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Title: Urban Living Labs: Governing Urban Sustainability Transitions

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Abstract: Urban Living Labs (ULL) are advanced as an explicit form of intervention delivering sustainability goals for cities. Established at the boundaries between research, innovation and policy, ULL are intended to design, demonstrate and learn about the effects of a range of urban interventions in real time. While rapidly growing as an empirical phenomenon, our understanding of the nature and purpose of ULL is still evolving. While much of the existing literature draws attention to the aims and workings of ULL, there have to date been fewer critical accounts that seek to understand their purpose within the shifting landscape of urban development. In this paper, we suggest that transition studies and the literature on urban governance offer important insights that can enable us to address this gap. We illustrate how insights from transition studies can inform us about the role of ULL as 'niches' within wider urban regimes and the kinds of dynamics that are important to their success (and failure). We suggest that the debate on urban governance can provide us with a perspective that takes into account not only the institutional arrangements through which ULL are pursued, but to more fundamental questions about the capacities they enable through creating new forms of power and agency. Armed with these insights, we conclude that work on ULL needs to account for how they are designed or configured, the practices they undertake, as well as the processes through which they seek to foster broader urban transformation.

Response to Reviewers

We would like to thank the reviewers for their positive comments and constructive critique that has enabled us to further develop the paper and tighten our arguments. Specifically we have addressed the following concerns.

Further justification for the focus on urban governance – Both reviewers asked us to develop the argument for why a focus on the governance dimensions of ULL was particularly useful or necessary. We have done this by extensively reworking the introduction.

Further justification/development of the power/agency focus – Reviewer 1 asks us to consider whether the 'knowledge' dimension of governance should be given more weight, and the power dimension reduced in emphasis. In the paper, we make the argument that transition studies and other perspectives have heavily invested in the institutional dynamics of urban experiments in general, and ULL in particular, and have had a specific interest in the role of knowledge/learning as determining the potential of ULL. Our interest in power/agency is seen as supplementary to this (as set out in the paper) and the concluding section seeks to bring the two together through our concepts of design, practice and processes. We have clarified these points in the relevant sections of the paper. We have also reduced the number of references to the literature on the importance of power in understanding the dynamics of urban change.

Further development of the conclusions – Reviewer 1 asks if ULL can really 'govern' the city. We hope our perspective on governing is clear – that governing is a process accomplished through an array of interventions, programmes etc. that intervene in the urban arena with the intention of achieving particular ends. We further develop this argument in the conclusions and reflect that such intentions are no guarantee of success. From our perspective in this paper, what matters more is that ULL are becoming a means through which governing is being pursued rather than whether/not they are able to achieve their outcomes – this is material we are working on for other publications.

Revisiting the position of the Framework introduced in the conclusion – Reviewer 2 suggests that the framework is treated in rather cursory manner and on reflection we agree. Rather than presenting it as a fully worked through framework, given the constraints of the length of the paper, we have instead drawn out of the proceeding sections the importance of practice, processes and design as important components of how we understand the governing of transitions, and then used this to develop these three aspects as providing a new perspective on the role of ULL which we set out in the conclusion. We have removed reference to the future work.

Clarifying the substantive focus of ULL – Reviewer 1 helpfully makes a number of suggestions about the focus of ULLs (on place, on socio-ecological systems, as learning arenas). We have developed the introduction to ensure the strong link between place & ULL as well as ULL & 'triple helix' thinking is clear. We have replaced the term 'socio-technical' throughout with 'socio-material' to include socio-ecological systems, except where it refers to the analytical concept of socio-technical systems.

Rewriting the Abstract – Reviewer 2 suggested we rewrite the abstract to make the purpose of the paper clearer from the outset. We have provided a revised abstract accordingly.

Specific minor revisions – Reviewer 2 suggested we refer to a new book and that one sentence was confusing. We have included the book in our review of the literature and deleted the sentence.

Annotations – There are 32 references in the paper, 6 of which are now annotated.

Highlights:

- ULL are sites to design, test and learn from innovation in real time.
- ULL are proliferating rapidly while our understanding of their nature and purpose is still evolving.
- We seek to develop a theoretical framework on ULL by bringing governance thinking into transitions theory and vice versa.
- The framework helps identify shared concepts to inform the analysis of ULL in different contexts.
- Key framework elements are design, practices and processes of ULL.

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- This perspective helps to identify shared concepts to inform the analysis of ULL in different contexts.
- The perspective demonstrates the roles of design, practices and processes of ULL in shaping their governance dynamics and transformative capacities.

Urban Living Labs: Governing Urban Sustainability Transitions

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Abstract: Urban Living Labs (ULL) are advanced as an explicit form of intervention delivering sustainability goals for cities. ULL are sites to design, test and learn from innovation in real time. They aim at co-creation and empowerment of multiple stakeholders in co-shaping of the experimental approach and being open and participatory. While rapidly growing as an empirical phenomenon, our understanding of the nature and purpose of ULL is still evolving. Drawing on transitions theory and urban governance and politics, we seek to shed light on ULL as part of this broad phenomenon by developing a perspective that brings governance thinking into transitions theory and vice versa. This paper focuses on core concerns within different approaches and the common ground they share as well as exploring important tensions. Through this process we develop a theoretical framework that can identify a shared set of concepts and issues to inform the investigation and analysis of ULL in different contexts and conditions. We argue the key elements in such framework include the design, practices and processes of ULL.

Keywords: urban living labs, governance, urban sustainability, transitions

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Introduction

Urban Living Labs are being advanced as an explicit form of intervention capable of delivering sustainability goals for cities. ULL are broadly conceived as forums “for innovation, applied to the development of new products, systems, services, and processes, employing working methods to integrate people into the entire development process as users and co-creators, to explore, examine, experiment, test and evaluate new ideas, scenarios, processes, systems, concepts and creative solutions in complex and real contexts” (JPI Urban Europe 2013). For those designing and implementing ULL, they are seen as a means through which to set up experiments and to trial innovations. They are purposefully intended to bring together multiple actors that seek to intervene in order to address contemporary sustainability challenges and foster learning through forms of open and engaged experimentation.

ULL aim at co-creation and empowerment of multiple stakeholders in co-shaping of the experimental approach (Edwards-Schachter et al. 2012; Lehmann et al. 2015) and being open and participatory (Franz 2015). ULL are distinct in terms of their explicit place-based focus and their future-orientation, seeking to experiment today with solutions for the future. ULL seek to deliver innovative and transformative improvements across the urban milieu, from buildings to green space, transport to energy systems, local food to sustainable forms of consumption (Voytenko et al. 2015). In short, ULL are sites devised to design, test and learn from innovation in real time in order to respond to particular societal and environmental issues in a given urban place.

While rapidly growing as an empirical phenomenon, our understanding of the nature and purpose of ULL is still evolving. In this paper, we position ULL as part of a broader shift in the nature of urban governance in which forms of innovation and experimentation are being marshalled as a means through which to govern particular (urban) conditions. ULL are not a stand-alone set of interventions, but part of a wider ‘politics of experimentation’ through which the governing of urban sustainability is increasingly taking place (Bulkeley et al. 2015; Frantzeskaki and Loorbach 2010; Franz 2015; McCormick et al. 2013; McGuirk et al. 2014; Wolfram and Frantzeskaki 2016). Drawing on the broad body of work on transitions theory and on urban governance and politics, we seek to develop a novel framework to critically understand the existing role and future potential of ULL as part of this broad phenomenon of urban experimentation. This paper therefore focuses on the core concerns within these two approaches, the common ground they share, and the important tensions. Through this process we develop a theoretical framework that can identify a shared set of concepts and issues to inform the investigation and analysis of ULL in different urban contexts and local conditions.

Understanding ULL as Innovation Governance and Governance Innovation

As a means of intervening in the urban arena to address particular sustainability challenges, ULL constitute a particular form of governance innovation. Understanding the means through which they are designed, implemented and take effect can therefore usefully draw on the tradition of innovation studies and socio-technical transitions. This work has examined the role of niches that provide experimentation space for the development, testing and failure of novel innovations in ‘real’ contexts, where new networks can be supported and sustained (Smith and Raven 2012). These innovations struggle against stable regimes through which existing socio-technical systems are stabilised due to the processes of lock-in, path dependency

1 and 'entrapment' (Schot and Geels 2008; Grin et al. 2010). This work suggests that
2 what is critical to the governance potential of ULL are the ways in which they
3 constitute, and are constituted by, social networks, expectations or visions, and forms
4 of learning. Niche experiments provide a space in which new ideas, ways of viewing
5 the future, partnerships, socio-technical configurations and so on can be trialled in a
6 'protected' space, affording the actors involved the potential to go beyond business
7 as usual and prove the potential of alternatives.
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9 In the case of ULL, it is the focus on the creation of a new learning arena that marks
10 out this particular type of governance innovation from other kinds of urban
11 experimentation. Co-created by research organisations, public institutions, the private
12 sector and community actors (Liedtke et al. 2012), ULL are seen as a means through
13 which to gain experience, demonstrate, and test ideas, and co-develop new skills
14 and actionable knowledge that is explicitly captured and used to inform the process
15 of creating urban sustainability (Evans et al. 2015; Frantzeskaki and Kabisch 2016;
16 Karvonen and van Heur 2014; Voytenko et al. 2015). In practice, the nature and
17 extent of learning in ULL varies from those ULL which are highly-instrumented and
18 seek to collect data in real-time, e.g. through 'smart' applications and data
19 management and control systems, to those which regard learning as a collective and
20 reflective practice, e.g. through ongoing forms of community and stakeholder
21 engagement and consultation.
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25 The extent to which the practices of learning, the social networks through which this
26 is enabled, and the kinds of visions for urban sustainability that are designed and
27 implemented through ULL, and the degree to which they are able to gain traction in
28 the wider landscape has yet to be systematically analysed. Central to the analysis of
29 niche innovations is a concern with their potential to transform wider systems. Smith
30 and Raven (2012) argue that alongside processes of protection, niches and
31 experiments foster different forms of empowerment – means through which they are
32 able to either 'fit and conform' or 'stretch and reform' existing regimes. Our approach
33 is to include a geographical perspective, which seeks to understand how the
34 emergence of ULL under particular urban conditions is made possible and in turn
35 changes the conditions of possibility for urban places – of what constitutes 'the
36 regime'. This can contribute to our understanding of how ULL are formed and come
37 to gain momentum, and in turn the ways in which this shapes their transformative
38 potential.
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43 Placing ULL within their wider context and seeking to analyse their consequences
44 ensures that they are not considered only in their own terms – as a form of
45 governance that may be more or less suited to specific contexts – but also in terms of
46 their role as part of the wider phenomenon of a shift in the governance of
47 sustainability. If urban sustainability used to be a matter of the development of urban
48 plans and strategy, often informed by processes of environmental assessment and
49 public consultation, ULL in common with other forms of experimentation involves a
50 more interventionist, incremental and 'learning by doing' approach in which urban
51 sustainability is emergent rather than pre-given. Yet, ULL, like all other interventions
52 that seek to govern the urban condition in relation to a specific set of visions, entails
53 the pursuit of some goals while others are sidelined. The ways in which ULL govern
54 the urban arena has yet to be fully explored.
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Governing the City through ULL

1 Understanding how ULL are becoming part of the urban governance landscape is a
2 critical and emerging area of inquiry. There has, however, been a concern that the
3 institutional and actor-orientation of the governance debate has backgrounded a set
4 of key questions – how, by whom and with what consequences does governing take
5 place? Therefore, the emphasis on analysing governance – as an institutional
6 configuration – would benefit from an additional perspective that deals explicitly with
7 governing – the means through which power and agency is orchestrated and takes
8 effect. Such a combined approach would allow us to complement the identification of
9 distinct spatial or temporal forms of governance with an examination of the means
10 through which governing shapes societal transformation. In doing so, it helps to
11 specify and unpack the causal mechanisms in these institutional configurations
12 through which governing effectively takes place and through which we might seek
13 both explanation and leverage to effect greater transformative potential (i.e. how and
14 why such institutions effect the governing of innovation). Such an approach asks for a
15 more vigorous interrogation of the ways in which power and agency are orchestrated
16 to produce particular outcomes (and foreclose others). Such debates are of course
17 long running in the social sciences and subject to sustained debate.

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19 A central challenge is to provide an account that is able to deal with the stability of
20 regimes and the dynamics of innovation. Initial attempts that have emphasised the
21 structural power of regime formations and the agent-based power of innovations
22 appear to have come full circle. Emphasising power as a property of individual agents
23 neglects the structuring power of regimes. Focusing on power as a matter of interest
24 neglects the long history of work in political science that has demonstrated the
25 importance of ideas, values, and norms in shaping the dynamics of power. A human-
26 centred vision of power (and agency) neglects the significant work of scholars in
27 urban political ecology, actor-network theory and new materialism (much of which is
28 concerned with questions of the urban and of infrastructure) in demonstrating the
29 socio-material means through which power and agency are co-constituted and the
30 importance of such perspectives in their emphasis on the political economies of
31 infrastructure and metabolic flows (e.g. Bulkeley et al. 2015; Castán Broto and
32 Bulkeley 2014; Desfor and Keil 2014; Evans 2011; Evans and Karvonen 2014;
33 Hodson and Marvin 2010; Kaika 2005; Karvonen 2014; Graham and Marvin 2001;
34 Maassen 2012; Monstadt 2009; Rutland and Aylett 2008; Swyngedouw and Heynen
35 2003; Swyngedouw 2010; Shove and Walker 2007).

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37 One means of addressing this conceptual dilemma is to actively engage with the
38 notion that power is a distributed property, such that it neither resides with individual
39 agents nor is structurally determined (Ekers and Loftus 2008). Governing in such
40 accounts is accomplished not by individual institutions, but is an active, dynamic and
41 provisional process that is continually being sought through ‘programmes’ or
42 ‘projects’ that seek to intervene in the existing social (and material) order to achieve
43 particular ends (Bulkeley and Schroeder 2012). From these perspectives, power
44 cannot be conceived as a held resource or property of individual actors. It is instead a
45 relational force that emerges through the juncture of different configurations of social
46 (and material) entities. This accords with Avelino (2011) that power is a capacity to
47 mobilise, though it shifts away from the understanding that this capacity relates to a
48 set of resources that are somehow outside of the socio-material relations within
49 which power is generated.

1 Instead, it suggests that what constitutes a resource is itself realised through the
2 configuration of power. Agents and institutions are central to such an account of
3 power. Yet their nature, capacities and effects are not pre-given but rather generated
4 through the socio-material conditions within which power is realised. Governing from
5 such a perspective takes place through “strategically constructed concrete
6 programmes of action” by which the means of governing and the actors which enact
7 them are themselves constituted (McGuirk 2004). From this perspective, particular
8 projects of action – in our case ULL – can be seen as a manifestation of the ways in
9 which actors seek to constitute not only the world around them, but also what it
10 means to govern. ULL are then a calculated form of intervention. The nature and
11 effect of such interventions are constrained by the socio-technical configurations
12 within which they intervene and the power they generate in their assemblage,
13 whether it be of a particular modality (e.g. authority, domination, seduction, after Allen
14 (2003) or seen to have particular kinds of potential (e.g. innovative, transformative,
15 after Avelino (2014)).
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18 **Conclusion**

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20 Conceiving of ULL as particular governance projects provides one means through
21 which to conceptualise their role in transformative change. Taken together, this
22 reading of the literature on socio-technical transitions, power and governance
23 suggests that there is considerable scope to work with a notion of the governance of
24 transitions that pays attention to the dynamic qualities of power as a set of capacities
25 that are constituted through the formation of calculated interventions or projects
26 designed to intervene in the city in relation to particular goals which have some
27 degree of authority and legitimacy. Taking a view of power as a relational property
28 and manifest in the ways in which capacity is exercised suggests that investigating
29 how governing takes place requires an assessment of the ways in which ULL serve
30 to (re)configure socio-material conditions and mobilise agency and resources.
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34 We suggest that such an approach requires the examination of how capacity to
35 govern is exercised in different arenas. Such an analysis involves attending not only
36 to what might appear to be the inherent capabilities or resources of organisations and
37 institutions (and from such descriptive accounts, reading off their power) but also
38 examining how the ULL intervention – its *design* – served to configure or reconfigure
39 the capacities, resources and agency of the actors, intermediaries and materialities
40 (e.g. the capacities of particular technologies, ecologies, or material properties of the
41 urban and how they are enrolled into strategic interventions) in particular urban
42 contexts and with what consequent effect. Following on we consider the design to
43 shape and form the *practices* and *processes* of ULL. Practices here comprise the
44 instruments (e.g. policy tools, incentives, consultation deployed) and techniques (e.g.
45 forms of learning, measurement, accountability used). Processes are the means
46 through which elements of the ULL are mobilised and transformed beyond the initial
47 site and objectives of intervention.
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52 Utilizing this framework in our comparative work on ULL across different European
53 urban contexts is starting to reveal important insights into the heterogeneity and
54 diversity of these forms of urban experiment. For instance the design of laboratories
55 varies significantly across three types of ULL: ‘strategic’ responses, often with strong
56 state private funding that structure the urban context as a site for experimentation;
57 ‘civic’ responses, often with municipalities and universities as key actors with other
58 social interests focused on economic growth and sustainability; and ‘organic’
59 responses, often with NGOs and civil society based on diverse local priorities. Each
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1 of these responses is configured through quite different sets of practices and
2 processes producing distinctive and often disconnected landscapes of ULL within a
3 particular urban context. Further detailed empirical work is exploring the extent to
4 which these diverse responses achieve their intended impacts but also we want to
5 explore what unintended consequences these might produce in shaping urban
6 sustainability transitions.

7 **Acknowledgements**

8
9 The authors acknowledge the support of JPI Urban Europe for the
10 Governance of Urban Sustainability Transitions (GUST) project.
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Urban Living Labs: Governing Urban Sustainability Transitions

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Abstract: Urban Living Labs (ULL) are advanced as an explicit form of intervention delivering sustainability goals for cities. Established at the boundaries between research, innovation and policy, ULL are sites teintended to design, test demonstrate and learn from innovation in about the effects of a range of urban interventions in real time. They aim at co-creation and empowerment of multiple stakeholders in co-shaping of the experimental approach and being open and participatory. While rapidly growing as an empirical phenomenon, our understanding of the nature and purpose of ULL is still evolving. While much of the existing literature draws attention to the aims and workings of ULL, there have to date been fewer critical accounts that seek to understand their purpose within the shifting landscape of urban development. In this paper, we suggest that transitions studies and the literature on urban governance offer important insights that can enable us to address this gap. We illustrate how insights from transition studies can inform us about the role of ULL as 'niches' within wider urban regimes and the kinds of dynamics that are important to their success (and failure). We suggest that the debate on urban governance can provide us with a perspective that takes into account not only the institutional arrangements through which ULL are pursued, but to more fundamental questions about the capacities they enable through creating new forms of power and agency. Armed with these insights, we conclude that work on ULL needs to account for how they are designed or configured, the practices they undertake, as well as the processes through which they seek to foster broader urban transformation. Drawing on transitions theory and urban governance and politics, we seek to shed light on ULL as part of this broad phenomenon by developing a perspective that brings governance thinking into transitions theory and vice versa. This paper focuses on core concerns within different approaches and the common ground they share as well as exploring important tensions. Through this process we develop a theoretical framework that can identify a shared set of concepts and issues to inform the investigation and analysis of ULL in different contexts and conditions. We argue the key elements in such framework include the design, practices and processes of ULL.

Keywords: urban living labs, governance, urban sustainability, transitions

Highlights:

- ULL are sites to design, test and learn from innovation in real time.
- ULL are proliferating rapidly while our understanding of their nature and purpose is still evolving.

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- We seek to develop a ~~theoretical framework~~new perspective on ULL by bringing governance thinking into transitions theory and vice versa.
- ~~The framework~~This perspective helps to identify shared concepts to inform the analysis of ULL in different contexts.
- ~~Key framework elements are~~The perspective demonstrates the roles of design, practices and processes of ULL in shaping their governance dynamics and transformative capacities.

Introduction

Urban Living Labs ([ULL](#)) are being advanced as an explicit form of intervention capable of delivering sustainability goals for cities. ULL ~~are~~ can be broadly conceived as forums “for innovation, applied to the development of new products, systems, services, and processes, employing working methods to integrate people into the entire development process as users and co-creators, to explore, examine, experiment, test and evaluate new ideas, scenarios, processes, systems, concepts and creative solutions in complex and real contexts” (JPI Urban Europe 2013). For those designing and implementing ULL, they are seen as a means through which to set up ~~experiments~~ demonstrations and to trial ~~innovations~~ different kinds of intervention in the city, from relatively simple technical innovations to more complex or integrated measures designed to contribute to urban social and economic development and wider goals of sustainability. They are purposefully intended to bring together multiple actors ~~—~~ that seek to intervene in order to address contemporary ~~sustainability~~ urban challenges and foster learning through forms of open and engaged experimentation.

What makes ULL distinct is their focus on knowledge and learning as a means through which such interventions can be successfully achieved. ULL aim at co-creation and empowerment of multiple stakeholders in co-shaping of the experimental approach in a ‘triple’ or ‘quadruple’ helix mode of bringing science, policy, business and civil society together (Edwards-Schachter et al. 2012; Lehmann et al. 2015) and being open and participatory (Franz 2015). ULL are ~~distinct in also~~ marked by terms of their explicit place-based focus, whether this be concerned with a specific urban site, district or economy and their future-orientation, seeking to experiment today with solutions for the future. ULL seek to deliver innovative and transformative improvements across the urban milieu, from buildings to green space, transport to energy systems, local food to sustainable forms of consumption (Voytenko et al. 2015). They work within and across urban socio-technical and socio-ecological systems in order to mobilise change. In short, 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 place ([McCormick and Kiss 2015](#)).

While rapidly growing as an empirical phenomenon, our understanding of the nature and purpose of ULL is still evolving. There are a growing number of accounts of ULL derived from actors who have been involved in establishing ULL or in undertaking analysis of how they have been established and the extent to which they are fulfilling their intended purposes of testing, learning and developing innovation. Given the early stages of the development of ULL, this material tends to primarily be in the grey literature with fewer academic papers having been written to date (though for recent examples see: Evans 2016; Karvonen and van Heur 2014). There have been fewer perspectives to date that have taken a more critical approach to the analysis of ULL, seeking to investigate the emergence and embedding of this phenomenon within broader logics of urban development and examining their consequences and implications (for a recent and comprehensive exception, see: Evans et al. 2016).

In this paper, we seek to address this gap by positioning ULL as part of a broader shift in the nature of urban governance in which forms of innovation and experimentation are being marshalled as a means through which to govern particular (urban) conditions ([Bulkeley and Castan Broto 2013](#)). We suggest that ULL are not a stand-alone set of interventions, but part of a wider ‘politics of experimentation’

1 through which the governing of urban sustainability is increasingly taking place
2 (Bulkeley et al. 2015; [Evans et al. 2016](#); Frantzeskaki and Loorbach 2010; Franz
3 2015; McCormick et al. 2013; McGuirk et al. 2014; Wolfram and Frantzeskaki 2016).
4 [While they may be distinct in terms of their concern with the use of data and real-time](#)
5 [knowledge in order to generate insight and traction for the forms of intervention they](#)
6 [are undertaking, here our focus is not on their capacities to develop learning per se](#)
7 [but rather with how they contribute to the emergent experimental approach to](#)
8 [responding to sustainability challenges at the urban level. This raises the question if](#)
9 [and how such an experimental approach can create an impact beyond their](#)
10 [immediate domain and induce transitions across urban socio-technical and socio-](#)
11 [ecological systems. A crucial challenge in this regard is how loosely coupled system](#)
12 [elements \(new technologies, institutions, markets, actor and network constellations\)](#)
13 [evolve and align into more stable configurations that would be able to replace and](#)
14 [transform a current \(unsustainable\) system.](#)

17 [It has been within the fields of transitions theory and urban governance that the](#)
18 [nature and dynamics of urban experimentation has been most closely studied to](#)
19 [date. We draw on these broad bodies of work](#) ~~Drawing on the broad body of work on~~
20 ~~transitions theory and on urban governance and politics, we seek~~ to develop a novel
21 framework to critically understand the existing role and future potential of ULL as part
22 of this broad phenomenon of urban experimentation. This paper therefore focuses on
23 the core concerns within these two approaches, the common ground they share, and
24 the important tensions. Through this process we develop a [theoretical framework](#)
25 [new perspective](#) that can identify a shared set of concepts and issues to inform the
26 investigation and analysis of ULL in different urban contexts and local conditions.

30 **Understanding ULL as Innovation Governance and Governance Innovation**

31 As a means of intervening in the urban arena to address particular sustainability
32 challenges, ULL constitute a particular form of governance innovation. Understanding
33 the means through which they are designed, implemented and take effect can
34 therefore usefully draw on the tradition of innovation studies and socio-technical
35 transitions. This work has examined the role of niches that provide experimentation
36 space for the development, testing and failure of novel innovations in 'real' contexts,
37 where new networks can be supported and sustained (Smith and Raven 2012).
38 These innovations struggle against stable regimes through which existing socio-
39 technical systems are stabilised due to the processes of lock-in, path dependency
40 and 'entrapment' (Schot and Geels 2008; Grin et al. 2010). This work suggests that
41 what is critical to the governance potential of ULL are the ways in which they
42 constitute, and are constituted by, social networks, expectations or visions, and forms
43 of learning. [The configuration or design of nNiche experiments provides](#) a space in
44 which new ideas, ways of viewing the future, partnerships, socio-~~technical-material~~
45 configurations and so on can be trialled in a 'protected' space, affording the actors
46 involved the potential to go beyond business as usual and prove the potential of
47 alternatives.

53 In the case of ULL, [as discussed above](#), it is the focus on the creation of a new
54 learning arena that marks out this particular type of governance innovation from other
55 kinds of urban experimentation. Co-created by research organisations, public
56 institutions, the private sector and community actors [in what is often referred to as a](#)
57 ['triple' or 'quadruple' helix mode](#) (Liedtke et al. 2012), ULL are seen as a means
58 through which to gain experience, demonstrate, and test ideas, and co-develop new
59 skills and actionable knowledge that is explicitly captured and used to inform the
60

1 process of creating urban sustainability (Evans et al. 2015; Frantzeskaki and Kabisch
2 2016; Karvonen and van Heur 2014; Voytenko et al. 2015). In some contexts, such
3 as the development of projects under the JPI Urban Europe Programme, the
4 development of ULL draws explicitly on the learning gained from approaches to
5 transition management in which research teams, together with stakeholders, are
6 actively engaged in fostering the ULL and leading a process of visioning and learning
7 through which transitions in urban practice, policies and planning can take place. In
8 practice Elsewhere, the nature and extent of learning in ULL varies from those ULL
9 which are highly-instrumented and seek to collect data in real-time, e.g. through
10 'smart' applications and data management and control systems, to those which
11 regard learning as a collective and reflective practice, e.g. through ongoing forms of
12 community and stakeholder engagement and consultation. The different practices
13 which animate ULL are critical in shaping how these interventions in turn are able to
14 gain traction and realise their objectives for governing the city.

17 ~~The extent to which the practices of learning, the social networks through which this~~
18 ~~is enabled, and the kinds of visions for urban sustainability that are designed and~~
19 ~~implemented through ULL, and the degree to which they are able to gain traction in~~
20 ~~the wider landscape has yet to be systematically analysed. Beyond questions of the~~
21 ~~social networks and visions that constitute how ULL are configured and the practices~~
22 ~~of learning through which they are enacted, —c~~ Central to the analysis of niche
23 innovations is a concern with their potential to transform wider systems. Smith and
24 Raven (2012) argue that alongside processes of protection, niches and experiments
25 foster different forms of empowerment – means through which they are able to either
26 'fit and conform' or 'stretch and reform' existing regimes. ~~Our approach is to include~~
27 ~~including a~~ geographical perspective, which seeks to understand how the
28 emergence of ULL under particular urban conditions is made possible and in turn
29 changes the conditions of possibility for urban places, is critical for developing our
30 understanding of the processes through which ULL are (and are not) able to leverage
31 change within and across the urban arena (Truffer et al. 2015) — of what constitutes
32 'the regime'. ~~This can~~ In short, integrating insights from the growing body of work on
33 the geographies of niche innovations and transitions can contribute to our
34 understanding of ~~how the processes through which ULL are formed and come to~~
35 ULL ~~come to~~ gain momentum, and in turn the ways in which this shapes their
36 transformative potential.

42 Transition studies perspectives therefore provide a great deal of insight into how ULL,
43 as a form of niche innovation or as a process through which transition management
44 is deployed, are governed. It signals the importance of the visions, knowledge, skills
45 and social networks designed into ULL, the practices through which learning is
46 enabled, and the processes through which broader transformation is sought.
47 However, it is critical that ULL are not considered only in their own terms – as a form
48 of governance intervention that may be more or less suited to specific contexts – but
49 also in terms of their role as part of the wider phenomenon of a shift in the
50 governance of sustainability. It is to these debates that we now turn. ~~If urban~~
51 ~~sustainability used to be a matter of the development of urban plans and strategy,~~
52 ~~often informed by processes of environmental assessment and public consultation,~~
53 ~~ULL in common with other forms of experimentation involves a more interventionist,~~
54 ~~incremental and 'learning by doing' approach in which urban sustainability is~~
55 ~~emergent rather than pre-given. Yet, ULL, like all other interventions that seek to~~
56 ~~govern the urban condition in relation to a specific set of visions, entails the pursuit of~~

1 ~~some goals while others are sidelined. The ways in which ULL govern the urban~~
2 ~~arena has yet to be fully explored.~~

3 **Governing the City through ULL**

4 ~~If governing urban sustainability used to be a matter of the development of urban~~
5 ~~plans and strategy, often informed by processes of environmental assessment and~~
6 ~~public consultation, ULL in common with other forms of experimentation involves a~~
7 ~~more interventionist, incremental and ‘learning by doing’ governing approach in which~~
8 ~~urban sustainability is emergent rather than pre-given. Seeing ULL not only as~~
9 ~~discrete arenas for research and development, but as part of a broader shift in the~~
10 ~~ways in which society responds to urban sustainability challenges requires a more~~
11 ~~explicit engagement with the ways in which they form part of the shifting governance~~
12 ~~landscape. Within the transitions studies field,~~

13 ~~Understanding how ULL are becoming part of the urban governance landscape is a~~
14 ~~critical and emerging area of inquiry. There has, however, been a concern that the~~
15 ~~institutional and actor-orientation of the governance debate has backgrounded a set~~
16 ~~of key questions – how, by whom and with what consequences does governing take~~
17 ~~place?~~

18 ~~We suggest that in seeking to understand the nature and dynamics of governing~~
19 ~~urban transitions through ULL, Therefore, the emphasis on analysing governance~~
20 ~~– as an institutional configuration – would benefit from an additional perspective that~~
21 ~~deals explicitly with governing – the means through which power and agency is~~
22 ~~orchestrated and takes effect (see also Raven et al. (2016) for a similar argument in~~
23 ~~relation to niche governance).~~ Such a combined approach ~~would allowenables~~ us to
24 complement the identification of distinct spatial or temporal forms of governance with
25 an examination of the means through which governing shapes societal
26 transformation. In doing so, it helps to specify and unpack the causal mechanisms in
27 these institutional configurations through which governing effectively takes place and
28 through which we might seek both explanation and leverage to effect greater
29 transformative potential (i.e. how and why such institutions effect the governing of
30 innovation). Such an approach asks for a more vigorous interrogation of the ways in
31 which power and agency are orchestrated to produce particular outcomes (and
32 foreclose others). Such debates are of course long running in the social sciences and
33 subject to sustained debate.

34 A central challenge is to provide an account that is able to deal with the stability of
35 regimes and the dynamics of innovation. Initial attempts that have emphasised the
36 structural power of regime formations and the agent-based power of innovations
37 appear to have come full circle. Emphasising power as a property of individual agents
38 neglects the structuring power of regimes. Focusing on power as a matter of interest
39 neglects the long history of work in political science that has demonstrated the
40 importance of ideas, values, and norms in shaping the dynamics of power. A human-
41 centred vision of power (and agency) neglects the significant work of scholars in
42 urban political ecology, actor-network theory and new materialism (much of which is
43 concerned with questions of the urban and of infrastructure) in demonstrating the
44 socio-material means through which power and agency are co-constituted and the
45 importance of such perspectives in their emphasis on the political economies of
46 infrastructure and metabolic flows (e.g. Bulkeley et al. 2015; ~~Castán Broto and~~
47 ~~Bulkeley 2014; Desfor and Keil 2014; Evans 2011; Evans and Karvonen 2014;~~
48 ~~Hodson and Marvin 2010; Kaika 2005; Karvonen 2014; Graham and Marvin 2001;~~

1 Maassen 2012; Monstadt 2009; ~~Rutland and Aylett 2008~~; Swyngedouw and Heynen
2 2003; Swyngedouw 2010; Shove and Walker 2007).

3 One means of addressing this conceptual dilemma is to actively engage with the
4 notion that power is a distributed property, such that it neither resides with individual
5 agents nor is structurally determined (Ekers and Loftus 2008). Governing in such
6 accounts is accomplished not by individual institutions, but is an active, dynamic and
7 provisional process that is continually being sought through 'programmes' or
8 'projects' that seek to intervene in the existing social (and material) order to achieve
9 particular ends (McGuirk et al. 2016) (~~Bulkeley and Schroeder 2012~~). From these
10 perspectives, power cannot be conceived as a held resource or property of individual
11 actors. It is instead a relational force that emerges through the juncture of different
12 configurations of social (and material) entities (see also Avelino 2011). ~~This accords
13 with Avelino (2011) that power is a capacity to mobilise, though it shifts away from
14 the understanding that this capacity relates to a set of resources that are somehow
15 outside of the socio-material relations within which power is generated.~~

16 ~~Instead, it suggests that what constitutes a resource is itself realised through the
17 configuration of power.~~ Agents and institutions are central to such an account of
18 power. Yet their nature, capacities and effects are not pre-given but rather generated
19 through the socio-material conditions within which power is realised. Governing from
20 such a perspective takes place through "strategically constructed concrete
21 programmes of action" by which the means of governing and the actors which enact
22 them are themselves constituted (McGuirk 2004). From this perspective, particular
23 projects of action – in our case ULL – can be seen as a manifestation of the ways in
24 which actors seek to constitute not only the world around them, but also what it
25 means to govern. The design of ULL is then central to their capacities as are then a
26 calculated form of intervention. The nature and effect of such interventions are
27 constrained by the socio-~~material~~technical configurations within which they intervene
28 and the power they generate in their assemblage, whether it be of a particular
29 modality (e.g. authority, domination, seduction, after Allen (2003) or seen to have
30 particular kinds of potential (e.g. innovative, transformative, after Avelino (2014)). This
31 in turn suggests that the ways in which ULL are conducted – the techniques of data
32 gathering, the forms of participation – are a critical means through which the
33 governing of the urban milieu takes place. In short, that the practices commonly
34 associated with ULL's – of partnership, participation, learning, data mining etc. – are
35 not neutral mechanisms but central to the ways in which governing is achieved and in
36 shaping the possibilities for transformative processes.

37 Conclusion

38 Conceiving of ULL as particular governance projects provides one means through
39 which to conceptualise their role in transformative change. Taken together, this
40 reading of the literature on ~~socio-technical~~ transitions, power and governance
41 suggests that there is considerable scope to work with a notion of the governance of
42 transitions that pays attention to the dynamic qualities of power as a set of capacities
43 that are constituted through the formation of calculated interventions or projects
44 designed to intervene in the city in relation to particular goals which have some
45 degree of authority and legitimacy. Taking a view of power as a relational property
46 and manifest in the ways in which capacity is exercised suggests that investigating
47 how governing takes place ~~requires an assessment of the ways in which through~~ ULL
48 requires that we move beyond understanding them only as a means through which
49 new kinds of research, development and learning are being orchestrated towards an

1 assessment of how they serve to (re)configure socio-material conditions and mobilise
2 agency and resources.

3 We suggest that such an approach requires the examination of how capacity to
4 govern is exercised in different arenas. Such an analysis involves attending not only
5 to what might appear to be the inherent capabilities or resources of organisations and
6 institutions (and from such descriptive accounts, reading off their power) but also
7 examining how the ULL intervention ~~—its design—~~ serv~~es~~ed to configure or
8 reconfigure the capacities, resources and agency of the actors, intermediaries and
9 materialities (e.g. the capacities of particular technologies, ecologies, or material
10 properties of the urban and how they are enrolled into strategic interventions) in
11 particular urban contexts and with what consequent effect. In short, that what ULL's
12 are capable of is not only a matter of the institutions and actors involved, but how
13 their configuration or design realises new kinds of capacities and capabilities.
14 Following on we consider the design to shape and form

15 This in turn shapes the practices that are undertaken within ULL, including the ~~and~~
16 ~~processes of ULL. Practices here comprise the~~ instruments (e.g. policy tools,
17 incentives, consultation deployed) and techniques (e.g. forms of learning,
18 measurement, accountability) used. ~~These practices can both serve to reinforce the~~
19 configuration of the ULL but also create new junctures and configurations through
20 which the ULL may evolve in its intentions and capacities). ~~The ability for any~~
21 particular ULL to realize a broader set of transformations. ~~Processes are the means~~
22 through which elements of the ULL are mobilised and transformed beyond the initial
23 site and objectives of intervention ~~relies on a series of processes, including learning,~~
24 mobilization and translation, which are made more or less possible and feasible by
25 both the design of the initial intervention and the practices to which it gives rise.

26 From our analysis of the insights given by transition studies and urban governance,
27 we find that these three elements – the design, practices and processes – of ULL are
28 critical in terms of understanding their role in governing urban development and
29 contributing to social and environmental transformation. In this perspective, ULL are
30 doing more than simply fostering learning and innovation, they are part of the ways in
31 which urban responses to sustainability challenges are governed. Viewing ULL as
32 part of the shifting governance landscape, a means through which interventions are
33 increasingly pursued in order to realize urban objectives, does not mean that they are
34 all equally successful in realizing their aims. Understanding how and why some ULL
35 are able to take effect and others are not requires that we delve into these dynamics
36 of power and agency to grapple with how the governing of the city is taking place.
37 Using this perspective, we suggest that further detailed empirical work is required to
38 explore the extent to which these diverse responses achieve their intended impacts
39 and the unintended consequences these might produce in shaping urban
40 sustainability transitions.

41 Utilizing this framework in our comparative work on ULL across different European
42 urban contexts is starting to reveal important insights into the heterogeneity and
43 diversity of these forms of urban experiment. For instance the design of laboratories
44 varies significantly across three types of ULL: 'strategic' responses, often with strong
45 state private funding that structure the urban context as a site for experimentation;
46 'civic' responses, often with municipalities and universities as key actors with other
47 social interests focused on economic growth and sustainability; and 'organic'
48 responses, often with NGOs and civil society based on diverse local priorities. Each
49 of these responses is configured through quite different sets of practices and
50

~~processes producing distinctive and often disconnected landscapes of ULL within a particular urban context. Using this perspective, we suggest that further detailed empirical work is exploring required to explore the extent to which these diverse responses achieve their intended impacts but also we want to explore what and the unintended consequences these might produce in shaping urban sustainability transitions.~~

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