens and students will be the daily users of this site, for which it will be a bounded space to conduct experimental studies of immediate environmental impact of public behaviour. The role of Newcastle University is undoubtfully significant in this lab. Newcastle University owns a large proportion of land and buildings within the lab site. It is also the main partner to operate the real-time data element of the lab, for example, researching about technology, studying data, and presenting results.

There are two cases looking very similar with the case that is studied by Evans and Karvonen (2014), as discussed in the previous section. Both cases of CityVerve Manchester and Triangulum[11] Manchester are located specifically at the Oxford Road Corridor in Manchester. Both cases emphasise the monitoring of environmental data (e.g. traffic and air quality) in real time. Both cases engage the University of Manchester and Manchester Metropolitan University as the leading actors. Both are EU-funded Horizon 2020 projects.

In addition to the above three cases, there are some more cases that mostly demonstrate the above-reviewed features of ULL, but they seem to diverge or compromise in various aspects and to different degrees. For example, Coventry City Lab is mainly led by Coventry University and aims at using real-life environment to enhance the study of novel technologies (e.g. electric vehicles). However, the lab site is bounded within the University Technology Park. Although this site is accessible to the public, the degree of being an 'urban' space is less than that in the

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[9] Much research has used these organisations to gather empirical cases. See, for example, Veeckman et al., 2013; Franz et al., 2015; Schliwa & McCormick, 2016; Voytenko et al., 2016; Sharp & Salter, 2017; Steen & van Bueren, 2017; Kronsell & Mukhtar-Landgren, 2018; Bulkeley et al., 2019; von Wirth et al., 2019.

[10] Real-time data from almost 500 sensors is presented live in an artistic way, which is also adopted as the project logo. The presentation is available at: https://newcastlehelix.com/logo (27th August 2020)

[11] Triangulum is mentioned in another paper co-authored by Evans and Karvonen (Evans et al., 2015).

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above three cases in Manchester and Newcastle. In other words, the lab space to some degree avoids, or only cautiously involves, the real-life urban environment, compared to the cases mentioned above. Similar to the above cases, the university is largely in control of the operation of the lab activities due to its ownership of the lab site and the research infrastructure.

There are also cases which do not engage universities. These cases emphasise public participation and engage citizens to co-create and co-conduct local projects. Oftentimes the local council or local charity groups act as the actor to initiate the projects and facilitate the process with necessary resources. However, citizens are considered as the central actors who actually conduct the activities and drive the implementation of the lab. These cases are also clear about the physical sites of the labs (usually community centres). For example, Manor House PACT is a project led by the charitable social enterprise called Manor House Development Trust. This trust owns some real estates in London, so these estates can be used as the physical space to organise events or to facilitate self-organising activities, such as community gardening. The lab experiments participatory approaches of urban governance and demonstrates that citizens have great potential to address their local issues, improve local environment, and encourage behaviour change (e.g. enhancing climate awareness and sustainable lifestyle).

Some other cases do not have clearly bounded space as the lab areas. It can be a research centre which emphasises its preference for participatory, collaborative, and interdisciplinary approaches. However, specific approach will vary from project to project. It is the research centre (not the specific projects) that claims to be the lab. For examples, THINKlab Manchester and Centre for Sustainable Technologies Belfast. There are also cases which intend to create or incubate urban living labs. These cases are like what Keith and Headlam (2017) term 'living lab programmes' that facilitate further individual labs. For example, Urban Education Live Sheffield and Incubators of Public Spaces London. The role of universities in these cases is significant, as these cases mostly resemble academic research projects, with academic staff acting as the project leaders.

Finally, there are also cases that focus on rural areas or issues largely related to natural environment, such as Greening Wingrove Newcastle and Living Don Sheffield. This reflects the scope of living lab generally, in comparison to urban living lab particularly, as also discussed in the earlier sections. The benchmarking organisations do not exclude rural areas from their scope, although most registered cases do have an urban focus.

Discussion

This section re-visits the issue with which this paper begins: the emergence of urban living lab. After the reflection in the previous sections, it becomes questionable what this issue indicates. It seems still unclear what ULL is. Therefore, based on what 'the emergence of ULL' becomes a valid statement? How come the wide variety of practice becomes captured under one label? Who are in favour of this capturing effect, and how they succeed in fostering the popularity of such a label? There are several ways in which these questions might be circumvented. However, there seems lacking the kind of questioning and research about ULL that may investigate into fundamental social and political processes underlying the governance of cities and environment today.

Several authors use 'emerging' and 'proliferation' to describe the recent appearance of urban living labs (Voytenko et al., 2016; Puerari et al., 2018; von Wirth et al., 2019). This recent emergence of ULLs started around the beginning of the 2000s (Veeckman et al., 2013; Schliwa

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& McCormick, 2016). Afterwards, increasing number of institutions and initiatives call themselves living labs and practice relevant experimental approaches. The European Network of Living Labs (ENoLL) continues to benchmark living labs in not only Europe but also additional countries in Africa, Asia, and the American continents. While ULL as an empirical phenomenon rapidly grows, there is a growing number of accounts about it, largely based on practitioners' experience (Bulkeley et al., 2016). Besides becoming a popular development approach, ULL continues to not only catch the attention from academics but also gain recognition among policy makers (Schuurman et al., 2013; Steen & van Bueren, 2017).

The context of urban innovation and experimentation is broad enough to concern an almost infinite number of cases. All these cases can arguably be identified as ULLs. For this reason, the samples of empirical cases can vary greatly from research to research. This paper takes a very narrow route, which only includes the cases that are registered under the well-known benchmarking organisations. This results in 33 cases in the whole UK. With similar parameters, Keith and Headlam (2017) find over 200 ULLs around the world. Marvin and Silver (2016) map over 70 urban labs around the world, including around 40 in the UK. In contrast, it is also possible to take a much more inclusive approach, especially to identify the grassroot initiatives that are created among the very local actors without signing up to international schemes (Voytenko et al., 2016). This more inclusive approach can identify already around 100 cases only in one single city (Steen & van Bueren, 2017; Durrant et al., 2018).

Some research claims to focus on not urban living lab itself, but on how it may transform the wider situation towards sustainability (Bulkeley et al., 2016; 2019; von Wirth et al., 2019). For this line of thinking, the emergence of ULLs provides many empirical opportunities to observe how niche actions may intervene in regime stability. Whether this niche is labelled as ULL is not the central concern. Moreover, for research on urban governance, ULLs create many opportunities to observe the trial of innovative or alternative governance approaches. Case studies like the one in Manchester (Evans & Karvonen, 2014) offer timely insights about how new governance approaches are addressing or continuing avoiding certain urban issues. For this line of research, individual ULL provides materialised storylines to complement normative debates. Whether the space of this materialising process is called ULL is not the central concern, either.

Therefore, this paper suggests a question: does ULL really matter? In what ways urban living lab is essentially important for our urban living? What is actually emerging along with the proliferation of ULLs? This enquiry sits in the nuance between the acknowledgements of the phenomenon itself (i.e. proliferation of ULLs) and the translation of such phenomenon into the existing academic contexts (e.g. niche-regime, urban governance etc.). If the emergence of ULL is accepted, are there any questions that are worth considering before research moves on to studying further impact of ULL? In addition to looking forward, it is also worth looking back. What is behind the emergence of ULL? Why is it ULL, and why is it the recent time? The emergence of ULL can not only be taken as the background of research, it can also be foregrounded as the focus of enquiry, which is arguably missing from existing research.

For practitioners, the emergence of ULL is interesting as there are new opportunities for concrete actions. For academics, the emergence of ULL is interesting as there are new materials for advancing reflection and discussion. What ULL is exactly, however, seems of little interest to either of them. During the time when postmodernism thoughts are becoming the mainstream, which rejects any universal claim or attempts to standardise such claims, is it even important to be so exact on the general level? Instead, emphasis is put on the

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understanding of specificity with sensitivity to particular context, place, time, culture, history, and so on.

However, neither practitioners nor academics would have benefited from this proliferating practice had ULL not made it possible. Has ULL made this proliferating practice possible, or has the name of ULL been given to the proliferating practice which would take place regardless of the name? Arguably, the emergence of a certain kind of social phenomenon does not come with no reason. There must be groups of entities and forces that diligently promote the parameters of changes, either consciously or unconsciously (Latour, 2005). The question is, to what extent and in what ways urban living lab – the phrase itself and the stabilisation of the concepts supporting the popularity of this phrase – is vital to the emergence of 'new' practice? What possibly sits behind ULL is deeply influential storylines that may have stood out from complex battles of thoughts, interpretation, argument, discourse, and political power.

On the one hand, ULL might be another example of 'buzzword' which actually makes little substantial difference. On the other hand, it may be a 'black box' which has significant impact on both theorisation and practice. A black box in the social science context has high authority over its internal matters (Jacobs et al., 2007; Rydin, 2012). Outsiders would only calculate and accept the output from the black box based on the given input. What happens inside the black box would hardly be questioned or challenged. If certain social process is maintained as a black box, the power structure and relations within this process become stabilised. The stability of the black box leads to its mobility, for which its practice could be transferred over time and space. The making of the black box is a constant matter for relevant actors, because controversy may rise at any point. Failure to maintain the black box would mean certain actors' loss of power. It would shed light on understanding of social processes if further research questions could link the study of ULL to this conceptualisation.

Conclusion

The attempt to clarify the meaning of urban living lab has led to further questions. The definitions of ULL do not seem to resolve its ambiguity. The effort to clarify ULL seems to mis-represent the historical events in which relevant ideas have evolved. ULL can be rooted in not only one but also multiple related contexts. These contexts together adopt the concept to facilitate certain changes of power relations in which the positions of certain powerful actors get reinforced. The empirical practice in the UK indicates the flexibility of ULL, for which a variety of projects can adopt the concept and adapt it to their specific purposes. These points of reflection suggest that ULL and its emergence may not be a simple entity that can be straightforwardly clarified. There may be complexity of sociological dynamics behind, which could be an interesting focus for further study.

Around the world, the increasingly urgent call for sustainable transition has seen flourishing practice of urban innovation under the banners of, for example, resilient city, inclusive society, and smart growth. The eye-catching emergence of urban living lab may represent certain winning political power and discourse. The matter of ULL can potentially go beyond what it means or how it is described in words. It may become the agency representing certain interest groups whose political influence is maintained and expanded by stabilising and transferring ULL across spatial boundaries and levels. From this viewpoint of political agency, the ambiguity of its meaning may be the precise outcome of deliberate effort.

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Appendix: ULL projects in the UK

No.	ULL	Networks	Keywords
1	Bristol Living Lab	ENoLL	Knowle West Media Centre; digital technologies; local centre for meetings and collaboration; access to innovative tools; open data sharing platform; energy; citizen engagement
2	The Community Energy Lab, Tottenham London	GUST	building retrofitting; waste recycling; social enterprise; inclusion and equity; energy efficiency; local employment services; Selby Centre Green Hub
3	Coventry City Lab	ENoLL	low carbon community; ICT; vehicles and traffic; sustainable buildings; old building retrofitting; home energy measurement sensors; Coventry as a test-bed
4	Centre for Sustainable Technologies (CST)	ENoLL	multidisciplinary research; energy
5	Communities Building Capacity Birmingham	ENoLL	citizens self-help; digital technologies; local services; social inclusion; internet connectivity; access to computers
6	City Observatory Glasgow	ENoLL	Technology and Innovation Centre; information system
7	DEHEMS (Digital Environmental Home Energy Management System) Birmingham	ENoLL	Edgbaston area; intelligent metering system; graphic user interface online
8	Innovate Dementia Living Lab, Liverpool	ENoLL	dementia and aging; healthcare accessibility and affordability; user-friendly approach; Regional Stakeholder Platforms; intelligent lighting; nutrition and exercise
9	ECIM (European Cloud Marketplace for Intelligent Mobility) Birmingham	ENoLL	Platform as a Service (PaaS); SMEs; services to the cloud; open cloud-based services for innovators; technical outputs include ECIM Marketplace, ECIM mobility apps, and ECIM Smart Mobility API specifications
10	Edinburgh Living Lab	ENoLL	mobility; energy; co-designing; data-driven analysis and participatory design techniques
11	WASTE FEW ULL Bristol	JPI Urban Europe	reduce waste; Food-Energy-Water nexus (FEW); testing viable phosphate recapture from sewage; design thinking, systems mapping, resource flow dynamics, corporate risk management; Centre for Agro-ecology, Water and Resilience at the University of Coventry
12	FloodCitiSense Birmingham	JPI Urban Europe	Selly Park area; app for pluvial flood warning service; sensors and web-based technologies; citizen scientists building their own rain drop counters
13	Future City Glasgow	GUST	smart city technology; Operations Centre; Data hub and open data
14	GLIMER Glasgow	JPI Urban	migrants and refugees; integration
15	Greening ingrove Newcastle	GUST	community engagement

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16	Newcastle Science Central / Helix	GUST	data science, urban science, and life science; digitally enabled sustainability; real-time data lab and data sensors; office building and business district; mixed use urban centre; local employment; largest single regeneration site in the UK; smart homes; public space
17	Incubators of Public Spaces London	JPI Urban Europe	Pollards Hill area; incubators online platform; co-creative software; e-participation; scenario and model forming;
18	Newcastle Living Lab for Innovating Relationships	ENoLL	partnership and organisation building
19	Living Don Sheffield	GUST	nature landscape protection
20	MadLab Manchester	ENoLL	public centre for meetings and collaboration; media production; technology and art
21	Manchester Digital Innovation Living Lab	ENoLL	digital application; interdisciplinary
22	Muswell Hill Low Carbon Zone of London	GUST	reducing carbon emission; home energy; low carbon loan; electric car and charging points; solar panels; social enterprise; community building retrofit; community engagement
23	Manor House PACT (Prepare Adapt Connect Thrive) London	GUST	resilience to climate change consequences; social networks and communities; home energy advice and installation; food; water; local economic opportunities; health; encouraging people to walk; community garden at the community centre
24	CitySDK (Service Development Kit) Manchester	ENoLL	digital services; participation, mobility and tourism; open street map; easy access for citizens to give feedback to municipalities
25	Sum Studios Sheffield	ENoLL	community engagement; arts, business and community
26	Sheffield City Region	ENoLL	healthcare; Advanced Wellbeing Research Centre (AWRC); digital inclusion
27	SmartImpact Manchester	ENoLL	smart cities; data governance and integration; smart finance and procurement initiatives; regulations and incentives; data integration and urban data platforms
28	MK: Smart Milton Keynes	GUST	sustainable growth; MK Data Hub; data enhanced city services
29	THINKlab Manchester	ENoLL	interdisciplinary research; digital cities; digital service to business
30	Traiangulum Manchester	ENoLL	Oxford Road Corridor; infrastructural integration of energy, mobility and ICT systems; ICT platform 'Manchester-I'; marketplace for innovative business; reducing car usage

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31	SmartUrbl (Smart Urban Intermediaries) Birmingham and Glasgow	JPI Urban Europe	smart urban intermediaries; social innovation; smart urban development
32	Urban Education Live (UEL) Sheffield	JPI Urban Europe	community engagement; collaboration between universities and communities; local hubs
33	CityVerve Manchester	ENoLL	smart city; open smart platform; health, energy, transport and public realm; Oxford Road Corridor area; art and technology; gamification and citizen behaviour; Internet of Things; data sensors and cloud services; sustainable building

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