The experimental city: new modes and prospects of urban transformation
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> The world hates change yet it is the only thing that has brought progress.
>
> Charles Kettering

The promise of experimentation

As the global population becomes increasingly urbanised, cities have emerged as the dominant arenas to address the grand challenges facing humanity. Problems associated with climate change, economic under-development, and social inequality are essentially urban in character. And so are their solutions. The burgeoning realisation that 'business as usual' will no longer do has prompted a search for alternative ways to organise, plan, manage, and live in cities. Experimentation promises a way to do this, gaining traction in cities all over the world as a mode of governance to stimulate alternatives and steer change (Bulkeley and Castán Broto 2012). Policymakers, designers, private companies, and third sector organizations are initiating innovation activities to trial alternative future visions of local economic development, social cohesion, environmental protection, creative sector expansion, policy evolution, service delivery, infrastructure provision, academic research, and more (Karvonen et al. 2014). This book's primary goal is to make sense of urban experimentation as a rapidly emerging field of practice and theory by bringing different approaches and cases into dialogue with one another. To set the scene for this task, this introductory chapter surveys the key themes that animate urban experimentation as a field of study before introducing the contributions that comprise the volume.

The concept of experimentation feeds on attractive notions of innovation and creativity (both individual and collective) while reframing the emphasis of sustainability from distant targets and government policies to concrete and achievable actions that can be undertaken by a wide variety of urban stakeholders in specific places (Karvonen and van Heur 2014). The ability of urban experiments to be radical in ambition while limited in scope underpins a vibrant debate in both the policy and academic worlds with respect to their ability to prompt genuine change. Are they simply extensions of business as usual, spatially limited and captured by a familiar cast of dominant interests? Or can they generate real alternatives and stimulate profound transformation? The profusion of major international research projects currently addressing this very question suggests that there is no simple answer (see Castán Broto and Bulkeley 2013, McGuirk et al. 2014, Wieczorek et al. 2015). A primary aim of this volume is to contribute to this rich debate.

Discussing urban experimentation with experienced planners often draws the response that they have always pursued innovative projects. But while an ethos of experimentation has arguably animated the urban project from classical antiquity onwards, urban experiments are currently being deployed in a more widespread and explicitly recognised fashion than at any other time (Evans 2011). The Mayor of Bogatá, Enrique Peñalosa, is famous for transforming the city from one of the most dangerous and unpleasant places to live into a global leader in sustainable urbanism by the end of the 1990s. What he calls the 'Bogatá experiment' started with a far smaller one, the *dia sin carro* or day without cars,

which catalysed the global 'Happy City' movement (Montgomery 2013). This is just one of a multitude of urban movements that share a commitment to changing the way in which we build, manage and live in cities through explicitly staging experiments. Smart cities, eco cities, low carbon urbanism, urban living labs, happy cities and sustainable urban development all draw on the idea that experimentation can generate more liveable, prosperous, and sustainable urban futures (de Jong et al 2015). Experimentation forms a common thread running through otherwise disparate contemporary urban trends, from corporatized attempts to create smart, low-carbon cities to grass-roots civic movements to make neighbourhoods more socially cohesive. It is for this reason that urban experimentation has assumed such rapid prominence across a broad range of urban practice and academic thought.

While assuming many forms, urban experimentation can be distinguished conceptually from conventional urban development or policy by an explicit emphasis on learning from real world interventions. Urban experimentation offers a framework within which to arrange instruments, materials and people to induce change in a controlled manner, and subsequently evaluate and learn from those changes (Karvonen and van Heur 2014). The institutionalization of experimentation sets contemporary activities apart from more broadly experimental approaches to urbanism practiced in previous decades and, indeed, as Gross suggests (2010: 66) 'anything that is subject to change'. This ethos of experimentation resonates with the broader emergence of reflexive governance and the importance of learning within and between networks of urban actors (McFarlane 2011a, 2011b). Current attempts in cities to learn through place-based experimentation reflect Beck's (1995: 15) model of reflexive modernity, characterised by the reconciliation of 'the science of data and the science of experience'. Research inspired by the laboratory studies tradition and socio-technical studies has revealed how experiments spread by supplying both tangible evidence of impacts and outcomes and experiential evidence through the demonstration of urban alternatives in real life settings (Marres 2009). Experimenting in cities promises scientifically rigorous knowledge that both reflects and is shaped by the context of lived experience and which as a result can be applied more quickly and successfully (Evans and Karvonen 2011). Various manifestations of the experimental mode of governance like living labs, maker spaces, and hackathons hold the potential to reconnect the traditional political institutions of modernity, characterised by Beck as 'zombie' institutions that are dead but still alive (Boyne 2001), with everyday life.

The promise of learning, and by extension innovation, lends experiments considerable rhetorical power. As experimental activities reinterpret and reframe the trajectories of contemporary urban development, different frameworks are being developed to understand these processes. In their survey of Australian cities McGuirk et al. (2014) distinguish between institutional and practical experiments, with the former entailing experiments in arrangements within and between institutions to produce new ways of governing and the latter involving novel practical actions. Focusing on the transformative capacity of experiments, Smith and Raven (2012) distinguish between 'fit-and-conform' and 'stretch-and-transform' modes of change, which refer to experiments that take place within dominant institutional contexts versus those that transform their contexts. Practical experiments can prompt broader institutional change, and for many this represents the *sine qua non* of urban experimentation as a worthy pursuit. For others, urban experiments open up spaces for new kinds of governance and action in the city, giving centre stage to social interests that are downplayed under dominant governance arrangements but which over time may coalesce into coherent pathways to wider transformation (Bulkeley et al. 2015).

A key question emerging from the literature concerns the politics of experimentation, or more specifically who is allowed to take part at both the institutional and practical levels. For example, the smart city discourse as articulated in Europe and Asia has hitherto focused on trialling technological

'solutions' in real cities, privileging multinational corporations as urban actors (Vanolo 2013, Viitanen and Kingston 2014). In contrast, the Transition Towns movement positions local communities as the designers and instigators of urban experiments (Smith 2011, Seyfang and Haxeltine 2013, Aiken 2014, Feola and Nunes 2014). In reframing urban development experimentation shifts the balance of power between actors, empowering some while disempowering others, and privileging new forms of knowledge and evidence in the process (Karvonen et al. 2014). In some cases, the availability of information about the performance of experiments invites a data-driven approach to urban governance. In others, it militates towards a design-led approach to urban development, as cities and parts of them become positioned as urban living labs, serving as laboratories for radical change in which users are involved in the co-design of solutions to pressing urban problems (Nevens et al. 2013, Voytenko et al. 2015). Much like the localism trap in development studies, which assumes that initiatives at the local level are somehow fairer, there is a tendency to assume that urban experimentation is an *a priori* beneficial endeavour. In their recent review, Luque-Ayala and Marvin (2015) highlight the need for smart urbanism to be more experimental, but Masdar City, perhaps the most high profile example of a smart eco city, positions itself explicitly as an experimental city, albeit a highly technocentric and corporatist one (Shelton et al. 2015). Experiments, understandings of experiments, and the attendant future visions they entail, are not inherently positive but carry politics just like any other urban development strategy.

An important political dimension of urban experimentation concerns how success is defined and measured. The quote at the start of this chapter is from Charles Kettering (1876-1958), an American inventor who led the research division of General Motors for 27 years. He patented the electric starter amongst numerous electric and lighting systems for cars, paving the way for the huge success of General Motors in establishing the automobile as a primary focus of urban planning in the second half of the Twentieth Century. The unintended consequences of this success – pollution, congestion, poor health and the destruction of communities – are both well known and a central focus of cities that are striving to realise more sustainable urban futures. Strictly speaking, this example concerns innovation rather than experimentation, but the point holds in relation to how the evaluation of experiments can vary significantly depending on what outcomes are seen to constitute success. The definition of success and its evaluation often reflects the political goals and approaches of the specific actors involved, including researchers themselves (Voytenko et al. 2015). For example, transition scholars tend to highlight success when experimentation produces more environmentally friendly development pathways, while urban scholars highlight success when experiments are more socially and democratically robust. Caution is required here. Many different definitions of experimentation are at play, and the way in which experiments are designed, mobilised, and evaluated differs hugely.

Considering the political aspects of urban experimentation leads inexorably to the question of how an experiment or set of experiments drives wider transformation, including whose interests are mobilised in the process. This is a key topic of concern motivating this volume and many of the theoretical frameworks presented are essentially attempts to conceptualise this process. In relation to the low carbon agenda, numerous successful experiments have been established in cities over the last 20 years, leading funding bodies, policy makers, charities, companies, and communities to a shared contemporary focus on how to translate discrete experiments into broader change. Part of the allure of experimentation is based on the assumption that it is possible to scale up from an individual project to the city through a process of trialling, learning, and rolling out (Brown and Vergracht 2008, Evans 2011) but the complexity of achieving broader transformations is often hidden behind a lexicon of verbs such as upscaling, replicating, seeding, rolling out, and breaking through. These words imply quite different understandings of how change unfolds over space and time while blackboxing the social and political agency through which it takes place. While a revolution is enacted by revolutionaries, experiments, transformations and transitions have no obvious corresponding terms,

despite the fact that they imply a power dynamic whereby certain (more powerful) groups are experimenting on other (less powerful) groups with the purpose of transforming or transitioning them.

Focusing on experiments directs attention to the specific social and material contexts in which urban change is embedded and through which it literally 'takes place'. Understanding experiments as sites through which 'particular urban infrastructure regimes…are configured and challenged' (Bulkeley et al. 2014: 1477) resonates with current understandings that emphasise the relational and provisional aspects through which the city is comprised (Graham and McFarlane 2015). Urban Political Ecology with its emphasis on flows of power and materials, socio-technical studies with its emphasis on the co-evolution of technology and society, and critical infrastructure studies focus on the ways in which urban institutions, techniques, and artefacts are 'established, maintained and challenged' (Monstadt 2009: 14). The process of urban experimentation unfolds over time and space through reworking the relationships between social and material networks in the context of existing economic, social, and political trajectories.

The body of work that has emerged around the idea of transitions presents an increasingly influential way to think about this relationship. Since its inception in the early 1990s, a bourgeoning literature on socio-technical sustainability transitions has drawn attention to how experimental approaches to innovation drive socio-technical change in the context of prevailing institutional, material, and social structures (Markard et al. 2012). Drawing on evolutionary theories and socio-technical studies in particular, this literature is primarily concerned with understanding the emergence of new socio-technical systems and their interplay with system-level dynamics of incumbent ones. This literature highlights how incumbent socio-technical systems (or 'socio-technical regimes') are stabilized through the rigorous alignment of routines, institutions, infrastructures, and networks that constitute the provision of societal needs such as energy, mobility, and food. These regimes developed out of earlier responses to societal challenges and economic opportunities in the twentieth century, but now pose structural challenges to innovation responses to contemporary challenges such as climate change, global resource depletion, rapid urbanization, and global economic restructuring. In evolutionary terms, regimes form disadvantageous selection environments for path-breaking innovations seeking to transform the very core of how we produce and consume goods and services. Successful experimentation as such entails not just short-term successes in experimental projects but more so their critical influence in transforming wider regime structures (Smith and Raven 2012).

Real life experimentation with path breaking innovations outside of laboratory spaces is a way to trancend this structural impasse (Kemp et al. 1998). It ideally enables reflexive and multi-dimensional learning processes across a range of issues such as infrastructures, policy paradigms, cultural norms, ways of organizing markets, and consumer behavior. As such, experimentation entails the negotiation of multiple expectations of possible and desirable futures (Berkhout 2006), and the re-making of social relations across chains of actors involved in or influenced by transitions in socio-technical regimes. The urban forms a relatively new context for socio-technical transitions research (Hodson and Marvin, 2010; Frantzeskaki et al. 2016), which historically drew national and sectoral boundaries around transitions in socio-technical systems (Raven et al. 2012). A key question is how urban and sectoral structures are entangled and form multi-scalar contexts for urban experimentation, including the role of power relations enacted through these (Murphy 2015, Truffer et al. 2015). To summarise, urban experiments provide a unique point of intersection between practice and theory. They increasingly shape the activities of cities trying to transform themselves as well as occupying the efforts of scholars from across a range of traditions to understand this process. By focusing on urban experimentation as a unit of study, this volume advances conceptual and practical understandings of the topic to identify common concerns, challenges, and questions.

Contributions in this volume

The following chapters are contributions from leading scholars across the key disciplines currently at the cutting edge of the research field. They have a shared interest in understanding how experimentation is being conceived, implemented, and assessed in a wide range of settings. The questions of how urban experiments happen, who is involved, and what their wider impacts are motivate this volume. The book is organised into three sections: logics of urban experimentation, experimenting in cities, and experimental cities. The insights and examples that populate these three sections provide a framework to examine the phenomenon of urban experimentation in conceptual and empirical detail.

The first section, logics of urban experimentation, explores different theoretical and conceptual approaches to urban experimentation. It investigates the origins and undercurrents of urban thinking that resonate with and nourish current debates about urban experimentation. Section two, experimenting in cities, presents a set of chapters that analyse how experiments are being staged within cities, focusing on who does the experimenting, on who or what, how and with what effects. This section reflects the wide variety of urban experiments that are currently in play, varying from buildings to neighbourhoods, and from highly formalised state-led experiments to informal attempts to remake the urban fabric. Section three, experimental cities, asks how entire cities or groups of cities are constructed and conceived as experiments and what can be learnt from understanding how experimentation plays out at the city level. By definition, this final section focuses on more iconoclastic examples of ambitious attempts to prompt rapid urban innovation through extreme forms of experimentation. As a note of clarification, the distinction between the terms urban experimentation and experimental cities is one of scale rather than process, reflecting a desire to explore both the content and context of urban experimentation. To re-phrase the relationship between urbanisation and the city preferred by urban studies, urban experimentation can be viewed as the process that ultimately generates the experimental city as its outcome.

Section One: Logics of Experimentation

The first section includes six chapters that examine different logics and theorisations of experimentation. The first chapter by Frans Sengers and colleagues reviews the notion of experimentation as discussed in the 'sustainability transitions' literature. The chapter develops a typology of experimentation distinguishing between niche experiments, social experiments, transition experiments, grassroots experiments, and sustainability experiments, and proposes an encompassing definition of experimentation. Tim May and Beth Perry critically examine how global dynamics, in particular those related to neo-liberal capitalism and the knowledge economy, are framing the conditions within which experimentation takes place. They discuss the possible dangers of such a framing, in which neo-liberal practices do not positively benefit city populations but rather risk accelerating the inequalities produced by business-as-usual approaches. They propose an alternative framing around the notion of grassroots experimentalism. Simon Marvin and Jonathan Silver draw an on extensive survey of over 70 urban laboratories to develop a typology of multiple styles of experimentation. The typology captures the huge variety in terms of the focus, setting, logics, activities, and temporal orientation of experimentation in urban laboratories. Reflecting on the results, they argue for more comparative research to better capture the political roles and social organisation of urban laboratories.

In their chapter, Chris Ryan and colleagues report on recent attempts to engage in experimentation from a visual design perspective. They build upon collective envisioning and participatory methods promoted in transition management approaches and combine these with recent design techniques. The resulting process is organised around debating 'glimpses of possible futures' in interactive

workshop settings. Although it is too early to make any definitive conclusions about how this process contributes to actual transformations on the ground, the preliminary results illustrate that visual design experimentation enables a necessary cognitive break from the status quo. Elizabeth Rapoport looks at the recent history of 'sustainable urban projects' – large scale efforts to create a new district or area of a city with explicit attempts to integrate sustainable design criteria. She highlights how branding and marketing, and in particular voluntary rating and certification schemes, are the most common reason to incorporate sustainability in these projects. She also argues that radical innovation is unlikely in a constrained space of urban development due to risk aversion amongst the rather narrow group of sustainable property developers involved. Simon Marvin and Mike Hodson end this section with a chapter on 'cabin ecologies' – enclosed life support systems. They trace the intriguing history of the development and deployment of integrated urban infrastructures from its origins in space and military programs, and reflect on the path dependencies and implications of these developments for more recent attempts such as ecological urbanism and urban control rooms.

Section Two: Experimenting in Cities
The second section provides different interpretations of how experiments are situated in particular material and institutional contexts. Martin Sanzana Calvet and Vanesa Castán Broto explore the emergence of green enclaves in peri-urban areas of Santiago, Chile through state- and market-led experiments. By applying ideas from Urban Political Ecology, they argue that green enclaves reveal the contradictory character of experiments as simultaneously emancipatory while reproducing and facilitating the existing neoliberal political agenda. Their chapter highlights the connections between greening and social power that have significant political implications for urban experiments. Duke Ghosh and colleagues focus on mobility experiments in India and Thailand using ideas from socio-technical transitions theory. They follow the actors in four case studies to reveal the various navigational strategies employed to realise systemic change in incumbent and obdurate transportation networks. Their analysis provides a comparative framework for understanding how context influences strategies of innovation and vice versa.

Gareth Powells and Lynsay Blake explore experimentation in a very different way in Newcastle-upon-Tyne in Northeast England, they focus on the dynamics of an urban science network comprised of actors from the private, public, and third sectors and highlight the increasing role of universities in local partnerships in generating new knowledge about sustainable urban development. The particular forms of experimentation that emerge are negotiated and shared amongst the various partners in an attempt to align their agendas. Jana Wendler argues that experiments are not always intentionally designed but can emerge organically over time. Her study of a community garden in Berlin demonstrates how everyday activities can produce an arena of learning and improvisation that is distinct from more formalised experimental activities. These grassroots modes of innovation provide opportunities for more creative and open-ended forms of experimentation and suggest a latent potential in social movements to influence urban trajectories. Finally, Gabriele Schliwa and Kes McCormick focus on the increasing use of living laboratories in European cities to address sustainability challenges, providing a comprehensive review of the literature in this field. Drawing on case studies they identify a clear distinction between living labs that are user-centric and those that are citizen-centric, associating the latter with a focus on social learning and a greater capacity to prompt lasting transformation.

Section Three: Experimental Cities
The third section comprises five chapters that explore how entire cities or groups of cities are constructed and conceived as experiments, and the attendant effects. Sofia Shwayri contrasts two case studies that reveal the diversity of experimentation characterising current urban planning in Seoul, as well as how the city has learnt from other experiments. The chapter situates both accounts within the

wider trajectory of Korean development and hints at a specifically Korean approach to urban experimentation based on the 'bali bali' philosophy. Federico Cugurullo uses Masdar City, a well-known experimental eco-city project under development in the United Arab Emirates, to demonstrate the fragmentary character of urban experiments. Masdar City is understood as an urban experiment composed of multiple sub-experiments such as smart grid installations, large-scale pedestrian spaces, fusions of vernacular and modern architectural styles, and automated transport systems. The number of actors involved, divergent understandings of sustainability and fragmented projects ultimately prevents Masdar City from achieving its vision of the sustainable city, revealing fundamental tensions between urban experimentation and sustainability.

Thomas Yarrow offers a compelling post-mortem of a past urban experiment, focusing on a mid-century failed experiment in urban living in Ghana. Informed by the tenets of modernist planning, the Volta Resettlement Project offers insights into the challenges of experimenting on the city scale. The chapter explores the relationships between social experiments, forms of expertise, and the emergence of a specifically urban mode of development. Yarrow also discusses how the promised futures of experiments are reconceived after their failure, arguing that far from revelling in its subversion the resultant urban ruins prompt fidelity to the original vision. In the penultimate chapter, James Evans and colleagues explore two cases that have explicitly positioned themselves as experimental cities: Arcosanti, founded in the 1960s in Arizona, and Masdar City, a current day attempt to discover the blueprint for sustainable urbanism in the Middle Eastern desert. The authors reflect on the relation between the design and reality of these experimental cities, showing how contrasting efforts have run up against similar obstacles in practice and argue that urban experiments need to take place within a functioning political community if they are to achieve broader impacts. In the final chapter, Stephanie Pincetl considers what a post-carbon city might look like at street level, discussing the broader legal and regulatory challenges that hinder the widespread transformation of urban areas. This forthright think-piece poses some of the bigger, 'harder to answer' types of questions that lurk behind contemporary discussions of urban experiments and sustainability. The chapter broadens the purview of the book, situating the experimental endeavour within the context of deeper urban transformation and what might have to happen to enable fundamental change.

Towards experimental urbanism?
Urban experiments intrigue because they constitute explicit attempts to stage and learn about different possible futures in the real world; their actuality matters in producing a different kind of city. They offer novel modes of engagement, governance, and politics that both challenge and complement conventional strategies in important ways. Taken as a whole, the chapters demonstrate the broad set of impacts that experimentation is having on cities and processes of urban development. They show how experimentation is increasingly informing urban practices, reshaping understandings of the city, and the related practices of knowledge production that sustain it across a wide variety of sectors, including carbon governance, energy services, technological innovation, transportation networks, economic growth, and social organization. The incorporation of urban experiments into the mainstream of urban planning and thought is producing a nascent, stabilised set of precepts that could be termed 'experimental urbanisation.' This entails a dynamic yet highly political mode of governance that is continually experiencing change as the result of targeted interventions. The contributions to this volume indicate a growing effort to situate urban experimentation as a mode of governance within broader understandings of the material and political production and reproduction of cities and parts of cities (Merrifield 2014, Brenner and Schmid 2015, Walker 2015). The maturation of this field of study is characterised by a deeper engagement with and dialogue between the theoretical canons of urban studies and socio-technical transition studies to flesh out the dimensions of a specifically experimental mode of urbanisation.

The contributions in this volume reveal how the current round of urban experimentation differs from previous incarnations, representing a specific kind of governance 'fix' for a broadly neoliberal system that is struggling to move towards more sustainable forms of urban development. As a distinct mode of urban governance, the challenge of experimentation is to bring people and infrastructures together in ways that are capable of realizing significantly different and more sustainable urban futures in socially just and democratic ways (Evans and Karvonen 2014). A key question animating the research represented in this volume involves whether the experimental mode constitutes a subversive or reinforcing element of contemporary urbanisation. Many of the contributors highlight the implicit assumptions that experimental urbanism carries about what a city is and who should be involved in creating and managing it. The tendency for experimental approaches to be captured by dominant interests and produce socially and politically fragmented cities are clear, and provide a corrective to the sometimes overly exuberant and uncritical celebration of urban experimentation among academics and policymakers. Clearly, urban experimentation is neither entirely subversive nor entirely reinforcing of the status quo, but includes activities that are one or the other and sometimes both. There is a clear need here to understand how different modes of experimentation co-exist and interrelate at larger urban and regional scales.

Related to this the contributions indicate that the current research agenda in this field is increasingly focusing on how to embed experimentation into cities in the long term and in more meaningful ways, paying attention both to the micro-scale social and political practices, impacts, and implications of experimentation as well as to the larger scale networks and policies that sustain them. These concerns resonate with those of practitioners and policy-makers, who are increasingly focused on moving past isolated experiments to consider how more durable and varied modes of experimentation can stimulate broader urban transformation. Understanding the durability and multiplicity of experiments within their broader urban context is a necessary first step towards recuperating experimental urbanism as a progressive driver of change. It is hard to imagine a more important research agenda to address the challenges facing humanity in the early twenty-first century.

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