Urban Living Laboratories: conducting the experimental city?

1. Introduction

The recent upsurge of interest in the experimental city as an arena within and through which urban sustainability is governed (Bulkeley & Castan Broto 2013; Evans et al. 2016) marks not only the emergence of the proliferation of forms of experimentation – from novel governance arrangements to demonstration projects, transition management processes to grassroots innovations – but also an increasing sensibility amongst the research community that urban interventions can be thought in experimental terms. As a phenomenon, urban experimentation appears to be driven at least in part as a means through which societies "act in an increasingly complex environment, where the challenges they encounter overflow institutional, regional and ontological boundaries" (Kullman 2013: 879). Where the capacity to govern is recognised as fragmented and where what it means to govern well – to improve the urban condition – is subject not only to uncertainty but to contestation – experimentation provides a means through which diverse actors seek to navigate and make sense of the present whilst also giving concrete form to particular visions of the future (Bulkeley et al. 2015). Whether explicitly or not, experimentation as a mode of sustainability governance has arisen as the "the modernist dream of total control" has been challenged, in its place creating a "more provisional, adaptive understanding of the city … which view the city as an emergent and heterogeneous assemblage" (Evans 2016: 429). As a field of research, concerns with urban sustainability experimentation have been driven both from within urban studies (Hodson and Marvin 2009) as well as by those within the transition studies community who have begun to attend to the city as an important arena within which sustainability transitions are forged and contested (Truffer et al. 2015). These factors combined have served to generate a vibrant field. Multiple studies have now documented the phenomenon of urban sustainability experimentation, have sought to investigate the particular drivers and dynamics at work, and consider the consequences at both the level of the city and beyond.

Yet as research has progressed, it has become clear that urban sustainability experimentation is not a singular phenomenon that can readily be understood using any one conceptual entry point. In this paper, we focus on one particular mode of experimentation – the urban living laboratory (ULL) (Bulkeley et al. 2016) – and develop a typology through which to undertake a comparative analysis of European ULL to understand how and why such forms of experimentation are being designed and implemented, and to identify the distinct forms of experimentation they entail. Such an analysis is not only important in distinguishing what *is* a ULL, but also in determining what falls outside this delimitation and might be better considered either as another form of experimentation or indeed as a different kind of intervention altogether. Distinguished by a specific interest

in learning (rather than, for example, 'trying things out') and its utility as a means through which change can be engendered, ULL have become a prominent form of sustainability experimentation across Europe (Evans and Karvonen 2014; Voytenko 2016). In descriptive terms, ULL are often considered as possessing several common characteristics: geographical embeddedness in a specific urban context, an explicit learning function, participation and user involvement, alternative modes of leadership and ownership than found in traditional private sector projects or urban planning processes, and the intention to undertake evaluation and ongoing improvement (Voytenko et al. 2016). ULL have attracted the attention of European funding programmes (such as those concerned with 'lighthouse' projects through which notions of smart and sustainable cities can be tested and lessons shared) and national funding agencies. At the same time, ULL have become important in new forms of partnership working between municipalities and local higher education institutions concerned with generating new forms of knowledge that are closer to society and more immediately able to be put to use. ULL have also provided a means through which community organisations have sought to establish different possibilities for the development of local areas, seeking to capture knowledge and learning to secure both legitimacy and resources. The propensity of the laboratory to multiply in the city can appear unbounded.

Yet analysis of ULL remains often very broad-brush, based on descriptive categories and focused on emerging trends as well as a few emblematic examples. As a result, our understanding of the drivers and outcomes of ULL, and how they fit within other modalities of urban governance, is partial at best. There is a significant gap in the current literature focused on two critical questions. First, there is a need to examine the reasons for the emergence of ULL in terms of who is involved (and excluded), and why they are developed. Second, there is a need for new empirical analysis of the emerging practices of ULL through extensive review and detailed intensive case studies of the formation, stabilisation and operation of ULL in different urban contexts to better understand ULL outcomes and contribution to urban governance. In short, to understand how the specific design and conduct of ULL shape the capacity to translate between the laboratory and the urban arenas and networks of which it is part. In this paper we seek to develop analytical categories to develop a framework through which to address these two deficits. We argue that there are distinct types of ULL taking shape, delimited both by the ways in which they are designed and are deployed through specific kinds of configuration and practice on the one hand, and by the ways in which they take form as a laboratory – of the different dispositions towards the laboratory they entail.

In pursuing this analysis, we follow recent work that suggests that experimentation can usefully be thought from a pragmatist perspective to be a particular form of inquiry, identified by John Dewey as a "key practice in which situations are problematized and disclosed as undetermined, which are then given a determination and a solution" (Delgado and Callen 2017: 188). ULL are then part of a politics of determining solutions to

problematic situations, situations in which some form of improvement is seen as necessary and desirable (see also Bulkeley et al. 2015). The rest of the paper is divided into four sections. Section 2 examines the ways in which the laboratory has been seen as a means through which governance is conducted identifying two sets of relations that are critical to the functioning of the laboratory: the design of improved conditions and the mediation of the tension between control and contingency. From these literatures, we develop an initial typology of the forms of ULL design and their laboratory dispositions. Section 3 introduces the methodology through which we gathered and analysed a sample of ULL in European cities, before providing an analysis of the types of ULL that we found across this sample. Section 4 examines in more depth the four main emblematic types of ULL: a strategic demonstration ULL Aspern Urban Lakeside (Vienna, Austria), a community platform ULL Stapeln (Malmo, Sweden), a civic platform MK: Smart (Milton Keynes, UK) and a civic demonstration ULL Concept House Village Lab (Rotterdam, The Netherlands). Finally, in the conclusion we highlight the distinctiveness and contribution of the paper before outlining the implications for future research priorities.

2. Laboratory Governance

Laboratories have long occupied an essential passage point between society and the working of science and technology. Taking a privileged position in popular imagination as an uncontaminated space within which experimentation is conducted, scholars of science and technology studies have demonstrated the historically contingent nature of the laboratory and its multiple forms (Evans 2016). While conventionally laboratories have been seen to precede the scaling up of experiments and their infiltration into society at large, Gross (2016) argues that it is also imperative to acknowledge the ways in which wider processes of experimentation – such as those associated with the governing of sustainability – may retrospectively turn to the laboratory as a way of giving form and legitimacy to an experimental intervention. Yet for all of their various manifestations, laboratories are often imagined as geographically confined, bounded spaces for experimentation. Whilst these socio-spatial relations, and the ways in which they enable forms of mediation between the 'internal' world of the laboratory and the 'external' or 'real' world, are significant in shaping our understanding of the work that ULL perform in the urban milieu, we suggest that there are other characteristics that are also significant in understanding the contemporary urban form of experimentation and the ways in which the power of laboratories to govern unfolds.

First, laboratories are conceived as spaces in which it is possible to enact various forms of 'improvement'. As Knorr (1992: 116) argues, "the laboratory is an enhanced environment which improves upon the natural order in relation to the social order": that is, it provides an arena in which phenomena are manipulated according to their desired characteristics. As such, laboratories work with the *malleability* of phenomena and the

observation of this dynamic. As Evans (2016) argues, it is the combination of some form of intervention with a means of observation that then lend laboratories their distinction in relation to other forms of novelty or experimentation (Karvonen and van Heur 2014). This in turn requires that any account of urban living laboratories needs to attend to the ways in which intervention-observation is designed and practiced, an issue to which we return below.

The second set of relations that are vital concern the disposition of the laboratory in relation to the forces of control and contingency. While several authors have drawn attention to the importance of the ways in which boundaries are drawn between the laboratory and the 'real' world as a means through which degrees of control are enforced (Gross 2016), but here we are instead concerned with the disposition of the laboratory itself. The disposition of any socio-material assemblage can be thought of as "a tendency, activity, a faculty or property in either beings or objects – a propensity within a context" (Easterling 2014: 73). Rather than being a property of specific elements within the urban living laboratory configuration, an assemblage can be thought of as a form of what Easterling terms 'infrastructure space' in which "disposition is immanent, not in the moving parts, but in the relationships between components" (Easterling 2014: 73). Laboratory dispositions encompass both the requirement to be "flexible enough to allow for reconfiguration so as to sustain their transformative potential but also controlled enough to hold together." (Kullman 2013: 885). In short, they marry and continually negotiate control and contingency. Dewey's concept of 'inquiry' is also useful here. Inquiry, as discussed above, is a means through which an indeterminate situation can come to be formed as a whole that is capable of intervention (and resolution). An indeterminate situation is "not only 'open' to inquiry, but it is open in the sense that its constituents do not hang together" (Dellgado and Callen 2017: 188) and therefore more amenable to the contingent. Laboratory interventions, as a mode of inquiry, serve to configure these constituents into a viable set of socio-spatial, socio-material relations which are more or less ordered. Yet the very disposition as laboratory also entails that an ongoing openness to contingency in the socio-material relations established within the laboratory is maintained. As we set out below, the way in which the control-contingency dynamic is realised gives form to multiple dispositions of urban laboratory governance.

Tracing the work that a laboratory does, beyond its ready embodiment in the specific (and often privileged) form of a scientific enclave, suggests that its form, and with it its politics, are to be found in how intervention-observation are designed and practiced and the ways in which its disposition towards control-contingency is configured and put to work. These dynamics in turn configure the capacity of the laboratory and its relation to the urban milieu. In the rest of this section, we provide a typology through which these characteristics can be categorised and analysed. The resulting typology of urban laboratory governance is intended to provide a heuristic device for exploring the ways in which urban living laboratories (inter)mediate the governing of urban

sustainability transitions, recognising that each category is an 'ideal type' and that while it is possible, as we seek to do in the next section, to delimit particular urban living laboratories according to this framework, in reality any particular laboratory is likely to bear the hallmarks of different designs and dispositions as they evolve over time.

2.1 Laboratories by design: different modes of intervention and change

As set out above, laboratories involve, by definition, some form of intervention which is designed to improve on what might 'naturally' (in the broadest meaning of the term) occur: they are interventions designed to improve. At the same time, they are characterised by the intention to observe – to understand the potential of any such improvement and how it unfolds in particular conditions. As vehicles for intervention and improvement, ULL can readily be conceived as forms of governance. On the one hand, the arrangements and functions of ULL can be analysed as an expression of new governance institutions (Evans et al. 2015; Nevens et al. 2013). On the other, with their intention to improve the urban condition and provide a means through which socio-material conditions can be manipulated to create new forms of conduct, they can also be understood as form of governmentality in the Foucauldian sense (Bulkeley et al. 2015).

While each perspective leads to different analytical entry points and a concern with different dynamics, both institutional and governmentality readings of governance point to the importance of understanding the ways in which such interventions are *designed* and *practiced*. Here we consider the design of urban living laboratories to include the actors, arrangements, resources and visions that are bought to bear in the formulation of what it is that ULL are intended to address and how they are initiated. The practice of ULL includes the everyday, ongoing work of being a ULL, from the implementation of specific techniques to the operation of particular systems and technologies to monitoring ULL progress against its vision and goals. Alternative modes of design and practice shape both why and by whom ULL are configured and the nature and purpose of the forms of observation that take place. In short, the configuration and conduct of ULL take alternative forms which shape their purpose and capacities.

For Karvonen & Heur (2014) three particular, mutually reinforcing, characteristics are central to the constitution of the laboratory: situatedness, change orientation, and contingency. We concur that the situatedness and change-orientation realised through ULL design and practice are significant in shaping how the dynamic of intervention-observation that is so central to their work as laboratories takes place (and purse the notion of contingency further below). Karvonen & Heur (2014) expand on the notion of situatedness as a means of capturing the ways in which a laboratory has to both be grounded in particular conditions that are

accepted as a space from which legitimate knowledge can be produced and at the same time embody a 'placelessness' – a sense that the forms of intervention undertaken and the observations produced could happen anywhere. This situatedness is then both cognitive and material, constituted both through the particular forms of agency that is brought to bear that different constellations of actors and entities as well as the ways in which the laboratory is positioned in relation to the urban condition. In developing the typology of ULL governance, we therefore seek to draw out the different actor arrangements within which ULL are positioned as well as bringing to attention how the urban is conceived and situated in relation to the laboratory (see Table 1).

Turning to the change-orientation of ULL, we depart from Karvonen & Heur's (2014: 387) argument that ULL are necessarily concerned with "change that is intentionally radical – change that leads to ontological novelty - rather than incremental or entropic." While they reflect laboratories contain a "strong normative aim … to create more desirable urban futures" (Karvonen & Heur 2014: 387) we suggest that such goals for urban improvement are not necessarily radical in nature and indeed can seek to reinforce the status quo. Instead, we argue for attention to the politics of improvement – of how ULL work to identify conditions that require some form of improvement and seek to establish capacity to observe and document such changes for different forms of political purpose. This leads us to a concern with how the *priorities* of ULL are formulated and the *mechanisms or practices* of change that dominate any particular ULL, as well as how such forms of change and observation are to be *financed* (see Table 1). Using these categorisations and the analysis of forty snapshot ULL cases in Europe we identify three ideal types of ULL design and practice: strategic; civic and organic (see Table 1). While ULL may claim to provide a means through which change can be initiated at a small scale with the prospect of being extended beyond the initial confines of the laboratory, such normative intentions often belie underlying political processes that seek to confine the arenas of experimentation whilst the processes through which such forms of 'scaling up' or mainstreaming take place remain relatively opaque. We do not therefore include in the typology any specific change-orientation to the wider 'external' urban arena, but instead focus on these dynamics as part of our analyses of the working and implications of ULL cases, a point to which we return in the conclusions below.

Concept	Characteristic	Strategic	Civic	Organic
Situatedness	Leading Actors/Agency involved in imagining & configuring the ULL	Government (e.g. EU, National)/Corporate (multinational, national or major/dominant economic interests whatever their physical location)	Municipal & Higher Education	Civil society (e.g. environmental NGOs, community groups)

	Relation between the urban and the laboratory	The urban is a backdrop/test-bed for the aims and aspirations of strategic actors	The urban is configured as a public or civic domain through the partnership and experimentation taking place	The urban is the context within which experimentation grows
Change-Orientation	Priorities	Creating a mobile exemplar/global best practice for laboratory products	Urban transformation – economic and or sustainable	Locally contingent and diverse
	Techniques	Competitive	Developmental	Bespoke
	Finance	One-off usually 'external' funding	Co-funding provided by municipality and other civic partners ('internal')	Improvised & incremental

Table 1: Characteristics of Strategic, Civic and Grassroots Urban Living Labs

Strategic ULL

Strategic ULL are characterised by some degree of steering or conditioning by the national state or regional authorities, as well as the involvement of large corporate or private sector partners. Drawing upon the concept of national innovation systems the analogy here are national technology development programmes developed by state intermediaries such as Innovate in the UK, FFG Austria, RVO in the Netherlands, Vinnova in Sweden and JPI Urban Europe. These programmes are usually configured to undertake forms of state sponsored experimentation with corporate partners designed to test and develop applications, build local capacity and develop an internationally competitive technology sector. These actors have a tendency to consider their national urban contexts as potential sites for the development and implementation of these experimental activities on the basis of using a live test-bed and also trying to establish first mover advantage through the application. The forms of experiments are often varied using a variety of mechanisms – often through competitive processes such as competitions where urban sites assemble partnership and local assets to compete for state funding. Rather than small scale experiments these tend to be larger scale programmes where experimental initiatives are contained within a wider smart or sustainability strategy. Investment tends to be awarded for a specific activity through a lump sum rather than continued funding over a long period. In this sense the urban is constituted as an experimental test-bed to service other national and corporate priorities.

Civic ULL

Civic ULL unlike the strategic mode are much more focused on the priorities of municipal governments and civic universities and locally-based companies. While there may still be the involvement of national funders

and/or corporate entities the priorities for this form of ULL tend to reflect particular urban priorities and concerns – economic performance, employment creation, overcoming constraints within local infrastructures rather than national innovation priorities per se. The primary goals of these approaches therefore tend to have strong contextual and contingent character although to obtain national funding these local priorities would need to be reworked through the passage point of strategic national state priorities. Co-funding is often a common method for these funding patterns which are often based on a partnership that utilises municipal funding and assets, research and/or engagement funding through higher education institutions and may also seek to utilise national and European funds where appropriate. This style can include stand-alone projects as a one-off experiment or the constitution of a platform or intermediary capacity to undertake a programme of experiments in the city over time. The primary objectives tend to be the transfer of research into demonstration, the development of first mover advantage, innovation and economic development and/or accelerated transition within an infrastructure. In all cases, these eULL attempt to embed learning and benefits within the urban context.

Organic ULL

The final style of ULL is those concerned with highly contingent and specific contextual issues that are related to the needs and priorities of particular communities and/or neighbourhoods – these are highly diverse – social needs, unemployment, pollution, fuel poverty etc. The key actors are urban civil society and not for profit groups – including NGOs, charities, grassroots and community organisations who mobilise residents and publics around specific experimental responses. This framework resonates very powerfully with the grassroots innovation literatures (Seyfang and Smith 2007) in socio-technical and innovation studies. The focus of activity tends to be on infrastructural innovations that can support different economic, social and environmental dimensions of community well-being and development. Capacity is developed to either respond with a single-issue one-off project or the capability to formulate a programme of activities over a sustained period. Budgets tends to be limited – often dependent on competitive bidding into municipal national and/or European funding streams with match funding in volunteer time and other resources.

2.2 Laboratory dispositions: making space for experimentation

The ways in which the relation between control and contingency, essential to any form of laboratory, are negotiated produces an array of different *laboratory dispositions*. Control as a laboratory disposition seeks to tightly relate specific elements of the urban within the laboratory, in order that they be reshaped (and improved) for specific purpose. The process of intervention, of inquiry serves to determine to a high level of specification what it is that the laboratory is intended to resolve, bringing certain elements of the urban into

observation whilst excluding others and rendering the issue of, in this case, urban sustainability knowable under specific conditions. On the other hand, also at work is the dynamic of contingency, a disposition which seeks to only loosely configure socio-material relations through creating novel forms of intermediation that enable alternatives to co-exist. The process of intervention here is not one in which the problem to be solved is readily articulated and observed, but rather one which relies on the formation of new imaginations and relations through which alternative forms of urbanism may unfold and take root.

Simultaneously navigating each of these essential elements of the laboratory, different dispositions are comprised of diverse socio-material arrangements and relations, which alternatively privilege forms of (en)closure or openness between the ULL and its wider urban milieu, foster different capacities and rely on and enact different modes of power, from those of authority to those of persuasion (Allen 2004). Each in turn modulates the governing of urban sustainability transitions in distinct ways. From this starting point, we suggest that laboratory dispositions can be found variously positioned along the spectrum from those of tightly controlled environments to highly contingent arenas. Drawing on the literature from science and technology studies concerning the workings of laboratories, together with more recent work concerned with the emergence of urban laboratories and forms of sustainability experimentation, we identify four potential 'ideal type' dispositions which ULL might take: the trial, the enclave, the demonstration and the platform.

Trial

Where the dynamic of control dominates, we find the predominance of the *trial* as a mode of laboratory disposition. As Kullman (2013) argues, where laboratories are unable (or indeed do not intend to) foster the capacity for contingency, arrangements may become "too rigid and stabilised" (Kullman 2013: 882). While in Kullman's argument this is regarded as a failure of the capacity of experimentation to engage with the open-endedness of the world, we contend that there are certain forms of intervention, processes of inquiry, that seek to establish exactly such forms of determinate relation and foster relatively closed processes of observation and learning. In order to test under what are often termed 'real world' conditions particular products, technologies, or processes, the trial seeks to limit the indeterminate conditions that it encounters, often confining the urban living laboratory in both space and time. It is at heart a form of disciplinary power. Classic forms of market protection and political support associated with the development of innovation niches are usually required in order to implement and sustain this form of laboratory disposition. With the limited scope and spatial/temporal horizons of the trial used to minimise risk. This is a form of laboratory that is concerned with securing particular outcomes.

Enclave

A second mode of laboratory disposition is that of the *enclave*. Here too control is the predominant dynamic, but there is allowance for some forms of contingency. An enclave works by limiting the spatial domain of the laboratory and closely demarcating the boundaries of what is and is not part of the experimental work to be conducted. This is the form of control most often identified in the literature, where the use of (spatial) boundaries is the means through which coherence is given to the laboratory and the boundary comes to form an obligatory passage point between the 'real' and 'laboratory' worlds such that attempts to draw lessons, replicate, seed new ideas and so on must first overcome the boundary constraint of the laboratory. Common in urban areas are, for example, experimental neighbourhoods or districts, often selected (or represented) as microcosms or a wider whole, the laboratory as enclave nonetheless seeks to set itself apart from the wider whole of which it is part. Nonetheless, within these controlled conditions, a degree of contingency in the socio-material configuration of the laboratory is required, fostered through the development of, for example, alternative visions of the future, the creation of new intermediaries that bring together diverse entities within the enclave in novel ways, and interventions designed to reconfigure socio-material relations. Unlike the trial, which seeks to observe the effects of manipulating single entities, the enclave is intended to capture and scrutinise a host of interacting dynamics.

Demonstration

Where contingency comes to override the dynamic of control, we suggest a third mode of laboratory disposition can be identified which is characterised by *demonstration*. A managed form of contingency, laboratories disposed to demonstration provide a showcase or exhibition of what the urban could resemble under the right conditions. Rather than being characterised by discipline, power operates through a governmental mode, seeking to establish the socio-material conditions in which the conduct of conduct can be effected towards various goals of urban improvement. Kullman (2013) similarly identifies the "exhibition space" as a forum for experimentation, a site which enables the contingent generation of knowledge and experience in which outcomes are not predetermined. Demonstration as a laboratory disposition seeks then to establish potential, without then controlling the ways in which this is delimited or determined. As a mode through which forms of intervention take place, this enables a shift from a fully indeterminate condition to one in which new forms of relationality are established but remain precarious.

Platform

In a fourth mode, contingency dominates laboratory disposition. This *platform* disposition relies not on determining socio-material relations, but on creating the conditions in which multiple new socio-material relations and arrangements can be leveraged. Ureta (2016) uses the concept of platform from Muniesa and Callon to signify a "particular configuration that looks to remove some of the frames set in the laboratory in

order to "overcome the distance that an experiment generates between the 'inside' and the 'outside' of the experimental setting" (Muniesa and Callon 2007 p. 173) in order to "generate strong commitments between the involved actors regarding the objectives and conclusions of the experiment" (Ureta 2016: 3). Such an interpretation does not rely on the existence of specific platforms (e.g. Web 2.0 applications) or the condition of what has been termed platform capitalism (Langley & Leyshon 2016), though it bears many resemblances to their operation. In both interpretations of the term, "platforms are not simply in the business of intermediating connections, but of actively *curating connectivity*" (Langley & Leyshon 2016: 5, after van Dijck 2013). Laboratories that perform as platforms create arenas in which previously disconnected entities are brought into coincidence and provided with a stage upon which to build new forms of relationality and socio-material configurations. The disciplinary power of control is limited and the boundaries of the laboratory only loosely adhered to as forms of governmental power – governing through conduct and circulation – dominate. It is from these forms of interaction and circulation that the laboratory seeks to capture value and improve the urban condition (Langley & Leyshon 2016).

3. Analysing the Design & Disposition of ULL in Europe

Bringing together these categorisations of the design/practice of ULL and of their disposition provides a heuristic typology to analyse this phenomenon. The GUST project[1], funded through JPI Urban Europe, collected forty snapshot cases of ULL focused on the countries of the partner organisations – Austria, the Netherlands, Sweden and the UK, which are analysed in this paper.

3.1 Research Design

The GUST project methodology involved the development of forty 'snapshot' cases through the analysis of secondary sources, including policy documents, web-based material and previously published academic research. We searched academic literature using publicly available, online databases such as Web of Science, SCOPUS, Google Scholar, EBSCO Host and ResearchGate. For grey literature search we used the homepages of research projects and funding agencies associated with ULL and urban experimentation work as well as Google search engine. The initial keywords for search were: living laboratory; urban lab; urban living lab; city lab; urban experiment; test-bed. We have also capitalised on the many years of research experience of the GUST team in the fields of urban governance and experimentation, sustainable urban development and sustainability transitions in cities as well as used discussions within our established urban networks to identify potential ULL snapshot cases.

---

[1] See http://www.urbanlivinglabs.net/

Snapshot cases[2] are two page descriptions of ULLs, which follow the same format and discuss the key ULL characteristics as identified in Voytenko et al. (2016). Each partner organisation completed ten such case-studies for the country in which they are based (Austria, the Netherlands, Sweden and the UK) focusing on the core themes of the GUST project: how ULL are designed, the practices through which they are realised on the ground, and the processes through which they come to have wider effects and implications. In some cases, these snapshot reports provided the focus for the in-depth case-studies conducted by each project team, which involved primary research including fieldwork, site visits, interviews with policy-makers, practitioners and experts, focus group discussions and policy-maker workshops.

The snapshots were selected through the nomination of examples followed by a dialogue and a discussion in a research team to filter and choose ULL cases that are emblematic and exemplary but also diverse enough to capture the examples of different ULL types. Some cases called themselves 'urban living labs', 'urban labs' or 'living labs' while others did not use the terminology explicitly (due to the relative novelty of the ULL term and the fact that it is not yet widely used). We selected interventions that displayed the five descriptive characteristics frequently associated with ULL: geographical embeddedness, learning, participation and user involvement, novel models of leadership and ownership, and evaluation (Voytenko et al. 2016). Selecting ULLs from the four countries that are quite advanced in urban experimentation for sustainability allowed us to obtain a rich and exemplary sample of snapshots.

Once they had been selected on this basis, for the analysis in this paper each research team applied the analytical categories of *design* and *disposition* derived above (Table 1) to the set of snapshot cases, in order to identify which category each ULL most closely resembled. Given that these are a set of ideal categories and that ULL evolve over time, many cases were not wholly encapsulated by one category. After an initial categorisation process, the project team met and deliberated on the different aspects of each case that were most significant. We sought to determine the *preponderance* of features exhibited by a ULL as they related to design or disposition (e.g. across different aspects of situatedness and change-orientation) over time. Each snapshot case was categorised on this basis, and it is to the analysis of the resulting distribution that we now turn, before examining four detailed cases of ULL from Austria, Sweden, the UK and the Netherlands that enable us to investigate the emerging trends visible in this data.

---

[2] All GUST snapshot cases are available at: http://www.urbanlivinglabs.net/p/snap-shots.html

3.2 Categorising European ULL

Our analysis of the categorisation of European ULL is presented in Table 2. First, there are some notable differences how ULL are being designed and their disposition nationally. In Austria and Sweden, ULL take multiple forms, stretching from largely technical trials to platforms and incorporating strategic, civic and grassroots types. The UK also has a good deal of variety in the types of ULL, though there is an absence of trials. In the Netherlands, ULL are predominantly viewed as civic endeavours, with a more limited role for both strategic and grassroots actors as determining their design. Of particular significance is the relatively limited use of ULL in the mode of a trial. Despite the origins of the notion of a 'living laboratory' in the corporate sector's intention to trial novel technologies in 'real world' settings, we find that as the notion has been translated into an array of urban conditions its resemblance to a trial and the connotations of controlled testing has given way to a wider variety of laboratory modes.

Second, we find that design and laboratory disposition are not independent of one another: there are distinct forms of disposition being enacted and performed through particular types of ULL.

Strategic ULL are primarily focused on two modes – demonstration and platform. The distinction here lies in whether politically and economically strategic actors, such as national governments or significant corporate interests, are engaged in enacting and demonstrating the potential of particular forms of (often technically determined) urbanism, creating showcases for specific technologies or ways of inhabiting the urban realm, or whether they are engaged in seeking to create a platform on which new forms of collaboration and (technical) urban development can take place. An example of strategic demonstration is Hållbarheten ULL (Malmo, Sweden) - a custom designed apartment house, in which the energy company E.ON enrols residents to test energy-smart solutions in order to understand their viability at a larger scale. Future by Lund (Lund, Sweden) is a strategic platform funded by Vinnova, through which Lund municipality, Lund University and businesses collaborate to experiment with urban mobility, smart energy systems, the Internet of Things and illumination.

Grassroots ULL also focus on two distinct modes of ULL, the enclave and the platform. In part reflecting the scale and resource of the kinds of community-based organisation who convene grassroots ULL but also because of the ways in which specific urban conditions are enrolled to cultivate ULL, grassroots forms of ULL embody and configure the laboratory as an enclave, a protected environment in which the seeds of innovation can be sown. Also reflecting their limited capacities, within the platform mode grassroots organisations often intermediate – drawing resources into particular urban configurations and creating the networked capacity required to address sustainability. As such, Stapeln Open Maker Space (Malmo, Sweden) hosts multiple

workshops and creative organisations under its roof and thereby offers new work and leisure opportunities for all social groups, which encourage more sustainable lifestyles, enhance social cohesion, allow for new ways of interaction, learning and exchange of skills.

In contrast, civic ULL adopt all four dispositions, suggesting that particular urban interests (municipal, economic and knowledge-based) can be configured to realise their ambitions for urban transformation in multiple ways. The variety of civic forms of ULL may reflect efforts to capture and configure different (financial, technical and social resources) towards these ends. Led by Botkyrka municipality New Light on Alby Hill ULL (Stockholm, Sweden) focused on lighting installations to make a walkaway more secure and attractive, and aimed to examine how the residents can co-design innovations and what the effect of their involvement is on increasing social, economic and environmental sustainability of the area.

That the platform disposition is used across strategic, civic and grassroots ULL is also notable. This finding suggests both that it is a malleable disposition, able to be put to work in relation to multiple agendas, but also that is in some senses necessary. The prevalence of platform laboratories points to the dispersed resources and fragmented capacities for governing urban sustainability on the one hand and to the cross-cutting and multiple nature of the challenges being addressed. Nonetheless, our analysis shows that it is the particular conjunction of the civic demonstration laboratory that dominates this sample of ULL in Europe. Such demonstrations provide multiple functions for civic coalitions, including the capacity to develop initial or innovative projects that they hope will 'lead by example', a means through which to move prototypes into real world contexts, and the ability to create a showcase or shop window which enables civic partners to put their city 'on the map'. As such, HSB ULL (Gothenburg, Sweden), a residential building, in which knowledge, business and NGO partners test and develop sustainable innovations for homes, working in a co-creation setting with the tenants, focuses on innovative architectural design, more sustainable materials and technologies, minimisation of resource consumption and new ways of living together. Yet across these different rationales and practices of demonstration, a uniting feature is the way in which demonstration projects enable civic actors to realise particular visions: they serve as a means through which (seemingly distant and often contested) futures can be realised in the present.

	Strategic	Civic	Organic
Trial	Living Lab UbiGo, Sweden	VIsion Step I, Austria	
Enclave		Erntelaa, Wien Liesing, Austria Open Lab Ebbinge, The Netherlands Marconia, The Netherlands New Light on Alby Hill, Sweden Shape Your World, Sweden Living Lab Uddevalla, Sweden	Interethnic Coexistence in European Cities, Austria Urban Farm, Austria Sheffield Living Don, UK Sheffield Sum Studio, UK
Demonstration	Smart City Project Graz, Austria Lakecity Aspern Vienna; Austria Hållbarheten (project by EoN), Sweden Future City Glasgow, UK	Smart District Gnigl, Austria Smart City Hartberg, Austria E-Mobility: Greater Graz, Austria Aquadock, The Netherlands Concept House Village Rotterdam, The Netherlands Circulair Buiksloterham, The Netherlands Experimental Garden Feijenorrd, The Netherlands Lucthsingel Rotterdam, The Netherlands HSB Living Lab, Sweden Muswell Hill Low Carbon Zone, UK Newcastle Science Central/City, UK Urban.Gro.Lab, The Netherlands	
Platform	Norrby Innovation Platform, Sweden Future by Lund, Sweden Malmö Innovation Platform, Sweden BlueCity Lab, The Netherlands	Newcastle City Deal, UK MK:Smart, UK	Vienna Shares, Austria Mooi, Mooiwer, Middelland, The Netherlands Stapeln Open Maker Space, Sweden Manor House P.A.C.T., UK Greening Wingrove, UK Community Energy Lab, UK

Table 2: Categorising ULL in Europe

4. Contingent Urbanism: demonstration and platform as dominant ULL modes

Our analysis of forty cases of ULL in Europe suggests that this form of experimentation is being deployed by a range of actors related to different governance arrangements, capacities, resources and intentions, but that their disposition tends to be more *contingent* than *controlled*. Rather than operating along the lines of a formal laboratory, with emphasis on the testing of innovations under certain conditions or the trialling of specific technological or social interventions, the cases of ULL we have examined primarily work through the contingent dispositions of the demonstration and the platform. Consequently, here we provide more in-depth analysis of the ways in which the partial authority of ULL governance and indeterminate conditions under which it takes place are shaping the emergence of demonstration and platform interventions on the ground in Austria, Sweden, UK and Netherlands.

4.1 Strategic Demonstration: aspern Urban Lakeside, Vienna, Austria

One of the largest urban development projects in Europe, aspern Urban Lakeside is led by the Vienna City Administration and Wien 3420 AG, the development agency founded for the purpose, which will deploy public (including local, national and European) and private funds of approximately 5 billion Euros. The strategic vision of the leading actors is to develop a model of high-efficiency and low-impact cities of tomorrow. Over a time, horizon of more than two decades (2010-2028), the aim of this project is to create an efficient, low-impact "city within a city" on a total area of 240 hectares of a disused airfield in proximity to Vienna. Its focus is on the development of a 'smart' city, through the development of smart grids and shaping energy use at home, as well as on the 'liveable' city through green spaces such as lakes and parks, sustainable mobility as well as offering education and childcare institutions (Wien 3420 Aspern Development AG, 2016).

Through the use of detailed master planning, aspern Urban Lakeside has been established as an arena within which multiple actors, including investors, architects, urban planners, universities and research institutions, are able to experiment with new technologies, interventions and ways of working. Wien 3420 AG acts as a bridge builder: bringing in new partners, handling the sale and letting of building plots, being responsible for location marketing and branding activities. The strategic character and the size of the ULL also led to significant groundwork being undertaken, from the extension of the subway, the initiation of sustainable mobility measures, to research projects exploring systematic as well as individual aspects of urban sustainability related to building design, the electricity grid, communication and information technologies:

"It is always important to ask yourself: Which actors do you need to fulfil your goals and aims. Once you know the actors, you have to act accordingly and get them on board of the project and also give them incentives to locate them in the area. For example, one goal is to implement a research-hub in the area of aspern Vienna's Urban Lakeside. So, the area must give incentives to industry, research partners and associations to locate themselves in this area." [Interview, May 2016]

In short, the development agency, leveraging funding from a range of state and private interests, has sought to both deliver the initial conditions for a vision of a specific kind of urban future and created access for different types of stakeholders to experiment with the ways in which this can be demonstrated:

"aspern Vienna's Urban Lakeside is distinctive from other urban development projects through its various technological innovations such as the underground connection, barrier-free streets, e-bikes, LED lightening, W-Lan hot-spots located in the area, smart housing technologies." [Interview, Jun 2016]

At the same time, space is created for relatively circumscribed forms of contingency. Aspern Citylab, an interdisciplinary dialogue platform which works as an arena for ideas, an active tool for high-quality urban development, an expert platform, and as an instrument for the permanent monitoring of the development process. The Citylab takes an interactive stance to planning processes, using a range of tools to explore the conditions and techniques through which to undertake spatial development and develop new forms of urban practice in everyday life. Its approach primarily involves engaging experts and interested publics in the processes of design and deliberation, from which results are integrated into the realisation of the Urban Lakeside development.[3] By creating a shared vision of the future city and the space within which various different organisational, technical and social entities can be showcased, the project has a predominantly demonstration quality. Yet its composition is not entirely determinate, the provision of infrastructural groundwork together with the intermediating capacity of the development agency and its intentional deployment of open-ended and participatory design techniques serve as a means through multiple different forms of experimentation around which the new forms of urbanism are convening.

4.2 Providing a Community Platform: Stapeln Open Maker Space, Malmo, Sweden

Stapeln (STPLN) is a cultural house with a co-working facility, a space for exhibitions and performances, and several do-it-yourself-workshops for textile printing, sewing, knitting, carpentry, digital production, bicycle

---

[3] See: http://www.aspern-seestadt.at/en/investing-co-shaping/aspern-citylab/

repair, and creative use of industrial waste materials (Stpln 2017) (see Figure 1). Initiated by the municipality, it was transferred to the STPLN NGO, an organisation initiated by employees of Malmo municipality "to work with people in a more organised way but at the same time not necessarily following all the rules and experimenting a lot" (Interview, Feb 2016). STPLN brings together diverse projects and users, acting as a means through which they are bought into new alignments in relation to a shared vision of the need to develop alternative forms of economy and sustainability. The intermediary work of STPLN is also evident in the way it functions as a platform for generating finance. Malmo municipality provides premises for STPLN, short-term funding to some operations and pays salaries of 2.75 employees (Interview, Feb 2016). Other funding includes Swedish Inheritance Fund, one off grants by Arvsfonden (Interview, Mar 2016.) and Swedish Transport Administration (Interview, Feb 2015), and membership fees for some activities (Interview, Mar 2016). A key feature of grassroots forms of social innovation and experimentation is their limited capacity, which tends to lead to one-off events and initiatives. The platform disposition serves as one means through which multiple resources can be leveraged and bought into relation with one another in order to underpin more long-term, related and programmatic activities.
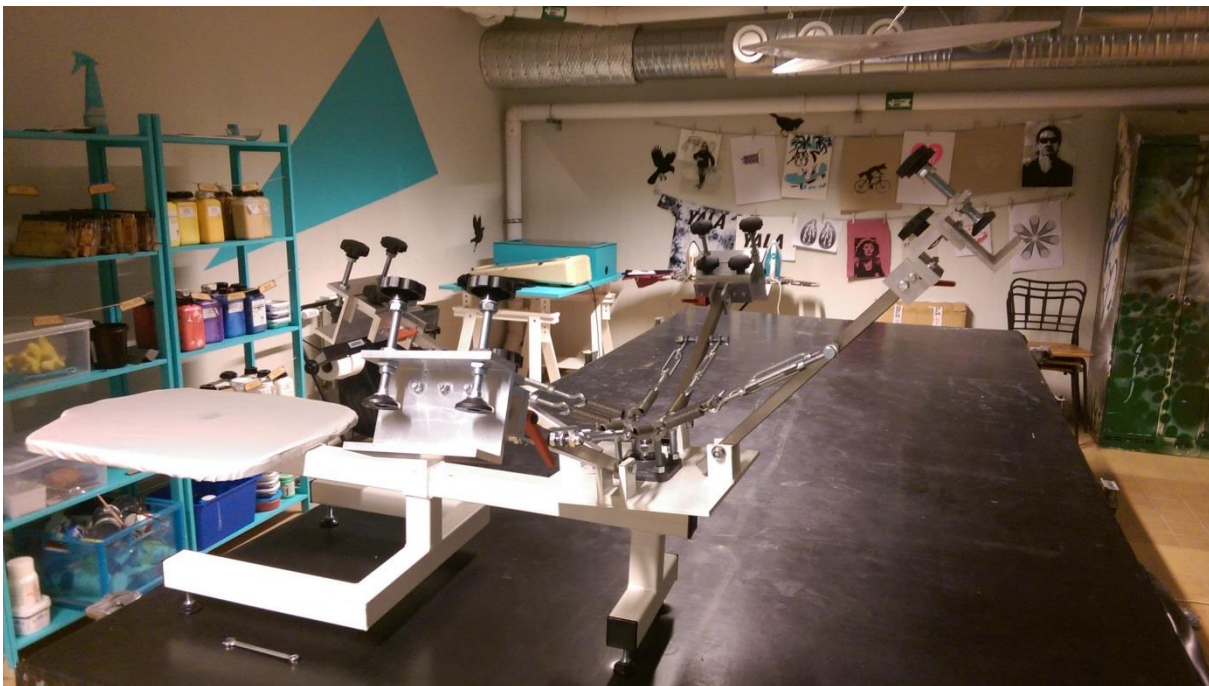

Figure 1. Grupptrycket - textile and printing workshop at Stpln

The initial approach to innovation by STPLN is opportunity driven. It provides opportunity for collaboration, openness and participation seeking to enhance democratic processes in Malmo. STPLN has positive implications for many urban challenges including needs for social integration, change of consumption patterns, waste reduction, and knowledge development. While the technologies used in STPLN are not

particularly innovative (Interview, Feb 2016), the ULL can be viewed as social innovation providing new opportunities for work, business and leisure for all citizen groups in Malmo, which would allow for the new ways of interaction, learning and exchange of skills. STPLN projects build "connections between different innovation stages, and deliver a lot of learning through… seminars, debates, crafts as well as informal learning and peer-to-peer learning" (Interview, Feb 2016).

STPLN literally and conceptually provides a platform for a range of forms of experimentation and takes the form of a series of linked inquiries as to the nature of urban economies. While it "has developed organically as a bottom up initiative" (Interview, Feb 2016), its growth has been purposefully shaped around the concepts of the collaborative economy and creating 'makers' space and increasing structure through its evolution (Interview, Feb 2016). STPLN's role as a platform has been particularly important in its search for identity and common vision, which is not least due to the need for more explicit external communication to its current and potential users and funders. Yet the platform mode of experimentation, as exemplified in STPLN, is in the continual work of both balancing multiple agendas and interests of its activities, projects and users while also providing direction. A platform disposition requires rather open with loosely defined boundaries but at the same time sufficient coherence and direction to retain a specific identity and place in urban transformation.

4.3 A Civic Platform: MK: Smart, Milton Keynes, the UK

In 2013 the Higher Education Funding Council for England (HEFCE) issued a call for bids for ULL with a focus on smart cites to its Catalyst Fund, which provided the impetus for the formation of a collaboration between the locally based Open University and the municipal authority of Milton Keynes. Its origins, however, can be traced back to an unsuccessful bid to the Future Cities Catapult which provided the impetus to the municipal authority to integrate a series of disparate projects interested in the development of 'smart' energy, transport and ICT projects, including a 'plugged-in places' electric vehicle and charging infrastructure program, electric bus project with ARRIVA, smart grid trial with Western Power Distribution, and a 'Thinking Energy' project with E.ON. Led by different actors and regarded as separate entities by the municipality, from 2010 they began to be seen in relation to one another as the municipality formed steering groups and structures through which to bring them into alignment (Interview, Mar 2016). The "test-bed" culture of the city has a longer history, with the former new town building agency, MK Development Corporation, having an enduring impact on the recent strategic positioning of the Milton Keynes Council despite its closure in the early 1990s.

With the development of the MK: Smart bid to the HEFCE came a shift in emphasis, from the municipality towards the University as the lead partner, which led to a subsequent focus on the development of the

integrated data and knowledge required to develop, monitor and manage 'smart' interventions in the city. Such a shift in part reflected the changing nature of municipal capacity under conditions of austerity, such that the consortium arrangement of MK: Smart can be seen as a tactical resort for gaining both resources and capacity under constrained conditions, which indirectly created "a very useful structural hydraulics" in Milton Keynes for the formation of a platform mode of ULL (Interview, Mar 2016). In addition, the legacy organisation, Community Action: Milton Keynes (CA:MK), established as a community trust with resources to support community development following the closure of the MKDA provided an unusually strong means through which to engage communities in the smart city programme. MK One served as a means through which these diverse and fluid interests and agendas could be gathered and put to work in relation to a vision of the future 'smart' city.

The design of MK: Smart was therefore central in shaping its disposition as a platform, a disposition that has been further realised through its work in practice. The Data Hub, a complex, cross-cutting initiative, serves as a means through which diverse entities and ambitions are bought into alignment (see Figure 2). The primary distinctive feature of the ULL, its intention to configure and curate real-time data so that it serves to mediate user behaviour, service provision and the development of new infrastructures requires such forms of intermediation and connectivity across the partnership. Subsequent to the establishment of the Hub, a series of initiatives designed to engage and connect citizens were established that also operate through a platform mode. A virtual space for sharing and deliberating innovation ideas – OurMK[4] was officially launched in September 2015. As of February 2016, 55 ideas and 18 projects had been inputted onto the platform (Interview, Mar 2016). A Citizen's Ideas Competition was launched in parallel with the OurMK platform to provide funding awards to some of the citizen-led project ideas shared on the platform. Eventually 11 projects were funded and as of May 2016 two of these projects had been completed successfully. Although the model of community micro-funding is not unique in practices across the UK, it is distinctive in its attempts to remove barriers between ideas and practices as well as to create cross-sector patterns of collaborations (Interview, Mar 2016). One of the citizen awardees reflected on her experiences, stating that:

> "I think it's really distinctive, I haven't heard of any other initiative that is tackling such a major issue but it's breaking it [i.e. the major issue] down, and to me it seems they are trying out a bottom-up approach, but working with the authorities, and fusing that … that you are getting the best of citizens who work on the ground floor, they see the problem everyday, and then they are actually communicating more and working with the authorities which have the control of these urban areas...It's putting citizens in touch with those who control our city." (Interview, Apr 2016)
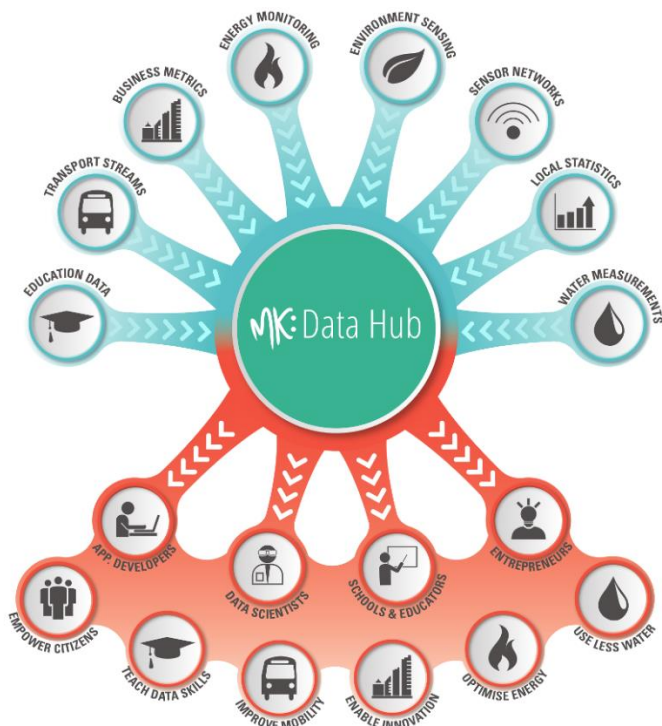
---

[4] See http://ourmk.org

Figure 2. MK: Data Hub[5]

4.4 A Civic Demonstration: Concept House Village Lab, Rotterdam, The Netherlands

The Concept House Village (CHV) Lab was initiated in 2011 by local universities Rotterdam University of Applied Sciences, Delft University of Technology and City Ports Academy., The aim of this ULL was to provide a test-bed for sustainable building technologies across the full construction cycle (including demolition) and for new building retrofitting approaches in the Heijplaat area of Rotterdam, as well as to provide a demonstration of the future of urban development. Funded by European research and regional development grants together with the Ministry of Academic Affairs and the Municipality of Rotterdam, the area was seen as marginal in terms of its redevelopment potential given the economic crisis and limited interest in the mainstream development industry. As a result, the site became seen as open to new forms of experimentation: "There were no interests in re-building the Heijplaat area during that time, that is why we got it for 5 years. They [the planning department of the municipality] did not expect it would develop, now the development is going." (Interview, Mar 2017).

As a project initiated by the university sector, there was a strong emphasis on trialling technologies in a 'real world' environment, encompassing user-led design, whilst at the same time providing a demonstrator of the ways in which renovation of existing housing in a mixed used neighbourhood could be undertaken differently. In this sense, the interruption to development-as-usual caused by the economic crisis and subsequent hiatus in the realisation of the urban plan created not only a physical space in the city but also opened up the potential for thinking about regeneration in new ways, facilitated in turn by the research programmes of the university partners, which served to establish continuous funding for the intervention. A range of different interventions took place through the ULL, including those at the house, appliance and system level, with user participation and monitoring enabling the research teams to generate new knowledge and share learning across the partners. As the project gained momentum, it garnered more active participation from the municipality and local businesses, serving as a means through which what it might mean to redevelop marginal areas of the city could be collectively explored.

The demonstrative disposition of the ULL was realised through a series of initiatives intended to showcase the ULL and its components to its primary constituents – existing residents and the local development industry – its sponsors, and beyond. This involved conducting tours on site with branch organisations and building companies, holding meetings and information visits with neighbours and community groups, embedding the Lab into the curriculum, which served to demonstrate its value to the wider academic community, as well as joining the European Building Technology Accelerator Program, through which the ULL and its activities could be translated across different contexts. Yet the civic intentions around which it had been built did not remain stable. Financial capacity has waned with the economic recovery and growing interest by the municipality in moving the area from its 'laboratory' status and into the mainstream: "The municipality says we [CHV] are not land-owner, we support the idea of Concept House but not for always. You got it for 5 years and you did your job, your research and now we are going to develop it." (Interview, Mar 2017). As the ULL has evolved from its initial 'test bed' focus in the initiation of research to providing a demonstrator for multiple different actors to experiment with urban futures, the degree of contingency has increased and the capacity for the actors to control its future diminished. While we find this model of civic demonstrator to dominate our sample of ULL, it is important to recognise that this is a fluid and often temporary state.

In summary our analysis of these four cases has shown that ULL can commence with rather different purposes in mind than those that they are then able to achieve. At the same time, the unfolding urban arena in which they are established provides new challenges and opportunities of ULL as they evolve. The openness of the ULL may be one of its most attractive features to those who seek to develop laboratories. Yet we still find that if the capacity and potential of ULL comes under pressure or even diminishes entirely, this is regarded in

negative terms – as a kind of failure that cannot be accommodated. For experimentation through ULL to become established as a mode of urban governance, new thinking about their 'failure' will be needed.

5. Conclusions

Drawing on the development of our analytical approach, analysis of the snapshots and in-depth cases, we can identify two main conclusions. First, our analysis demonstrates that despite the diversity of ULL governance arrangements there is a clear disposition to more *contingent* than *controlled* experiments. Rather than operating along the lines of a formal laboratory, the cases of ULL we have examined primarily work through the contingent dispositions of the demonstration and the platform. This finding speaks to the ways in which the capacity to govern urban transformations is configured (Bulkeley et al. 2015; Evans et al. 2016); : in many contexts, such forms of controlled intervention and the ability to adopt formalised processes of learning and strategic long-term planning are severely constrained. Municipal authorities, knowledge institutions and community based organisations govern in conditions of limited autonomy and restricted resources, while strategic political and economic interests either lack the legitimacy to enact urban projects or have limited capacities to enrol the multiple social and material entities required to accomplish such forms of governance on the ground. At the same time, the predominance of contingent laboratory dispositions reflects the open-ended and multiple nature of urban sustainability transformations. Drawing on the arguments we developed in opening this paper, this suggests that ULL are not being deployed towards secure end goals or in relatively defined conditions, but rather can be conceived as a form of pragmatic 'inquiry' into the urban taking place under conditions of indeterminacy where varied (and contested) forms of urban futures are in play (Delgado & Callen 2017).

Second, in the context of constrained experimentation most ULL have an ambiguous relationship with the concept of a sustainability transition pathway (Caprotti & Cowley 2016; Evans & Karvonen 2014). Demonstration is primarily concerned with developing a form of pre-figurative display of how a sustainable future may be materially configured in a building, district or socio-technical project. There is much less emphasis on how a systemic transition is configured to upscale or roll-out the experiment either across the urban context or in other locations. Similarly platforms are primarily concerned with configuring the social and material capacity to undertake programmes of different types of experiments. There is much less emphasis on the translating the societal learning from such programmes into wider sustainability transitions. Instead the capacity to experiment in a programmatic manner is the priority. The transformative potential of these dominant dispositions of ULL seems to be much more modest than the claims made and the links with radical visions of transition pathways rather limited.

The research implications that flow from this are three-fold. First, further work is needed to understand the ways in which ULL work in other contexts, both inside and outside Europe, where there may be other purposes and dispositions at work and where ULL might also have more transformatory visions. Second, many of these different ULL types co-exist in one urban context and much might be gained from understanding interrelations between their modes in particular how different purposes and forms of experimentation resonate or dissonate. Third, there is more to be done in tracing the work that the dispositions in creating various materialised versions of urban futures. Here the question is whether, and if so how, ULL are able to shape sustainability transitions beyond these particular visions and contexts, and the extent to which they are able to think beyond dominant visions and the interests of the most powerful actors.

References

Bulkeley, H. and Castan-Broto, V. C. (2013). Government by experiment? Global cities and the governing of climate change, Transactions. Institute of British Geographers 38: 361–375.

Bulkeley, H., Castan-Broto, V. and Edwards, G. (2015) *An Urban Politics of Climate Change: experimentation and the governing of socio-technical transitions*, Routledge, London.

Bulkeley, H. Coenen, L., Frantzeskaki, N., Hartmann, C. Kronsell, A., Mai, L., Marvin, S., McCormick, K., van Steenbergen, F., Voytenko Palgan, Y. (2016) Urban living labs: governing urban sustainability transitions, Current Opinion in Environmental Sustainability, 22: 13-17

Callon, M., Lascoumes, P. and Barthe, Y. (2009). Acting in an uncertain world: An essay on technical democracy. Cambridge, MA: The MIT Press

Caprotti, F. and Cowley, R. (2017) Interrogating urban experiments, DOI: 10.1080/02723638.2016.1265870 (available online)

Delgado, A. and Callén, B. (2017) Do-it-yourself biology and electronic waste hacking: A politics of demonstration in precarious times, Public Understanding of Science, 26 (2): 179–194

Dorstwitz, P. (2014) Planning and Experimental Knowledge Production: Zeche Zollverein as an Urban Laboratory, International Journal of Urban and Regional Studies, 38 (2): 431–449.

Easterling, K. (2014) Extrastatecarft: the power of infrastructure space, Verso.

Evans, J. P, and Karvonen, A. (2014). 'Give me a laboratory and I will lower your carbon footprint!' — Urban laboratories and the governance of low-carbon futures. *International Journal of Urban and Regional Research* 38 (2): 413–30.

Evans, J. P., Jones, R., Karvonen, A., Millard, L. and Wendler, J. (2015). Living labs and co-production: university campuses as platforms for sustainability science. *Current Opinion in Environmental Sustainability* 16(1), pp. 1–6.

Evans, J., Karvonen, A., Raven, R. (2016). *The Experimental City.* Routledge.

Evans, J. (2016) Trials and Tribulations: Problematizing the City through/as Urban Experimentation, Geography Compass 10: 429–443

Gross, M. (2016). Give Me an Experiment and I will Raise a Laboratory. Science, Technology & Human Values 41(4): 613–634.

Hodson, M. and Marvin, S. (2009). Cities mediating technological transitions: understanding visions, intermediation and consequences. Technology Analysis and Strategic Management 21: 515–34.

Karvonen, A. and Van Heur, B. (2014). Urban Laboratories: Experiments in Reworking Cities. International Journal of Urban and Regional Research 38(2): 379–392.

Knorr Cetina, K. (1992) The Couch, the Cathedral, and the Laboratory: On the Relationship between Experiment and Laboratory in Science, in Pickering et al. (eds) Science as Practice and Culture, Chicago University Press, Chicago. pp 113-138.

Kullman, K. (2013) Geographies of Experiment/Experimental Geographies: A Rough Guide, Geography Compass 7: 879–894

Langley, P. and Leyshon, N. (2016) Platform capitalism: the intermediation and capitalisation of digital economic circulation, Finance and Society, EarlyView: 1-21

Nevens, F., Frantzeskaki, N., Gorissen, L and Loorbach, D. (2013) Urban Transition Labs: co-creating transformative action for sustainable cities, Journal of Cleaner Production 50: 111-122

Seyfang, G. and Smith, A. (2007) Grassroots innovations for sustainable development: towards a new research and policy agenda, Environmental Politics 16 584 − 603

Stpln. 2017. "Stpln - en unik mötesplats, ett makerspace, och en inkubator för kreativa projekt [Stpln - a unique meeting place, a maker space, and an incubator for creative projects]." STPLN. June 4. https://stpln.org/

Truffer, B., Murphy, J. T. and Raven, R. (2015). The geography of sustainability transitions: Contours of an emerging theme. Environmental Innovation and Societal Transitions 17: 63–72.

Ureta, S. (2016) A failed platform: The Citizen Consensus Conference travels to Chile, Public Understanding of Science, 25 (4): 499-511

Voytenko, Y., McCormick, K., Evans, J., Schliwa, G. (2016). Urban living labs for sustainability and low carbon cities in Europe: towards a research agenda. *Journal of Cleaner Production*, 123: 45–54

Wien 3420 Aspern Development AG. 2016. aspern Die Seestadt Wiens - The Project Vol. 7, URL: http://www.aspern-seestadt.at/resources/files/2016/3/14/4119/the-project-vol7-2.pdf