



Interrogating urban experiments

Federico Caprotti & Robert Cowley

To cite this article: Federico Caprotti & Robert Cowley (2016): Interrogating urban experiments, Urban Geography, DOI: [10.1080/02723638.2016.1265870](https://doi.org/10.1080/02723638.2016.1265870)

To link to this article: <http://dx.doi.org/10.1080/02723638.2016.1265870>



© 2016 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



Published online: 09 Dec 2016.



Submit your article to this journal [↗](#)



Article views: 58



View related articles [↗](#)



View Crossmark data [↗](#)

RESEARCH NOTE

 OPEN ACCESS

Interrogating urban experiments

Federico Caprotti  and Robert Cowley 

Department of Geography, University of Exeter, Amory Building, Rennes Drive, Exeter, UK

ABSTRACT

The notion of the “urban experiment” has become increasingly prevalent and popular as a guiding concept and trope used by both scholars and policymakers, as well as by corporate actors with a stake in the future of the city. In this paper, we critically engage with this emerging focus on “urban experiments”, and with its articulation through the associated concepts of “living labs”, “future labs”, “urban labs” and the like. A critical engagement with the notion of urban experimentation is now not only useful, but a necessity: we introduce seven specific areas that need critical attention when considering urban experiments: these are focused on normativity, crisis discourses, the definition of “experimental subjects”, boundaries and boundedness, historical precedents, “dark” experiments and non-human experimental agency.

ARTICLE HISTORY

Received 26 May 2016

Accepted 18 November 2016

KEYWORDS

Urban Experiments; urban futures; sustainable cities; future cities

Introduction: interrogating urban experiments

Recent years have seen the emergence of interest in the notion of analysing, governing and understanding cities through an “experimental” lens: cities are being treated both as laboratories, and as field sites where innovations and new ways of organising urban life can be trialled (Evans, 2016). Thus, the notion of urban experimentation has become increasingly prevalent and accepted in scholarly and practice circles. For example, a Google Scholar search reveals that while “urban experiments” featured in 288 academic publications that appeared between 2000 and 2010, the number of mentions increased to 588 in 2010–16. As Evans (2016, p. 430) argues, while urban experimentation has become an important way of understanding and governing the city and of trying to steer processes of urban change in specific directions, “the social inclusiveness and disruptive potential of the ‘improvements’ sought through experimentation beg critical scrutiny”. In part, this is because the increasing adoption of discourses of experimentation constrains urban governance into a view of the city as laboratory, however complex, and of the urban sphere as a “problem” to be solved through sociotechnical means. However, there is also a broader need to critically engage with the underlying politics, ideologies and urban imaginations implicit in the deployment of widely accepted concepts and discourses around urban experimentation. In this sense, the notion of urban experimentation can be seen as an “empty signifier”, a concept that is defined by its indeterminacy. Urban scholars have pointed out how such concepts can

CONTACT Federico Caprotti  f.caprotti@exeter.ac.uk

© 2016 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

lend themselves to a range of political and governance interpretations, including the radically progressive (Brown, 2016) as well as those that are more reactionary or regressive (Swyngedouw, 2010). It is in this context, then, that the increasingly popular notion of urban experimentation needs to be critically challenged.

Urban experiments, we are told, have focused on a range of areas including climate change, sustainability, transport, creative industries, new technologies and innovation, to name a few. Scholars, policymakers and the private sector now frequently refer not only to urban experiments, but also to “living labs”, “future labs”, “urban labs” and the like. Urban experimentation, as explored in the emerging literature, is treated as a phenomenon that is either spontaneous or organised (Farrelly & Brown, 2011), but that is, at heart, a “purposive intervention” (Bulkeley, Castán Broto, & Edwards, 2015, p. 5) belonging to a nascent mode of urban governance *by experiment*. Following on from this, the definition of urban experiments, and of the experimental approach in urban governance, is correspondingly broad. Bulkeley and Castán Broto, for example, state that contemporary uses of the notion of urban experimentation “do not use experiment in the formal scientific sense of the term but rather to signify purposive interventions in which there is a more or less explicit attempt to innovate, learn or gain experience” (Bulkeley & Castán Broto, 2013, p. 363). This purposive focus, in turn, includes elements of both learning and institutionalisation. This means that the current focus on cities as experimental sites places the spotlight on the “learning by doing” made possible through bounded, experimental projects and initiatives. At the same time, current research on urban experimentation is interested in the ways in which lessons can be drawn from specific, often very local experiments, and applied more broadly (e.g. through “best practice” approaches, or processes aimed at “upscaling”) (Evans, Karvonen, & Raven, 2016).

Although there is nothing new about viewing the city as a laboratory, or as an experimental site, we argue in this paper that the resurgence of interest in conceptualising the city as a laboratory has neglected to consider important questions. These relate to the ways in which we should think about: the “boundedness” of experiments; how to remain adequately conscious of the often dark history of utopian/dystopian social and technical experiments; how to engage critically with the fact that much of the experimental literature deploys a narrative of “crisis” (climatic, demographic, political, etc.) in order to justify the experimental approach; and how to give a voice to the *subjects* that are implicit in any urban experiment, but who have, to date, been largely silent (or silenced). We propose that more critical engagement with the now popular notion of the “urban experiment” as a (new) form of urban governance, and as a way of conceptualising the city in view of future urban development, is both necessary and overdue. It is hoped that the questions raised in this paper will spark a lively and useful debate aimed at forming a more self-aware urban research agenda.

Urban experimentation: from garden cities to bounded experiments, and back again

Urban experimentation is firmly on the policy, planning and scholarly urban agenda. Academic surveys point to the existence of hundreds of urban experiments focused on responding to climate change (Castán Broto & Bulkeley, 2013), while the city of Aarhus, Denmark, has recently announced a fund of more than €200,000 aimed at investing in smart city-focused experiments (Aarhus University, 2016). “Urban labs” and “living labs” have become popularised as “new” forms of urban governance: in 2015, the

municipalities of Maastricht, Antwerp (both in the Netherlands), Malmö (Sweden), Graz and Leoben (both in Austria) formed a coalition aimed at establishing shared guidelines and frameworks for governance by experiment (Urb@exp, 2015). At the level of international policymaking, in 2015 the UN introduced a new urban-themed Sustainable Development Goal (SDG). SDG 11 aims to make cities “inclusive, safe, resilient and sustainable”, and specifically points to innovation and efficiency gains as central to sustainable urban futures, thus opening the way for projects and activities aiming to experiment with, and in, the city (UN, 2015).

Much of the contemporary literature on urban experiments is rooted in work on socio-technical transitions (Geels, 2005, 2010; Smith, Voß, & Grin, 2010). Although experiments loom large as a concern in transition studies (Brown & Vergragt, 2008; Bos & Brown, 2012; Farrelly & Brown, 2011), this interest has multidisciplinary and historical roots in Science and Technology Studies (Katsioloudes, 1996), structuration theory, evolutionary economics, studies of management and innovation, and other fields of enquiry (Grin, Rotmans, & Schot, 2010; Smith et al., 2010). Within this broad literature, there has been a sustained focus on a more specific experimental type: the bounded sociotechnical experiment (Brown & Vergragt, 2008). These are generally defined as attempts to introduce new technologies, services or “ways of doing” on a spatially and temporally bounded scale. In this context, the time horizon is generally a number of years, while the spatial scale is defined either geographically, or by identifying a defined (and usually small) set of users. In addition, these users form a coalition that explicitly recognises “the effort to be an *experiment*, in which learning by doing, trying out new strategies and new technological solutions, and continuous course correction, are standard features” (Brown & Vergragt, 2008, p. 112). McLean, Bulkeley, and Crang (2016), for example, have used the example of Austin’s Mueller district to examine a range of urban sustainability experiments focused on smart grid technologies and showed how cities as a whole can be considered as experimental arenas, while at a more limited spatial scale, Brown and Vergragt (2008) used their analysis of the design of a specific, zero-energy residential building in Boston as a way of exploring both the geographically bounded nature of experiments (i.e. focused on a single building) and the process of building design per se by a range of actors.

In parallel, the focus on cities as sites for transformation towards more ecologically sustainable futures, and as places where the challenges of environmental and climate change should be faced (Caprotti, 2015), is part and parcel of a decadal and continuously gathering interest in understanding processes of urban socio-economic and environmental change so as to promote “green” urban futures (Joss, 2015). It is at this juncture that the literature on sustainability transitions focuses on the city as the stage on which transitions can be seen to occur and can be prompted to happen. In this light, cities become the locations for analysis of bounded *urban* experiments in areas from climate change (Bulkeley & Castán, 2013; Castán Broto & Bulkeley, 2013), to experimental urban governance (Bos & Brown, 2012; Evans, 2011; Evans & Karvonen, 2014), to specific experiments in housing and low carbon transitions (Castán Broto, 2012), urban water management (Farrelly & Brown, 2011) and rewilding (Hinchliffe, Kearnes, Degen, & Whatmore, 2005; Lorimer & Driessen, 2014). The city, then, has become the subject of a broad range of geographies of experimentation (Kullman, 2013). Much of this experimental focus is, in turn, based on the premise that urban experiments can effect broader transformative change in the city: experiments are seen as potential sites from which transitional visions, strategies and action can emerge.

Although the ways in which the current literature treats experiments have evolved, concern with the city as an experimental site has much earlier roots, especially in modernist, utopian experiments with new cities and neighbourhoods (Cowley, 2015; Kargon & Molella, 2008). Some of these (such as Garden Cities) contained, at their core, aims which went beyond the urban and which aimed to bring about wider societal change (Howard, 2010). In this sense, early modernist urban utopias can be described as transitional in purpose. Contemporary agendas around sustainable urbanisation and experimental urbanism, then, trace their roots (albeit often implicitly) to a long history of attempts to envision changing the city as a way of changing society itself (de Jong, Joss, Schraven, Zhan, & Weijnen, 2015; Joss, 2015). In turn, it is not surprising that some of the literature that pre-dates the more recent concern with urban experiments incorporated approaches that are now central to contemporary research in urban experimentation. For example, Deas, Robson and Bradford's (2000) enquiry into the rise and fall of Urban Development Corporations (UDCs) in Manchester, Leeds and Bristol clearly treated UDCs as "experimental", in large part because of their territorially bounded nature. Thus, the literature on urban experimentation is not only wide-ranging and contemporary, but deeply rooted in specific historical, ideological and other contexts. Accordingly, there is a pressing need to map out and extend the range of approaches that would seek to critically engage with this body of knowledge.

Critical approaches to urban experimentation

In this paper, we mostly focus on the ways in which urban experiments have been conceptualised in the context of societal transitions. The range of approaches within studies of sociotechnical transitions has been critiqued from various disciplinary and theoretical perspectives (Lawhon & Murphy, 2012), which cannot be adequately summarised here. Nonetheless, some of the critiques that are of most direct relevance to this paper are, firstly, those that have highlighted the need to "spatialise" studies of transition and societal change (Coenen & Truffer, 2012; Coutard & Rutherford, 2010; Raven, Schot, & Berkhout, 2012). This has brought to light a need to focus on the actual sites and spatial networks of transition, and to flesh out the *places* and *scales* at which transitions and experiments happen and are deployed. Secondly, scholars have called for a clearer focus on the *politics* (Scrase & Smith, 2009; Shove & Walker, 2007; Smith et al., 2010) and *justice* (Newell & Mulvaney, 2013) aspects of transition and experimentation. Building on and extending these critiques, this paper proposes some additional considerations to be borne in mind, by both scholars and policymakers, when considering notions of urban experimentation as applied to contemporary and future-focused settings and projects. These considerations are rooted in prior critiques, as outlined above. Nonetheless, in their specific scope they also represent new directions in critically engaging with urban experimentation.

Normative narratives of urban change

The experimental literature often begins analysis by considering cases, and by tracing the outlines of the urban experimental initiatives in question. However, what must also be considered is the way in which the term "experiment" is deployed: specifically, the degree to

which the term is used normatively. The experimental approach is, on an ontological level, far from normative. However, it lends itself to a potentially normative epistemological approach to the city: knowing the city as a set of variables (a messy set, but still a collection of parameters that can be tinkered with and controlled). This is not surprising given the genealogy of some of the conceptual strands that contributed to the development of the focus on transitional experiments, as outlined above. Indeed, some of the pedigree of transition studies lies in sociotechnical systems theory, a conceptual framework that evolved over the course of more than half a century of research aimed at “optimising people, technology, organisations and all manner of other systemic elements” (Walker, Stanton, Salmon, & Jenkins, 2008). The normative element within studies of urban experimentation can usefully be acknowledged and rendered explicit as a precursor to, and enabler of, debate around the political nature of initiatives and “innovations” that are often couched in ecologically modernising language. As argued by Silver (2014) in his study of slum dwellers’ attempts to connect to energy networks in Accra, “experiments” that are less normatively defined and organised from the top down are often the most fruitful places where potentially progressive urban social, economic and technological change takes place.

The role of crisis

The notion of “crisis” as a stimulator of change needs to be unpacked. Recent work on the role of niches and experiments in transitions and transition pathways has highlighted the issue that it often seems difficult for niche developments (and for experiments) to have a lasting, transformational impact on sociotechnical regimes. For example, Longhurst’s (2012) analysis of the introduction of the “Totnes Pound”, an alternative currency in the town of Totnes, in the southwest of the United Kingdom, highlights the potential need for an incumbent system “to be in deep crisis before alternatives are adopted” (Longhurst, 2012, 183). Likewise, Castán Broto et al.’s (2014) work on innovations in infrastructure concludes that rather than taking place over long periods of time, sociotechnical system innovation may take place most efficiently over a short span of time and as a result of a significant “shock” to the dominant system. These insights have real implications for the role of bounded experiments aimed at stimulating urban change. Specifically, they point to the need for experimentation to occur at, and take advantage of, the window of opportunity presented by crisis (broadly conceived). And yet, it may be problematic to present crises (either in retrospective narratives or in contemporary diagnostic analyses) as “enabling factors”, to the extent that this underplays their constructed nature. Justifying experimental interventions and societal change through recourse to notions of crisis, for example, is a key feature in current trends of de-politicisation of the contemporary city (Swyngedouw, 2010, 2013). The construction of ecological and political crisis as a way of justifying specific, often exclusionary, urban projects has also been critiqued for a long time by urban political ecologists (Davis, 1998). Commentators, then, should be alert to the effects that such justifications may have on the political: a point further explored below.

Experimental subjects

The experimental literature is highly interested in the complex realities of *who* does the experimenting, but is mostly silent on the question of: *on whom* is the experiment carried

out? And by implication, *who* decides what is to be an experiment? Furthermore, who sets the boundaries (spatial, political or networked) that define the boundedness of the urban experiment? As Castán Broto (2012) has argued in her study of public housing in Ljubljana, Slovenia, it is just as important to focus on the processes of contestation *to* experimental initiatives as it is on the initiatives themselves. Answering this question explicitly in research and practice has the key consequence of giving “experimental subjects” a voice and agency within the experimental and transitions process.

Boundaries and boundedness

The question of defining the “boundary” in the context of bounded experiments is still open. Much work acknowledges the porousness of bounded experimental areas, as well as their existence within place-specific, or national, international and interest-based networks populated by a range of actors. Nonetheless, there remains the question, then, of how to conceptualise boundedness in a way that both preserves its conceptual integrity while extending its scope so as to include the diverse multiplicity of cases that may not fit so easily into contemporary narratives of how specific experiments are to be defined. For example, the recent and continuing migration crisis in the European Union has led to a range of experimental and ad hoc measures, some more physically bounded than others. In her work on the use of German *Wohnheime* residential accommodation for asylum seekers, Fontanari (2015) has elaborated the notion of “threshold” to indicate the complexities of spatial and temporal boundedness, as well as the possibility of being “in between” boundaries. More active recognition of these difficulties has the potential to enable not only the development of a more sophisticated understanding of the spatiality of urban experimentation, but also (again) a more explicit acknowledgement of the epistemological limitations of this conceptual framing.

Sensitivity to the history of experiments

Another issue to be considered is the ahistorical character of much of the contemporary literature on urban experiments. Lost amidst the glee of writing on experiments, shiny innovations, niches and breakthrough moments are those times, often within living history, when societal and urban experiments have moved from utopian intent to dystopian or authoritarian reality. Most of the literature on bounded urban experiments focuses on a narrow range of activities in (mostly) contemporary settings. Predominantly, the urban experiments under analysis have taken place over the past three decades. However, this risks raising the spectre of naiveté at best, and historical blindness and ignorance at worst. As Hajer (2016, p. xix) notes, living in a city that is an urban experiment or a living lab could be “quite a scary proposition”. Conscious, explicit critical attention needs to be paid to the fact that the 20th century was replete with urban experiments of the totalitarian variety, for example. In these cases, the “experiment” was used as a justification for the subjugation of people, as seen in the novel forms of urbanism (from New Towns to penal colonies and in between) found in the USSR, Maoist China, and fascist Italy, as well as in more contemporary formulations of the bounded “camp” (Pasquetti, 2015; Picker & Pasquetti, 2015). In this sense, the Nazi concentration camps can be

described as “bounded” and “experimental”, while their motivations and consequences were clearly not of the sort that would be envisaged or welcomed by contemporary scholars! It is therefore imperative for contemporary researchers to be keenly aware of the long and less than rosy history of experimentation with urban areas, and other societal formulations, over the past century.

“Dark” experiments

In light of the above, it would be desirable to expand the field of urban experimentation to consider bounded urban experiments that are less visible and certainly less fashionable than those focused on issues such as climate change. Some of these have moved from utopia to dystopia; some are areas of long-standing friction and injustice; and some have been dystopian from the beginning, and have served to concentrate and sideline the “Other” in spatially bounded ways. From long-term refugee camps to semi-permanent informal and illegal settlements, from urban slums to the migrant camps near Calais, France, it would be desirable for urban scholars to link these “dark” bounded experimental areas with the transitions literature more carefully (and one useful way of approaching this endeavour may be to devote more attention to the subjects of experiments, as advocated above). After all, bounded sociotechnical experiments are not all aimed at socio-environmental and technical-economic “progress”, nor do they all have progressive outlines – or consequences.

Non-human agency and urban experiments

Finally, most of the literature on urban experimentation is focused on bounded experiments as arenas within which novel and innovative social and technical niches may develop and emerge. And yet, the bounded experiments that populate this wide literature tend to be firmly rooted in the *human* experience of the city. Drawing on recent calls (from scholars interested in the non-human, non-representational theory and nature–society relations) to step away from clear nature/society binaries, and into the messy reality – or “cosmopolitics” (Hinchliffe et al., 2005) – of urban arenas that encompass and hold together both the human and the non-human (and joint reconfigurations of the two), this paper calls for a widening of the remit of enquiries into experimental urban areas. Such a widening necessarily seeks to include socio-natural hybrids (Swyngedouw, 1996) within the experimental area, as well as recognising and getting comfortable with the “environment’s” agency and transformative potential in the city.

Conclusion

This paper’s starting point was a sense of unease with the wide and often uncritical (or acritical) adoption of the notion of urban experimentation by a wide range of scholars and policymakers. In the brief points above, we have attempted to break apart the notion of experimentation by focusing on its spatiality (or lack of it), on the construction of its boundaries, and on key questions around experimental subjects and the role of the experimenter. This opens up important questions about the idea of using urban experiments as new modes of urban governance (Evans Karvonen, & Raven, 2016), but rather than advocating for

the sidelining of the notion of urban experimentation, we have argued for its widening and deepening. The modern period has been one where utopian urban and wider societal visions have at times been turned into nightmares for those who have to then populate these visions in material reality. It would be useful, then, to take the lived, human city as a starting point for considering notions of experimentation, rather than identifying a transitional end point and designing urban visions with which these illusory end points can be achieved. We have also argued for a more historically nuanced approach to the deployment of notions of urban experimentation: this will help urban scholars hone a more critically informed approach to urban change and urban futures. It will also enable urban practitioners and scholars to move past an impending situation whereby they may find themselves trapped within a discursive logic that they might otherwise be expected to challenge.

Acknowledgements

This paper was supported by the Economic and Social Research Council (ESRC) [grant number ES/L015978/1] “Smart eco-cities for a green economy: a comparative study of Europe and China”. We would like to thank the editor and the anonymous reviewer for comments on an earlier version of this article.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the Economic and Social Research Council (ESRC) [Grant Number: ES/L015978/1].

ORCID

Federico Caprotti  <http://orcid.org/0000-0002-5280-1016>

Robert Cowley  <http://orcid.org/0000-0002-5267-3974>

References

- Aarhus University. (2016). *DKK 1.5 million for urban experiments in Aarhus*. Aarhus: Aarhus University School of Communication and Culture. Retrieved from http://cc.au.dk/en/news-and-events/news/single_news/artikel/1-5-millioner-kroner-til-by-eksperimenter-i-aarhus/
- Bos, Annette J. J., & Brown, Rebekah R. (2012). Governance experimentation and factors of success in socio-technical transitions in the urban water sector. *Technological Forecasting and Social Change*, 79(7), 1340–1353.
- Broto, Vanesa Castán, Glendinning, Stephanie, Dewberry, Emma, Walsh, Claire, & Powell, Mark. (2014). What can we learn about transitions for sustainability from infrastructure shocks? *Technological Forecasting and Social Change*, 84, 186–196. May 2014.
- Brown, Halina S., & Vergragt, Philip J. (2008). Bounded socio-technical experiments as agents of systemic change: The case of a zero-energy residential building. *Technological Forecasting and Social Change*, 75(1), 107–130.

- Brown, Trent. (2016). Sustainability as empty signifier: Its rise, fall, and radical potential. *Antipode*, 48(1), 115–133.
- Bulkeley, Harriet, & Castán, Broto V. (2013). Government by experiment? Global cities and the governing of climate change. *Transactions of the Institute of British Geographers*, 38(3), 361–375.
- Bulkeley, Harriet., Castán Broto, Vanesa, & Edwards, Gareth. (2015). *An urban politics of climate change: Experimentation and the governing of socio-technical transitions*. London: Routledge.
- Caprotti, Federico. (2015). *Eco-Cities and the transition to low carbon economies*. London: Palgrave Macmillan.
- Castán Broto, Vanesa., & Bulkeley, Harriet. (2013). A survey of urban climate change experiments in 100 cities. *Global Environmental Change*, 23(1), 92–102.
- Castán, Broto V. (2012). Social housing and low carbon transitions in Ljubljana, Slovenia. *Environmental Innovation and Societal Transitions*, 2, 82–97. March 2012.
- Coenen, Lars, & Truffer, Bernhard. (2012). Places and spaces of sustainability transitions: Geographical contributions to an emerging research and policy field. *European Planning Studies*, 20(3), 367–374.
- Coutard, Olivier, & Rutherford, Jonathan. (2010). Energy transition and city–region planning: Understanding the spatial politics of systemic change. *Technology Analysis & Strategic Management*, 22(6), 711–727.
- Cowley, Robert. (2015). In defence of top-down sustainability planning: The case of Sejong City. In J. Condie & A. M. Cooper (editors), *Dialogues of sustainable urbanisation: Social science research and transitions to urban contexts* (pp. 36–40). Penrith: University of Western Sydney.
- Davis, Mike. (1998). *Ecology of fear: Los Angeles and the imagination of disaster*. London: Picador.
- De Jong, Martin, Joss, Simon, Schraven, Daan, Zhan, Changjie, & Weijnen, Margot. (2015). Sustainable–smart–resilient–low carbon–eco–knowledge cities: Making sense of a multitude of concepts promoting sustainable urbanization. *Journal of Cleaner Production*, 109, 25–38. December 2015.
- Deas, Iain, Robson, Brian, & Bradford, Michael. (2000). Re-thinking the Urban Development Corporation “experiment”: The case of Central Manchester, Leeds and Bristol. *Progress in Planning*, 54(1), 1–72.
- Evans, James, & Karvonen, Andrew. (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), 413–430.
- Evans, James, Karvonen, Andrew, & Raven, Rob. (2016). The experimental city: New modes and prospects of urban transformation. In J. Evans, A. Karvonen, & R. Raven (Eds.), *The experimental city* (pp. 1–12). London: Routledge.
- Evans, James P. (2011). Resilience, ecology and adaptation in the experimental city. *Transactions of the Institute of British Geographers*, 36(2), 223–237.
- Evans, Joshua. (2016). Trials and tribulations: Conceptualizing the city through/as urban experimentation. *Geography Compass*, 10(10), 429–443.
- Farrelly, Megan, & Brown, Rebekah. (2011). Rethinking urban water management: Experimentation as a way forward? *Global Environmental Change*, 21(2), 721–732.
- Fontanari, Elena. (2015). Confined to the threshold. *City*, 19(5), 714–726.
- Geels, Frank W. (2005). *Technological transitions and system innovations: A co-evolutionary and socio-technical analysis*. Cheltenham: Edward Elgar Publishing.
- Geels, Frank W. (2010). Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Research Policy*, 39(4), 495–510.
- Grin, John, Rotmans, Jan, & Schot, Johan. (2010). *Transitions to sustainable development: New directions in the study of long term transformative change*. London: Routledge.
- Hajer, Maarten. (2016). Foreword. In J. Evans, A. Karvonen, & R. Raven (Eds.), *The experimental city* (pp. xvii–xix). London: Routledge.
- Hinchliffe, Steve, Kearnes, Matthew. B, Degen, Monica, & Whatmore, Sarah. (2005). Urban wild things: A cosmopolitical experiment. *Environment and Planning D: Society and Space*, 23(5), 643–658.

- Howard, Ebenezer. (2010). *To-morrow: A peaceful path to real reform*. Cambridge: Cambridge University Press.
- Joss, Simon. (2015). *Sustainable cities: Governing for urban innovation*. London: Palgrave Macmillan.
- Kargon, Robert H., & Molella, Arthur P. (2008). *Invented edens: Techno-cities of the Twentieth Century*. Boston, MA: MIT Press.
- Katsioloudes, Marios. (1996). Socio-technical analysis: A normative model for participatory planning. *Human Systems Management*, 15(4), 235–243.
- Kullman, Kim. (2013). Geographies of experiment/experimental geographies: A rough guide. *Geography Compass*, 7(12), 879–894.
- Lawhon, Mary, & Murphy, James T. (2012). Socio-technical regimes and sustainability transitions: Insights from political ecology. *Progress in Human Geography*, 36(3), 354–378.
- Longhurst, Noel A. (2012). The Totnes Pound: A grassroots technological niche. In A. Davies (Ed.), *Enterprising communities* (pp. 163–183). Bingley: Emerald.
- Lorimer, Jamie, & Driessen, Clemens. (2014). Wild experiments at the Oostvaardersplassen: Rethinking environmentalism in the Anthropocene. *Transactions of the Institute of British Geographers*, 39(2), 169–181.
- McLean, Anthony, Bulkeley, Harriet, & Crang, Mike. (2016). Negotiating the urban smart grid: Socio-technical experimentation in the city of Austin. *Urban Studies*, 53(15), 3243–3263.
- Newell, Peter, & Mulvaney, Dustin. (2013). The political economy of the “just transition”. *The Geographical Journal*, 179(2), 132–140.
- Pasquetti, Silvia. (2015). Negotiating control. *City*, 19(5), 702–713.
- Picker, Giovanni, & Pasquetti, Silvia. (2015). Durable camps: The state, the urban, the everyday. *City*, 19(5), 681–688.
- Raven, Rob, Schot, Johan, & Berkhout, Frans. (2012). Space and scale in socio-technical transitions. *Environmental Innovation and Societal Transitions*, 4, 63–78. September 2012.
- Scrase, Ivan, & Smith, Adrian. (2009). The (non-)politics of managing low carbon socio-technical transitions. *Environmental Politics*, 18(5), 707–726.
- Shove, Elizabeth, & Walker, Gordon. (2007). CAUTION! Transitions ahead: Politics, practice, and sustainable transition management. *Environment and Planning A*, 39(4), 763–770.
- Smith, Adrian, Voß, Jan-Peter, & Grin, John. (2010). Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. *Research Policy*, 39(4), 435–448.
- Swyngedouw, Erik. (1996). The city as a hybrid: On nature, society and cyborg urbanization. *Capitalism Nature Socialism*, 7(2), 65–80.
- Swyngedouw, Erik. (2010). Apocalypse Forever? Post-political Populism and the spectre of climate change. *Theory, Culture & Society*, 27(2–3), 213–232.
- Swyngedouw, Erik. (2013). Apocalypse Now! Fear and doomsday pleasures. *Capitalism Nature Socialism*, 24(1), 9–18.
- Silver, Jonathan (2014). Incremental infrastructures: Material improvisation and social collaboration across post-colonial Accra. *Urban Geography*, 35(6), 788–804.
- UN. (2015). *Goal 11: Make cities inclusive, safe, resilient and sustainable*. United Nations. Retrieved from <http://www.un.org/sustainabledevelopment/cities/>
- Urb@exp. (2015). *Towards new forms of urban governance and city development*. Urb@exp: Learning from Urban Experiments. Retrieved from <http://www.urbanexp.eu>
- Walker, Guy. H., Stanton, Neville. A., Salmon, Paul M., & Jenkins, Daniel P. (2008). A review of sociotechnical systems theory: A classic concept for new command and control paradigms. *Theoretical Issues in Ergonomics Science*, 9(6), 479–499.