



## From temporary arrangements to permanent change: Assessing the transitional capacity of city street experiments

Katherine VanHoose<sup>a,\*</sup>, Ana Rivas de Gante<sup>b</sup>, Luca Bertolini<sup>c</sup>, Julia Kinigadner<sup>b</sup>, Benjamin Büttner<sup>b</sup>

<sup>a</sup> University of Amsterdam, Roetersstraat 11, Amsterdam 1018 WB, the Netherlands

<sup>b</sup> Technical University Munich, Germany

<sup>c</sup> University of Amsterdam, the Netherlands

### ARTICLE INFO

#### Keywords:

City streets  
Transition experiments  
Urban mobility  
Urban public space

### ABSTRACT

In response to acute urban mobility and livability challenges, city street experiments have emerged as a way to explore possible solutions for alternative futures. While the added value of these experiments to improve urban living conditions is widely acknowledged, their potential to stimulate larger system change remains unknown. This paper uses the defining characteristics of transition experiments and a multi-level perspective of transitions in order to assess the transitional capacity of city street experiments. We devise an assessment framework to systematically assess six case studies in Amsterdam and Munich, revealing emerging patterns of experimentation within urban mobility systems.

### Introduction

The transition to more sustainable and livable cities is a formidable one: an entire urban mobility system, including user behavior, government policies and market strategies, organizational frameworks, institutional arrangements, and existing infrastructure, must be overhauled (Berger et al., 2014). City street experiments offer a low-cost, low-risk way to explore potential routes towards increased sustainability and livability. As “intentional and temporary changes to the street use, regulation and or form, featuring a shift from motorized to non-motorized dominance and aimed at exploring systemic change in urban mobility and public life” (Bertolini, 2020), these practices offer a glimpse of “radically different arrangement of the urban mobility system” (Bertolini, 2020, p. 736) that look “beyond... mobility itself to reconceive streets as public places for social interaction and conviviality” (Prytherch, 2021). While city street experiments are not new - well-known examples like the Ciclovía in Bogotá, Columbia date back to the 1970's (Montero, 2017) and the first Parking Day took place in 2005 (Parking Day, 2021) - they have increased popularity over the last years in response to acute sustainability challenges (Bertolini, 2020).

Examples of these experiments include subtle modifications, like the remarking of street intersections to more radical projects, such as the closure of entire streets to traffic for pedestrian activities. With help from the recent coronavirus pandemic (Combs, 2020; Glaser & Krizek, 2021; Transport for London, 2021), current measures ranging

from ‘Parklets’ or the temporary conversion of parking spaces, to the temporary closure of entire streets to motorized traffic are the product of government-led efforts to take back the streets for leisure, socializing and playing (Iveson, 2013). By temporarily altering the streetscape, street experiments allow city makers to meet current spatial and social demands. At the same time, they offer the opportunity to test potential solutions to long-term challenges such as air pollution, noise, traffic-related accidents and road congestion. In particular, city street experiments have resulted in a number of benefits including increased social cohesion (Zieff, Chaudhuri & Musselman, 2016) and economic activity (Littke, 2016) feelings of safety and well-being (Meyer, Bridges, Schmid, Hecht & Porter, 2019) and physical activity (D’Haese et al., 2015). These added values represent possible change pathways to be learnt from and extrapolated to a wider scale or the long-term, a potential of city street experiments that is, however, often undervalued and underused (Bertolini, 2020).

Experimentation has been lauded as a useful tool in urban planning (Savini & Bertolini, 2019), especially in the context of the sustainability transition (Moloney & Horne, 2015; Evans et al., 2021). Still, the experimentation with city streets remains in its infancy, in both practice and research. Only a handful of studies have been conducted regarding their impacts (Bertolini, 2020; Meyer et al., 2019) and a critical reflection on their transitional capacity has yet to be made. This may be due in part to the common positioning of city street experiments as ‘one-off, fun events’ (Hipp, Bird, van Bakergem & Yarnall, 2017) and a failure to rec-

\* Corresponding author.

E-mail address: [k.a.vanhooose@uva.nl](mailto:k.a.vanhooose@uva.nl) (K. VanHoose).

ognize their long-term potential. How, then, can city street experiments create, build upon and exert their transitional capacity within the urban mobility system?

To answer this question, this paper explores the possible ‘ingredients’ needed to foster purposeful street experimentation within the context of a sustainable urban mobility transition. Our aim is two-fold. First, by introducing and immediately employing an assessment framework for the transitional capacity of city street experiments, we take the initial and, in our opinion, much-needed step towards conceptualizing the relationship between such initiatives and system change. Second, we identify emerging patterns to be pursued by future research, as well as initial lessons for practitioners of city street experiments.

The paper is structured as follows. We begin with a theoretical overview of transition studies, the backbone of our assessment framework, positioning city street experiments within this body of literature. Next, we present our assessment framework and research methodology, including our case selection strategy, and data collection methods. We then describe six case studies in Amsterdam and Munich, followed by a discussion of the results from the assessment framework and a reflection on this method of research. In the conclusions we highlight possible implications of these results for research and practice.

### Framing a transition within the urban mobility system: the multi-level perspective (MLP)

The field of transition studies specifically looks at the role of socio-technological innovations in the transition towards more sustainable practices with an emphasis on experimentation and learning. Much of the literature regarding ‘systems in transition’ employ Rip and Kemp’s (1998) ‘multilevel’ model of innovation, which distinguishes between the macrolevel of the ‘sociotechnical landscape’, the meso level ‘regime’, and the micro level ‘niche’ (Geels, 2005; Späth & Rohracher, 2012). The MLP has been utilized often in framing transitions within urban mobility (Geels, 2012; Grin, Rotmans, Schot, Geels & Loorbach, 2010; Switzer, Bertolini & Grin, 2013), and more recently applied as a framework for understanding the transitional capacity of city street experiments (see Bertolini, 2020 and Glaser and Krizek 2021). Generally speaking, changes at the landscape level put pressure on the regime, creating windows of opportunity for niches to emerge and develop.

According to Geels (2005): “Whether or not transitions take place depends partly on strategic maneuvering, the building of coalitions and power, and partly on wider developments at regime and landscape level that create or close windows of opportunity (p. 469).” Strategic maneuvering occurs at the niche level and is the result of individual agency from local actors, including users, policy makers, and civil society groups (Switzer et al., 2013). Related to this, individuals aggregate and build coalitions, leading to more resources meaning a higher degree of momentum for niches (Geels, 2012). This all occurs against the backdrop of developments at the regime and landscape levels, where external factors have just as much of an effect on the capability of such experiments to ‘break-through’ (Savini & Bertolini, 2019).

Literature regarding sustainable transition within urban mobility points to the factors that can determine change. A sustainable transition involves co-evolutionary developments between industry, markets, user behavior, policy, infrastructure and spatial arrangements (Geels et al., 2017; Moradi & Vagnoni, 2018). Based on this theory, we outline four ‘dimensions of system change’ across which developments within urban mobility system can be measured: behavioral, institutional, material, and organizational.

The first dimension, *behavioral*, is defined as ‘a shift in individual use and behavior’. It refers to changing the behavioral patterns of individual users, whose lifestyles are inextricably linked to mobility (Bertolini, 2012). Without access to basic services, taking part in modern-day social and economic life is not possible, and mobility is essential to access many of them. Such users however have limited incentives to address

sustainability transitions (Geels, 2011, Berger et al., 2014), making the altering of their behavior difficult. This is partly due to the magnitude of the transition and the fact that developments at the landscape level (where many of the mobility needs arise) cannot be directly influenced by individuals. Mobility choices vary per user and are the result of cost benefit assessments related to a combination of socio-demographic, economic and cultural conditions, habit, as well as the attractiveness of locations or transport options (Switzer et al., 2013). “This has important sociological implications, since there is no general ‘social mobility movement’ but various conflicting issues which take precedence depending on who is demanding the change (Vasconcellos, 2018).” While a change in the mobility pattern of one single actor does not mean system change, larger shifts are possible as a result of “aggregated” individual actions at multiple loci (Geels, 2013).

The second dimension, *institutional*, is defined here as ‘alterations to city-wide mobility and public space policies, legal and financial frameworks, cultural/social norms’. Sustainability-oriented policies in the mobility domain can adopt variegated approaches and instruments, including market-based, information-based and regulatory instruments (Holden, 2007). “To be effective, these instruments should contribute to a coherent policy framework and aim to stimulate, enable, and empower the actors along the mobility domain to engage in more sustainable production and consumption” (Berger et al., 2014, p. 311). Market-based instruments intend to spark change via taxes and subsidies. Information-based instruments are grounded in the assumption that “better informed consumers will make more socially desirable decisions” (Ibid., 2014). They aim to provide awareness so that individuals will make informed choices and ultimately change their behavior voluntarily. Regulatory instruments in the field of mobility mostly respond to health and safety concerns (e.g. speed limits, low emission zones, and lanes for bicycles and public transport), but are often linked to environmental sustainability issues and result in modifications in spatial planning like restrictions to the access of vehicles.

The third dimension of change, *material*, involves ‘a physical change in the composition of the streetscape’ including an alteration of the physical form (e.g. installment of furniture, greenery, removal of parking spaces, street layout and markings, and distribution of road space). Although a relatively underdeveloped concept within the literature on transitions (Coenen, Raven & Verbong, 2010), the role of the built environment represents an essential aspect in the transition towards increased sustainability of the urban mobility system. Existing infrastructure must be overhauled in order to make physical space for different modes of transportation and other uses. This includes an alteration of the physical form of predominantly car-oriented streetscapes with new layouts (priority to bicycles and pedestrians, space for socializing or lounging), the addition of usable objects (street furniture, bicycle sharing), greenery, and new programming. In the chapter ‘First we shape cities, then they shape us’ Gehl (2010) writes “Planning and design can be used to influence the extent and character of outdoor activities. Invitations to do something outdoors other than just walking should include protection, security, reasonable space, furniture and visual quality” (p. 21).

Transitions are multi-actor processes that involve interactions between many social groups and the creation of coalitions (Geels, 2005). This fourth dimension, *organizational*, includes ‘a shift in the network of players, organizations and/or state, market, and civic collaborations’. The transition towards greater sustainability in urban mobility is a collective effort, dependent on a network of actors as urban mobility “affects a great variety of different economic, public and social interest groups (Lindenau & Böhler-Baedeker, 2014, p. 348)”. One way forward is through collaboration between businesses, service providers, users, and the public sector. New coalitions and actor networks involving multiple actors or stakeholders lead to an increased efficiency by sharing resources. potentially leading to fewer vehicles in urban areas, less pollution, and lower prices for goods (Cleophas, Cottrill, Ehmke & Tierney, 2019).

## Framing the transitional capacity of city street experiments

Experimentation is one example of a niche development that occupies a central position within the field of sustainability transitions (Evans & Karvonen, 2016). By means of experiments, policy makers often celebrate the innovative potential of start-ups, local associations and new technologies in addressing sustainable development (Savini & Bertolini, 2019). Such experimentation often occurs in urban contexts and is seen to offer a crucial mechanism to develop transformative knowledge and catalyze social learning (Wolfram, 2016). “As precious yet-to-germinate microcosms of sustainable systems and practices, the alternative socio-technical configurations embodied in experiments are applied and tested in real-life contexts with the aim of technological, social and institutional learning (Evans et al., 2016, p. 15).”

Contrary to scientific experiments, the experiments conducted in the context of transitions are not designed to establish facts about a single causal relationship but aim to simulate a complex process of social and technological co-evolution with emergent properties (Evans & Karvonen, 2016). Evans and Karvonen (2016) offers a number of types of experiments, including sustainability experiments, grassroots experiments, ‘bounded socio-technical experiments’, and ‘transition experiments’. The latter are characteristically social and mobilizing, challenge-driven, aiming to make a step towards long-term change by way of an inclusive and participatory process between diverse participants. Because of this, and in combination with an extensive literature review, Bertolini, 2020 suggests framing of city street experiments as transition experiments, in order to understand how change within the urban mobility system can be achieved, and to center an assessment framework of their transitional potential around five defining characteristics derived from Roorda et al. (2014): their being *radical*, *challenge-driven*, *feasible*, *strategic* and *communicative*.

Bertolini, 2020 sketch of how the characteristics of transition experiments can be applied to city street experiments provides a stepping-stone for our assessment framework. City street experiments aim to provide a glimpse of a drastically different future scenario, wherein streets are for mixed uses including socializing, playing, and exercising - that is, ‘for people’ (Gehl, 2010) - rather than for traffic. When one acknowledges the novelty of this concept in light of the dominance of private automobility, city street experiments are particularly *radical* or “fundamentally different from dominant practices” (Bertolini, 2020, p. 746). By aiming to take back these ‘quintessential social public space(s)’ (Mehta, 2015) from the dominance of automobiles, city street experiments represent the testing of novel ideas for the first time in an urban context.

City street experiments can also be *challenge-driven* by “making a step toward a potentially long-term change pathway to address a societal challenge” (Bertolini, 2020, p. 747). While most current examples of street experiments seem to be focused on the event itself, they do have the potential to connect to long-term pathways towards system wide change, with which they often share aims. The popular and highly referenced Pavement to Plazas program in New York City represents street experimentation with explicit system-wide transformative side effects (Bertolini, 2020; Lydon & Garcia, 2015). This program was embedded in a city-wide strategy to structurally transform streetways into other uses, while deploying new bike-sharing programs and improved public transportation services (Sadik-Khan & Solomonow, 2017). This multifaceted quality of city street experiments and the ambition to address numerous challenges in one go (e.g. mobility, public space, social), further supports the *challenge-driven* characteristic. Moreover, experiments that model themselves after examples that (could) have achieved system-wide change, like the well-known *leefstraat* (living street) model from Belgium (Loorbach et al., 2016), the *ciclovías* of Latin America (Sarmiento, Díaz Del Castillo, Triana, Acevedo, Gonzalez, & Pratt, 2017) and the open streets of North America (see Eyler, Hipp and Lokuta 2015), can be considered challenge-driven.

The third characteristic of transition experiments is *feasible*, or “easy to be realized in the short-term and with readily available resources” (Bertolini, 2020, p. 747). Such experiments demand not only funding, but are also dependent on support from stakeholders, altered regulations of street use, and the provision of alternative transportation and parking options. A relevant aspect in this respect is the temporary condition of city street experiments. Important to note here is, however, the current literature’s lack of specificity with the designation ‘short-term’. While existing research has explored the different time-frames of experiments (see Kuhlberg, Hipp, Eyler & Chang, 2014), their preparation time has yet to be a focus of study. An important detail in regards to this characteristic is the fact that city street experiments are not simply temporary, but typically of very short duration. Some experiments last for one day, while others span the time frame of several weeks.

City street experiments can also be *strategic*, or “capable of generating lessons for reaching envisioned fundamental changes” (Bertolini, 2020). An important component to this characteristic is the monitoring and assessment of experiment effects both during and following its completion. In their review of the Pavement to Plazas experiment, Sadik-Khan and Solomonow (2017) stress that monitoring, publishing and publicly debating the effects of their experiments was an integral part of their longer-term change strategy. Because city street experiments are concerned with more than improving problems only related to traffic, but also impacts on physical activity, well-being, social capital, perceptions, and economic activity, methods for measuring these more qualitative benefits should be included, beyond a narrow mobility focus.

City street experiments can lastly be considered as *communicative*, “reaching and possibly mobilizing the broader public” (Bertolini, 2020, p. 748). Especially for those examples which target a physical redesign of public space, experiments act as a billboard for their own promotion. The collaborative nature of city street experiments furthers this mobilizing aspect, as a multitude of actors, including civic market parties, are brought into contact and connected by a shared goal. This process, similar to other forms of community activism (VanHoose & Savini, 2017), is fueled by bonding and bridging social capital and has the potential to result in an awakened or increased sense of community (Ibid.). Involving stakeholders in the decision-making process encourages them to take ownership of sustainable mobility ideas and, at the same time, provides policy-makers the opportunity to incorporate local expertise to reach the best possible outcome (Lindenau & Böhler-Baedeker, 2014). The *communicative* aspect works in two directions - experiments and their organizers can actively promote themselves by sharing information and creating awareness via social media or outreach programs, or experiments can open up, garnering media attention from the outside-in (e.g. news coverage, social media).

These five characteristics of city street experiments occur in different strengths across existing experiments and can be construed as ‘flocking’ together. For instance, *radical*, *feasible* and *communicative* go hand in hand and appear to be the strongest characteristics of current experiments (Bertolini, 2020). The *radical* nature of these experiments acts as a magnet for attention from news outlets and social media, contributing to their *communicative* capacity via a “virtual awareness” (Ibid., p. 15) and likewise, increasing their *feasibility* through the garnering of support and resources. The other two characteristics, *strategic* and *challenge-driven*, prove to be the weakest due to often “non-existing links with broader and longer-term urban policies and with social and organizational learning processes that reach beyond the event (Ibid., p.19).”

This balancing act has been suggested as a key challenge for city street experiments and their impact on system change. The very attributes that sets city street experiments apart is their temporality and informality, however, their positioning as one-off, fun events, rather than as long-term strategies (Hipp et al., 2017) has the potential to limit their range of influence. In fact, “several of the barriers, tensions and challenges identified by the literature seem to concern the weak relationship with city-wide, mainstream policy, financial, legal, and organisational

frameworks” (Bertolini, 2020, p. 744). In their analysis of open street initiatives in the United States, Hipp et al. (2017) note the limited impact of open streets in the U.S. as directly related to their low frequency. Such one-time events are unable to generate transformative processes that may influence other contexts and practices (Savini & Bertolini, 2019). Conversely, experiments that last longer and even become permanent are often more strategic and challenge-driven but likewise, tend to be less radical (Bertolini, 2020).

Knowledge regarding the specific interaction between characteristics is further limited, however it represents a crucial step in understanding the transitional capacity of city street experiments. As mentioned earlier, critical assessments of city street experiments are few and far between, with most evaluations focusing on the experiment itself with no mention of their impacts (Bertolini, 2020). In the next section we introduce an assessment framework for the transitional capacity of city street experiments, aiming to fill this knowledge gap.

### *Transitional capacity of city street experiments: an assessment framework*

Drawing from the transition literature and existing knowledge regarding city street experiments, their potential and challenges, we conceptualize the urban mobility ‘system’ as follows: Cities are composed of several mobility regimes including active modes, public transportation, and the most dominant, private automobility. Against the backdrop of developments at the landscape level (e.g. awareness for climate change) innovative ideas to meet challenges expressed on a local level are outed in the form of niche experiments. These experiments - temporary, local and place-specific - pop up, allowing users to explore possible solutions, potentially unlocking trajectories upheld by system regimes.

In order to understand *how* this process works, including barriers and challenges of change for city street experiments, we operationalize the transitional capacity of city street experiments using the five characteristics of transition experiments (C1-C5) as proposed by Bertolini, 2020 and discussed above. Each characteristic is further defined by indicators from existing literature (Bertolini, 2020; Glaser & Krizek, 2021; Roorda et al., 2014).

To operationalize change at the system level, we adapted the framework of the MLP to the urban mobility system using four dimensions: *behavioral* change (D1) in the behavior of users; *institutional* change or alterations to city-wide policies, legal and financial frameworks (D2); *material* change in the physical composition of the streetscape (D3) and *organizational* change in the network of players, organizations and/or state, market, and/or civic collaborations (D4).

For the purpose of theoretical exercise, the analysis is structured around the following working hypothesis: the greater the presence of the five characteristics, the greater potential change is realized (see Fig. 2). It is important to realize that these hypothesized relationships, like all frameworks conceptualizing transitions, are heuristic and not a “truth machine” (Geels, 2012, p. 474). Any evidence of an experiment leading to change on a system level is the result of multiple processes, actions, actors and levels representing different, potential change pathways extending well beyond the scope of our framework. This framework is therefore used heuristically, in order to guide us in identifying any emergent patterns inherent to city street experiments and their transitional capacity for system change in urban mobility, as a base for further, more focused enquiries.

### **Research methodology**

In order to explore the relationship outlined above, a qualitative and explorative, multi-embedded case-study design was adopted. The use of a multi-embedded case study design provides a holistic and meaningful understanding of a complex phenomenon (Yin, 2009) such as the transition towards sustainability in urban mobility. We selected Munich and Amsterdam as our cases ( $n = 2$ ) and local examples of city street experiments as the embedded unit of analysis ( $n = 6$ ). The two cities

were chosen for their comparability in terms of ambitions to reduce car use and evidence of street experimentation in recent years. At the start of 2020, both cities published policy-documents announcing their ambitions and plan to have fewer cars in the city (Gemeente Amsterdam, 2020; Referat für Stadtplanung und Bauordnung, 2020). Both Munich and Amsterdam have become more open to experimenting and processes are being facilitated, most recently accelerated in Munich, in particular, by the coronavirus pandemic. In Amsterdam, successful street experiments have been institutionalized, such as the ‘living streets’, with a clear process and financial support for organizers. In Munich, experiments are primarily seen as pilot projects used for promotion of the city’s campaign for less cars. ( While these cities share a common position in this transition, they differ in their urban governance patterns, offering insight into the impact of contextual factors on the transitional capacity of city street experiments.

We first made an inventory of city street experiments occurring after 2016 - for data accessibility reasons - in each city. From this catalog, six case studies were selected for the analysis based on the following criteria: (1) experiments must feature the streetscape (the road and adjacent public space) as the object of transformation and (2) they must have been implemented with the intention of being temporary, regardless of whether they later became permanent or were repeated elsewhere.

A total of 13 interviews with selected stakeholders from the six case studies were conducted between March and November 2021 (see Table A 2 in Appendix). With the intent of reaching a balanced representation, actors directly involved in the experiment, including experiment initiators ( $n = 4$ ) and project managers ( $n = 4$ ), as well as ‘helicopter viewers’ (Ehnert et al., 2018) including policy-makers ( $n = 2$ ) and urban designers ( $n = 1$ ) with a general knowledge of the urban context were interview subjects. Where possible, secondary data provided by policy documents, research articles, news articles and social media was collated to contextualize and triangulate interview responses and assessment results. The fieldwork was conducted by two local research teams, based in the respective cities. Each team followed the same interview and analysis guide, which outlined all steps in the research process in order to ensure comparability of the data. To avoid misunderstandings, interviews were conducted in the local language and translated into English afterwards.

To assess the transitional capacity of each case study, the interview data was coded following the transition experiment framework (see Table A1 in the Appendix) and rated on a scale from ‘0–2’ (0 = weak, 1 = average; 2 = strong). The research team members independently read the interview transcripts and relevant additional documents, scoring each of the six case studies based on the 32 components using the numerical scale. In order to reach a final score for each case, the researchers compared individual scores by way of a qualitative discussion within each team, an approach that has been applied in at least three other studies of a similar research design (Dill, Smith & Howe, 2017 and Norton, 2008; Glaser & Krizek, 2021). The components on the experiment level were tallied up to equal a Transition Score, while the components of the dimensions on the system level were added up for an Impact Score. On this point, we again stress the heuristic value of this scoring exercise; it is a way to help identify emerging relationships and more systematically compare cases and should not be viewed as a hard performance measure.

Because we are interested in change that occurred *as a result* of the experiment and outlasted it, this method poses one obvious limitation: accounting for the longitudinal aspect of the phenomenon ‘change’. Our approach involves a single snapshot of the experiments at a moment in their possible change trajectory. This is especially important to remember for those experiments which were finished most closely to the time of writing, and less of an issue for experiments that were completed years ago, assuming any change would have occurred in that time. Moreover, for experiments that were not formally monitored or assessed, change before and after is considerably more difficult to measure. Furthermore, we recognize the enormous challenge that is upending a system so em-



**Table A1**  
Transition experiment framework.

Capacity components (C1-C5)	
<b>C1</b>	<b>Radical: The experiment fundamentally differs from dominant practices</b>
C1.1.	The experiment is the first of its kind in the urban context
C1.2.	The experiment alters the use of streetscape for socializing, playing, exercising
C1.3.	The experiment includes a shift from motorized to non-motorized mobility
<b>C2</b>	<b>Challenge-driven: The experiment makes a step toward a potentially long-term change pathway to address a societal challenge</b>
C2.1.	The experiment models already established examples of city street experiments
C2.2.	The experiment is connected to existing policies or programs within the same city
C2.3.	The experiment is interdisciplinary in its ambition, combining objectives and goals (e.g. mobility, public space, social)
<b>C3</b>	<b>Feasible: The experiment can be realized in the short-term and with readily available resources</b>
C3.1.	Preparations for the experiment took no longer than six months
C3.2.	The necessary resources were made available
C3.3.	The experiment is well organized and communicated (signage, markings, arranging of permits)
C3.4.	The experiment garnered support from its residents, local businesses and other stakeholders
C3.5.	The experiment made arrangements for alternative transport (passenger and freight) and parking options
<b>C4</b>	<b>Strategic: the experiment generates lessons for reaching envisioned fundamental changes</b>
C4.1.	The experiment recognizes drivers and barriers to long-term change
C4.2.	The experiment was monitored, assessed and/or evaluated (e.g. citizen consultation)
C4.3.	The evaluation of the experiment is linked to long-term policy development
C4.4.	The experiment uses data collection methods, especially aiming to broaden mainstream mobility data (e.g. well-being, equity, social capital)
C4.5.	The experiment has the ambition to scale up or be repeated (e.g. in other locations, or in more locations)
<b>C5</b>	<b>Communicative: the experiment reaches and mobilizes the broader public</b>
C5.1.	The experiment garners attention from the outside-in (e.g. news coverage, social media)
C5.2.	The experiment garners attention by actively promoting itself from the inside-out (e.g. outreach programs, social media)
C5.3.	The experiment actively builds coalitions in order to achieve its goals
C5.4.	The experiment awakens or increases a sense of community
C5.5.	The physical presence of the experiment draws attention
Dimensions of change (D1-D4)	
<b>D1</b>	<b>Behavioral: there is evidence of a shift in individual use and behavior</b>
D1.1.	The experiment ignited a shift in mobility behavior from private automobility to alternative transportation options
D1.2.	The experiment ignited a different use of the streetscape
D1.3.	The experiment ignited social interactions
<b>D2</b>	<b>Institutional: there is evidence of alterations to city-wide mobility and public space policies, legal and financial frameworks, cultural/social norms</b>
D2.1.	The experiment led to the introduction of regulatory instruments (e.g. speed limits, environmental zones, lanes for public transport, closure to traffic)
D2.2.	The experiment led to the introduction of market-based instruments (e.g. taxes and subsidies)
D2.3.	The experiment led to the introduction of information-based instruments (e.g. providing awareness so that
D2.4.	individuals will make informed choices and ultimately change their behavior voluntarily)
<b>D3</b>	<b>Material: There is evidence of a physical change in the composition of the streetscape</b>
D3.1.	The experiment ignited an alteration of the physical form of the streetscape (e.g. installment of furniture, greenery, removal of parking spaces, layout of the street)
D3.2.	The experiment was scaled up (e.g. replication, spatial and/or temporal extension)
<b>D4</b>	<b>Organizational: There is evidence of a change in the network of players, organizations and/or state, market, and civic collaborations</b>
D4.1.	The experiment led to the creation of new organizations or groups (e.g. dedicated work group or task force, social media)
D4.2.	The experiment led to new relationships within existing organizations or groups (e.g. across municipal departments)
D4.3.	The experiment led to new relationships between existing organizations (e.g. municipality and commercial party)

**Table A2**  
List of stakeholders selected for personal interviews.

Reference in text	Stakeholder role	Affiliation
<i>Amsterdam</i>		
A1	Project manager	Municipality of Amsterdam
A2	Experiment organizer	Resident
A3	Junior program manager	Municipality of Amsterdam
A4	Senior designer	Municipality of Amsterdam
A5	Experiment participant	Resident
A6	Project manager	Municipality of Amsterdam
<i>Munich</i>		
M1	Policy maker urban mobility	City of Munich
M2	Experiment organizer	Local innovation platform to foster sustainable mobility
M3	Policy maker land use	City of Munich
M4	Citizens' initiative founder	Citizens' initiative
M5	Project manager public space	NGO
M6	Head of sustainable mobility and city councilor	NGO
M7	Business manager change	NGO

bedded and complex as that of urban mobility. For that reason, any evidence of a transition, regardless of its scale or magnitude, qualified as change.

## Case studies

### *Amsterdam: weesperzijde testbed*

As a response to an unmet demand for public space and an interest in the long-term effects of parking reduction (A1), 180 parking places totaling 2000 m<sup>2</sup> were freed up for alternative uses in the Weesperzijde neighborhood in the summer of 2019. This experiment stemmed from a niche development for Smart Mobility, which was implemented in the form of a European program called eHubs across a number of test cities. The Weesperzijde version included a ‘shared mobility hub’ with bike racks and electric (cargo-)bikes. In addition, parklet-style urban gardens and green street furniture were placed and paid for by active residents.

The aim of the Weesperzijde experiment was three-fold: reduce parking, increase alternative forms of mobility and improve public space (de Bruijn, 2019), which the residents were most interested in (A1). While from the outside it appeared as a collaboration between the Amsterdam East department of the Municipality of Amsterdam and active residents, these two parties had trouble aligning ambitions and efforts (de Bruijn, 2019). When residents attempted to organize a ‘living street’, closing the road entirely to traffic, they were denied by the Municipality on the grounds of insufficient funds, doubts about public support and the lateness of the application, which should have been submitted ten weeks prior to the start of the event (A1). As a response, the residents ‘illegally’ organized a communal lunch attracting more than one hundred people (see Fig. 3), for which they were reprimanded by the Municipality of Amsterdam (A1). In addition, residents also managed to find a loophole in the municipal system, applying and receiving temporary parking permits, typically used in the event of moving or construction, for a large number of spaces in the street. This chain of events stunted the building of a coalition between the two parties, which together ran the experiment as ultimately carried out.

Following the end of the experiment, an evaluation was made by the municipality municipality, specifically in order to better understand how the residents were able to apply for and receive the temporary parking permits (de Bruijn, 2019). This served as an important lesson for inter-departmental communication, leading to a new system for processing permits to prevent the recurrence of misuse that occurred during the experiment. Residents are still not satisfied with the current situation and are still searching for ways to clear the street of cars. In November of 2019, a group again applied for parking permits in the street, not to park their cars but to use as public space (de Boer, 2019).

### *Amsterdam: ‘Living Street’ Hugo de Grootkade*

The Hugo de Grootkade, a typical residential street in Amsterdam West, was closed to motorized traffic for use as public space for a period of four weeks during the summer of 2016. The main objective was to implement and test the first-ever *leefstraat* (‘living street’) in Amsterdam. All cars were removed and temporary barriers were put up at both ends of the street. A blue carpet was laid down the middle of the street to highlight its new play and social function. Various objects, including picnic tables, benches, a hot tub and a temporary beach were installed. The experiment originated as a citizen-led project supported by subsidy funding from the local government in the neighborhood of Amsterdam West. The local government provided organizational support while residents voluntarily formed a small committee that was responsible for arranging permits, materials, scheduling activities and managing communication (A3).

While the local government initially planned to use the experiment as a chance to explore the solutions for the larger parking issue in the

neighborhood, this goal was scrapped when the organization of the social activities proved to cost more time and money than expected, which was necessary in order to achieve all of the aims of the initiators (A2). The experiment was evaluated following its completion, however this feedback was not linked to any long-term policy development, nor did it address any long-term drivers or barriers of change (A2). Preparations for the experiment spanned over the course of four months, of which three were needed in order to receive approval for the plan from the municipality. In order to promote the activities, flyers were used, visual announcements in the form of large billboards were placed on the side of buildings, and residents were updated via a Facebook page that remained active following the completion of the experiment (A3). Local news outlets picked up the experiment, representing attention from the outside-in. Furthermore, the experiment’s full-packed and visible program, with activities happening every day on the street, proved to mobilize residents to interact and participate.

Following the completion of the Hugo de Grootkade experiment, interview respondents noted an increased feeling of social cohesion in the neighborhood that was a direct result of the living street. A new and still active Facebook group continues to bring residents together today. The success of the Hugo de Grootkade led to its repetition a year later in the summer of 2017 and informed policy regarding other living streets in Amsterdam, which are budgeted for every year and available for those who wish to organize such an event (A2). While the street was returned to its original state, some furniture that was used during the experiment remains on the sidewalks.

### *Amsterdam: the ‘cycling street’ Sarphatistraat Zuid*

The cycling street Sarphatistraat Zuid was transformed into a multi-modal roadway featuring sidewalks, more greenery, a shared car and cycling path, and an improved tramline in 2016. The experiment included changing the asphalt from black to red, applying markings indicating the *fietsstraat* (cycling street) status, removing traffic lights and changing the maximum speed to 30 km/h. Plans to redesign the entire inner city ring (*Binnenring*) - of which the Sarphatistraat forms a section - began with a top-down motion from the political party GroenLinks and were carried out by the Municipality of Amsterdam.

The Sarphatistraat Zuid experiment was the first to be adopted within the larger structural plan, however the experiment was strictly aimed at improving the mobility flow and did not serve a range of uses beyond being a channel for traffic. It was an experiment in the strictest sense of the word: the municipality purposefully used it to test a possible future street design that would be implemented across the entire inner city ring and vowed to change the street back to its original state if unsuccessful (A4). While preparations lasted a year due to political discussions and the need to convince different departments within the municipality, the necessary resources were made available. As part of a larger citywide policy ambition, the Sarphatistraat experiment recognized barriers to long-term change and was assessed quite thoroughly before, during and after the experiment. This included polling residents, local business owners and passers-by about their opinions on user safety and traffic patterns. Interestingly, residents from surrounding neighborhoods were informed of the plans by way of a letter but there was no formal citizen consultation, which was noted by policy-makers as beneficial to the experiment’s success as it made the process more feasible. The experiment received little backlash from local stakeholders and users adapted to the new scenario swiftly. Following the experiment, the number of cyclists using the street increased (A4) and eight out of ten respondents found that cyclists use the entire lane and 75 percent found that cars drive slower (Gemeente Amsterdam, 2016). Due to the improved safety revealed in the assessment following the experiment, the cycling street Sarphatistraat Zuid was kept, leading to a permanent alteration of the streetscape. The Sarphatistraat Zuid experiment further led to new relationships between the urban planning and traffic departments of the municipality. A shift in opinion from the traffic advisors

and the politicians who were originally opposed to the idea paved the way for the further application of the shared cycling path model across the city under the policy Project Binnering.

#### *Munich: Umparken Schwabing-west*

During the Umparken Schwabing-West experiment, which lasted four weeks, eight households exchanged their cars and parking spaces for public transport and shared mobility options while the leftover parking spaces were activated as public space. The experiment took place in the summer of 2020, during which the entire Hiltenspergerstraße was closed to motorized traffic and four parking spots were transformed into a modular parklet with a seating area, and bicycle and e-scooter parking to improve alternative mobility services in the area (M2). The experiment was an initiative of UnternehmerTUM, a center for innovation and business creation.

The Umparken Schwabing-West experiment featured a user-oriented approach to actively understand and reduce car ownership and was the first of its kind in Munich. While the experiment was not fully embedded in a strategy for long-term change, Umparken Schwabing-West was partially modeled after the popular shared mobility concept MaaS (Hensher, Mulley & Nelson, 2021). Organizers noted two challenges at the forefront of the experiment: first, finding test users for the mobility part of the experiment and second, understanding how the people living there want to use the space. In order to solve these barriers, the experiment conducted multiple citizen consultations. One included a neighborhood concert where possible participants for the mobility part of the experiment could be collected. Here an 'idea wall' was also constructed so that people could share their opinions on the use of the public space. Additionally, the organizers made use of a website for sharing information and an online survey to gather ideas (M2). During these preparations however, the experiment was almost canceled due to strong criticism from surrounding residents who were primarily worried about noise and the attraction of young people to the street at night (M2). Changes to the original plan (no benches in the public space) and support from the district committee allowed the experiment to continue.

The mobility behavior and user experience of the participants was closely monitored and assessed, although because the experiment was not linked to any long-term policy, it was used to mainly inform improvements for any follow-up experiments. To the surprise of the organizers, three of eight households permanently gave up their car (M2), signaling a behavioral change. Umparken Schwabing-West moreover ignited new cooperation among different stakeholders from the municipality, startups, and mobility operators who are continuing collaboration for a repeat of the experiment next year. The model of the Umparken Schwabing-West experiment will be improved and linked with the Summer Streets program (see below) and potentially brought to other cities (M2).

#### *Munich: summer streets*

Drawing from inspiration gathered during a visit to Stockholm, the city of Munich implemented its first 'Summer Street' pilot in two locations during the summer of 2019. The first street, south of Alpenplatz in Giesing, was closed to car and bicycle traffic, giving priority to pedestrians. The second, Schwanthaler Street, included a widening of the sidewalks for greenery and sitting areas (Landeshauptstadt München, 2019). Both pilot projects were implemented in order to identify a suitable process for temporary transformations of city streets on a larger scale. Due to the Coronavirus pandemic, the Summer Streets concept was expanded to the entire city in 2020, giving 10 streets traffic restrictions and designating four streets as play streets (M3). The main objective of the design was to provide outdoor space to citizens, without inducing crowds or gatherings (M3). The project was implemented in cooperation with

the district committees, who together with citizens, requested to have summer streets and parklets in their district.

Summer Streets featured a streetscape redesigned for increased social interaction between users. Like its Swedish counterpart, it was an experiment connected to various programs and existing policies from the city, such as urban and mobility development strategies. In particular, the initiative was fed by discussions within the city council about the redistribution of public urban space, serving as a backbone for a mobility transition. The City of Munich worked very closely with the district councils to use available resources (existing furniture from the Building Department) to quickly respond to the demands of the pandemic (M3). The experiment was assessed using both qualitative and quantitative methods, where interview respondents noted that the physical aspect of the experiment was not particularly inviting. Because members of the district councils acted as representatives for users in the experiment, internal communication was limited. This was furthered by contact restrictions of the pandemic. Promotion of the experiment was gained in other ways, for instance through local news media outlets.

Following the closure of the experiment, users began to use the streets differently than before. A new professional relationship emerged within the City of Munich and the district councils, who had previously not worked together on such an issue. The Summer Streets experiment led to a resolution outlining the specific procedures to scale-up and repeat the experiment in 2021.

#### *Munich: Piazza Zenetti*

The 'Piazza Zenetti' experiment (see Fig. 4) was implemented for two months in the summer of 2018 and repeated in 2019 and 2020 (City2Share, 2020). Located in a district with high parking demands, Ludwigsvorstadt-Isarvorstadt, the experiment had two aims: test shared e-mobility alternatives and reclaim the unused parking spots as public space (Ibid., 2020). The experiment was a collaboration between citizens, the local government, and a landscape architecture firm under the umbrella research project, City2Share. The success of the experiment in its first year led to the start of a citizens' initiative who took over the project from City2Share.

Piazza Zenetti was the first of its kind in Munich. It actively addressed the issue of private mobility and transformed the leftover parking spaces into places for interaction and a 'living space in the street' (M4). A mini library was created and a bottle collector was also installed in order to keep the space tidy. Other programs included a meet-up for swapping clothes and yoga (M4). Initially, a small stage was installed as the 'Speaker's Corner' intended for people to use for speeches or music, however it remained unused and was therefore left out of the second design. The possibility to test these ideas was noted by the initiators as a direct benefit of experimentation (M4).

Piazza Zenetti was linked to broader programs, including European Mobility week in the first year, and the Summer Streets Program in the second and third years (M5). The fact that the experiment began under a formal organization was noted as contributing to its feasibility (M4). From the start, the local government intended to learn from the experiment (M1) and its impact on public space by way of monitoring and evaluation. Promotion of the Piazza Zenetti experiment was extremely thorough, which helped to gain support from local residents. Interestingly, a small sample of residents initially feared that the redesign of the square signaled a start to the gentrification of the neighborhood. In order to promote the experiment and gather support, experiment organizers made use of flyers, newspaper publications, a kick-off event with the mayor and representatives of the municipality during an 'action week' (M1).

Following the experiment, new interactions between residents grew and according to interview respondents, there was an awakened sense of community. This was, according to the organizer of the citizen's initiative, a direct result of the stimulating character of the square which prompted people to use the space. Half of the space used during the ex-

periment was made permanent public space in 2018. The success of the citizen's initiative led to its formal adoption under the Summer Streets program in 2020 and the promise to repeat the experiment in the coming years.

## Discussion of results

The case descriptions outlined above begin to illustrate the similarities and differences between the city street experiments. We now expand on these insights, answering the questions of how city street experiments create, build upon and exert their transitional capacity upon the urban mobility system.

Fig. 5 reports the results of the scoring of the experiments and their relationship to change. As stressed in the methodology section above, we use these scores as a heuristic guide, rather than a hard performance measure, in order to highlight emerging patterns and issues for further enquiry. We further do not claim any simple cause-effect relationships.

Based on our findings, it appears that there exists a broad relationship between the transitional capacity of city street experiments - measured by the five defining characteristics of transition experiments - and some degree of behavioral, organizational, institutional, or material change. In five of the six case studies, the Transition Score correlates to the Impact Score (see Fig. 9), confirming our working hypothesis that 'the greater the presence of the five characteristics, the greater change observed'. The highest scoring change dimension was individual change (1.3), followed by institutional (1) and material (1), and ending with organizational change (0.9) (Figs. 1, 6–9).

The *radical* nature of the experiments was a particularly strong component in all case studies, as they all featured a fundamentally different use and activation of the streetscape. The Sarphatistraat Zuid experiment, although the first of its kind in Amsterdam, was strictly mobility related and therefore less *radical* than the others. In the other cases, the removal of traffic and use of the street for socializing was regarded as one of the most positive aspects of the experiments and generally met with acceptance, even in the cases where residents were initially against the idea of having to move their cars (Weesperzijde testbed and Umparken Schwabing). The characteristic *radical* did not reveal any significant correlations with any of the dimensions of change (i.e. the more radical the project the more change observed) as suggested by the literature (Bertolini, 2020). *Radicality* was primarily mentioned by respondents in connection with that of *feasibility*; the more radical the project, the less feasible and vice versa. As a result of a too ambitious and therefore *radical* program, the Weesperzijde Testbed and Umparken Schwabing West experiments struggled to achieve their goals (A1, M2). These patterns suggest a potential trade-off between these two characteristics: in order to increase *feasibility*, the radical nature of projects may have to be lowered and vice versa.

The characteristic *challenge-driven* still appears to be emerging, despite shifts at the landscape level towards demand for more livability and less cars in cities, and an increased awareness for experimentation in both cities. Only three of the experiments (Piazza Zenetti, Summer Streets, Sarphatistraat Zuid) were connected to existing policies or programs. This confirms the propositions made by current literature regarding the disconnection of city street experiments from long-term strategies (Bertolini, 2020; Hipp et al., 2017). According to an interview respondent (A2), the local government dropped their original goal of exploring long-term parking solutions with the Hugo de Grootkade experiment in exchange for *feasibility* as the social program took more time and energy than expected. Furthermore, the Weesperzijde Testbed experiment proved to suffer from unclear goals related to its too-ambitious program (wanting to explore shared mobility, parking solutions and organize social activities) and confusion regarding roles and responsibilities. Interestingly, these experiments still revealed scores on the dimensions of change, despite the absence of this characteristic.

The *feasibility* of city street experiments varied across all case studies. As mentioned earlier, there appeared to be a trade-off between the

*radicality* of the experiment and its *feasibility*. While all experiments garnered enough support and funding to be put on and completed, they likewise noted a lack of time and underestimation of the amount of energy required. Arranging permits proved to be the greatest culprit for experiments in both cities, an echo of the regime entrenchment of the automobile and relative novelty of such initiatives. In Amsterdam, this proved to be the case even for the Sarphatistraat Zuid experiment which was, solely organized by the municipality. Additionally, for the experiments that required a removal of cars, resistance from residents proved to slow preparations and prompted the alteration of plans according to interview respondents (M2). Active residents of the Weesperzijde testbed found (and continue to make use of) loopholes in the system to fast-track these processes: "It's good that they found a loophole, because they showed us that there was a weakness in our system and that shouldn't happen during such a project" (A1). Interestingly, resistance took on another form at the Piazza Zenetti, where some residents were wary of the experiment leading to gentrification. City street experiments have, until this point, been viewed as revealing positive benefits to current urban challenges. However, improvements to local economic situations (Littke, 2016) and livability could result in negative consequences in the form of exclusivity for certain groups, a risk also recognized in other contexts (Goossens et al., 2020).

The characteristic *strategic* formed a very weak point across all the case studies, confirming claims made by existing literature on city street experiments. In terms of assessment and monitoring, while most of the experiments were monitored, assessed and/or evaluated, the lessons generated were not used for the benefit of long-term change trajectories. This is an interesting point that relates to the literature stressing the importance of monitoring in connecting experiments to longer-term strategies (Sadik-Khan & Solomonow, 2017). The monitoring that occurred was mainly used to improve and learn from the experiment 'experience' itself, but was not extrapolated to wider, long-term plans, most likely because these experiments were not strongly embedded in long-term change trajectories to begin with. The possible lessons to be learnt from are therefore limited by the original framing of the experiment. Interestingly, the Umparken Schwabing-West and Hugo de Grootkade experiment scored very low on the characteristic *strategic*. This was matched in the former by a relatively low impact, yet the latter was the most impactful experiment in Amsterdam and the second most impactful of all case studies. One possible explanation for this divergence may be explained by the fact that the Umparken Schwabing-West experiment was initiated by a business accelerator and was the only case study that did not feature an active role from the local government. Conversely, the Hugo de Grootkade experiment featured a primary role from both the local government and the residents, representing a strong coalition between these two parties. The strength of this coalition and its role in achieving experiment goals, a component of the characteristic *communicative*, may have made up for the lack of *strategic* character.

The characteristic *communicative* proved a strong component in nearly all of the case studies. Street experiments garner momentum by way of building coalitions (reaching-out) and profiting from actor networks (reaching-in) that surround their niche development. As the initiator of the Umparken Schwabing experiment described: "It was only successful because we had good partners on board. We had the city... and we also had relevant partners and startups that were open to doing this project. Otherwise, it wouldn't have happened in such a short time frame. The project with its short planning and preparation phase didn't fit into the usual processes of the city of Munich at all" (M2). Initiators of the Piazza Zenetti experiment, mentioned new civic collaborations between citizens, the district committee and the city of Munich as a direct result of the project. Two nuances were revealed from our analysis. First, the type and intensity of communication strategies appears to vary depending on the aim of the experiment, and how *radical* it is. While the extremely *communicative* nature of the more interdisciplinary experiments combining mobility, social and public space goals, which was noted as the key to their success (Piazza Zenetti, Hugo de



## Increasing structuration of activities in local practices

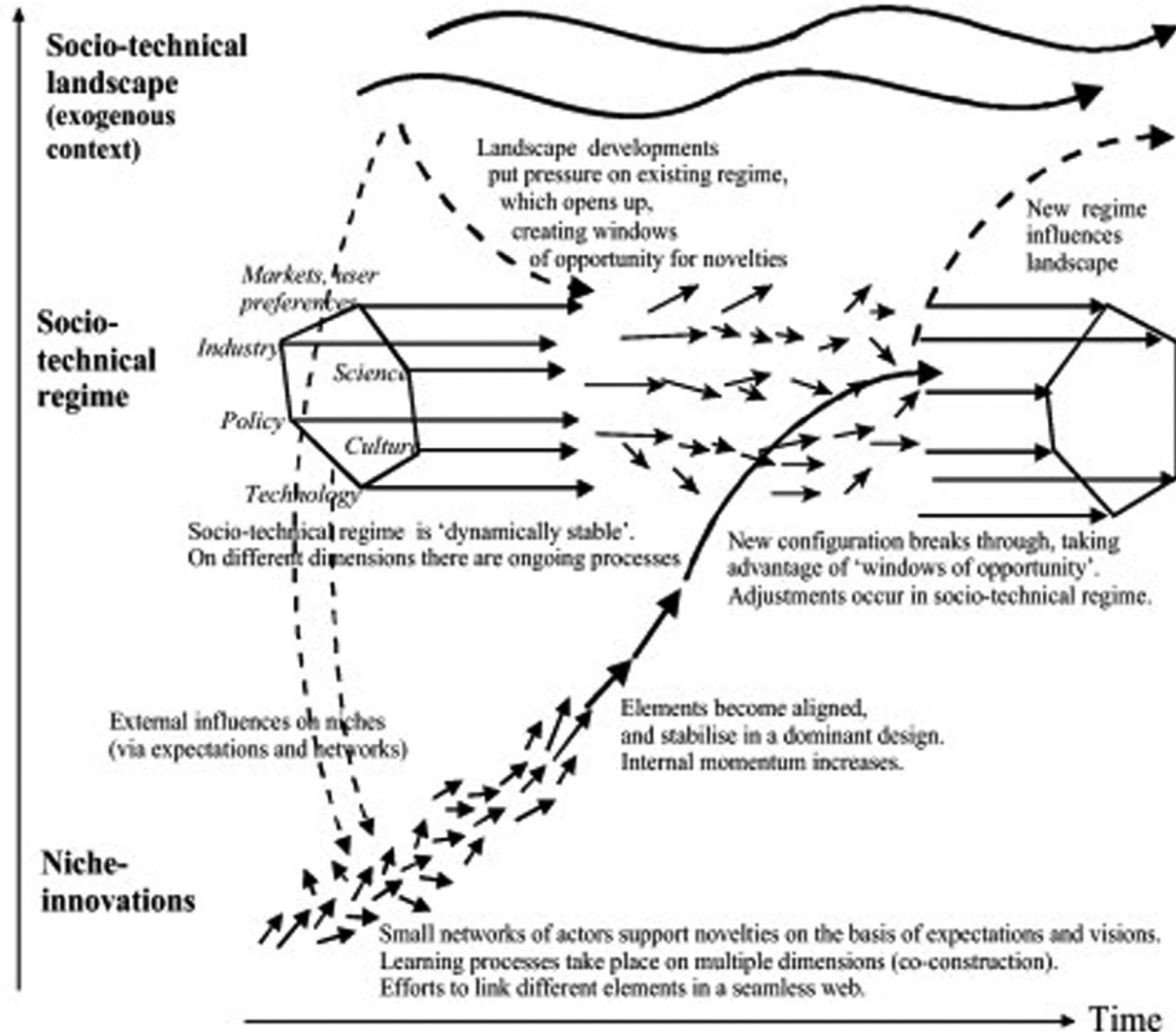


Fig. 1. The process of system change and innovation according to the multi-level perspective (Geels, 2004).

Grootkade, Summer Streets), the *absence* of a participation process in the Sarphatistraat experiment was noted as a factor in its success. This was likely made possible due to the lowered radicality of the experiment (solely mobility focused) and the promise to return the street to its original state if unsuccessful. This was also the case in the experimental and mobility-focused pop-up bike lanes in Munich from 2020 (M6). Secondly, while initiators of city street experiments can actively promote their experiments, the success of these efforts ultimately lies in the hands of their audience. A better understanding of the preferences of potential users and giving more time to ‘warm-up’ to the idea was noted as having been potentially favorable for behavioral change during the Umparken Schwabing-West experiment.

### Reflection on the assessment framework and areas for improvement

As stated earlier, this analysis represents the first attempt to assess the transitional capacity of city street experiments. For the purpose of this explorative study, the assessment framework proved to offer valuable insights into the transitional capacity of city street experiments in

relation to system change. It primarily acted as a stepping stone for the identifying of hypotheses for follow-up research. By scoring the individual characteristics and dimensions for each case study, we were able to single out specific patterns (e.g. trade-offs between characteristics) that would have otherwise been difficult to highlight. We therefore recommend the further use of this method, stressing its heuristic value and offering two points of improvement.

First, we defined material change as “evidence of a physical change in the composition of the streetscape following the experiment.” Based on our analysis, this definition did not cover all forms of material change. Some examples of city street experiments are repeated due to their success but are not permanently implemented. Although the physical changes are only temporary, the Summer Streets and Piazza Zenetti experiments are now planned to occur every year and have proven to lead to a visible increase in the use of the street as a communal living space. We suggest that future assessments revise this component to include such ‘temporary permanence’ when scoring experiments on the material dimension.

Second, the framework assumed that change is positive (e.g. shift to sustainable mobility and active modes, increased social capital, com-

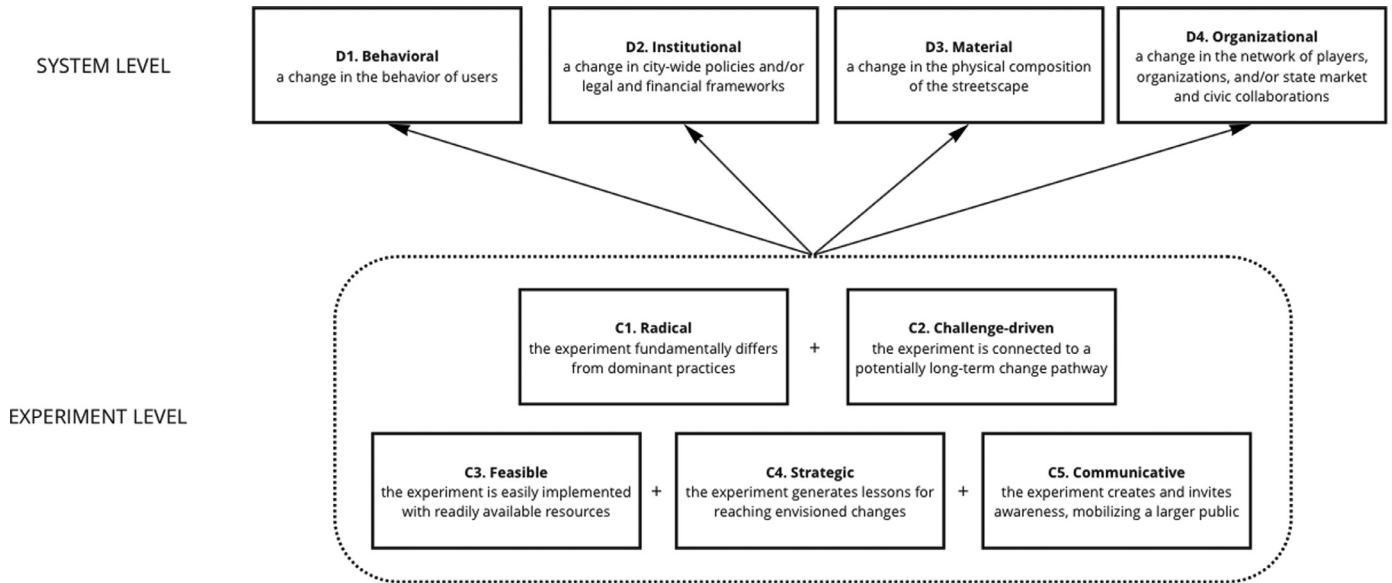


Fig. 2. Hypothesized relationship between the five characteristics of city street experiments (C1–C5) and the four dimensions of system change (D1–D4).



Fig. 3. Communal lunch in the Gijsbrecht van Aemstelstraat. Photo: Pieter Boersma.





Fig. 4. Children playing in the Hugo de Grootkade during the experiment. Photo: Authors.



Fig. 5. The red asphalt indicating the cycling street following the Sarphatistraat Zuid experiment. Photo: Floortje Opbroek.

munity building), however, this is not always the case, as shown by the Weesperzijde testbed. Here, social interaction increased, however it seemed to divide the neighborhood, the municipality and the residents, rather than unite them. In the Piazza Zenetti experiment, risks of gentrification were highlighted. This ‘dark side’ of social capital (Rydin, 2014) and the notion that change is not necessarily ‘good’ (on these and other aspects) should be explicitly considered when evaluating the transitional capacity of city street experiments and suggests the consideration of the possibility of negative scoring in future studies.

## Conclusions

City street experiments are increasingly being implemented as ways to explore possible solutions to the challenges and tensions of contem-

porary urban mobility. This paper explored the extent to which such on-the-ground initiatives can trigger system change by developing and employing an assessment framework for their transitional capacity. The comparative nature of the assessment framework revealed how different capacity components influence dimensions of change, and how this process occurs across different experiments and contexts. Valorizing the qualities capable of causing change which are inherent to city street experiments reveals opportunities and barriers and provides novel insights for areas for improvement. In sum, our analysis highlighted the following patterns regarding city street experiments and their transitional capacity:

- There exists a broad correlation between the cumulative strength of experiment characteristics and overall dimensions of change.





Fig. 6. Preparations for the Umparken Schwabing West experiment. Photo: experiment organizers.



Fig. 7. Sign designating the beginning of the Summer Street experiment: 'Welcome to the Summer Street'. Photo: Authors.

- The characteristic *radical* holds a strong presence, however, appears to have no determining relationship with the dimensions of change.
- There is a clear trade-off between the characteristics *radical* and *feasible*.
- The characteristic *challenge-driven* is weak, however does not appear to have a determining relationship with dimensions of change.

- Institutional barriers, both formal (legal frameworks) and informal (automobility as a social norm) major constraints to the *feasibility* of experiments.
- The characteristic *strategic* is weak and appears to have no determining relationship with the dimensions of change.



Fig. 8. Piazza Zenetti in the summer of 2019. Photo: Johann-Christian Hannemann.



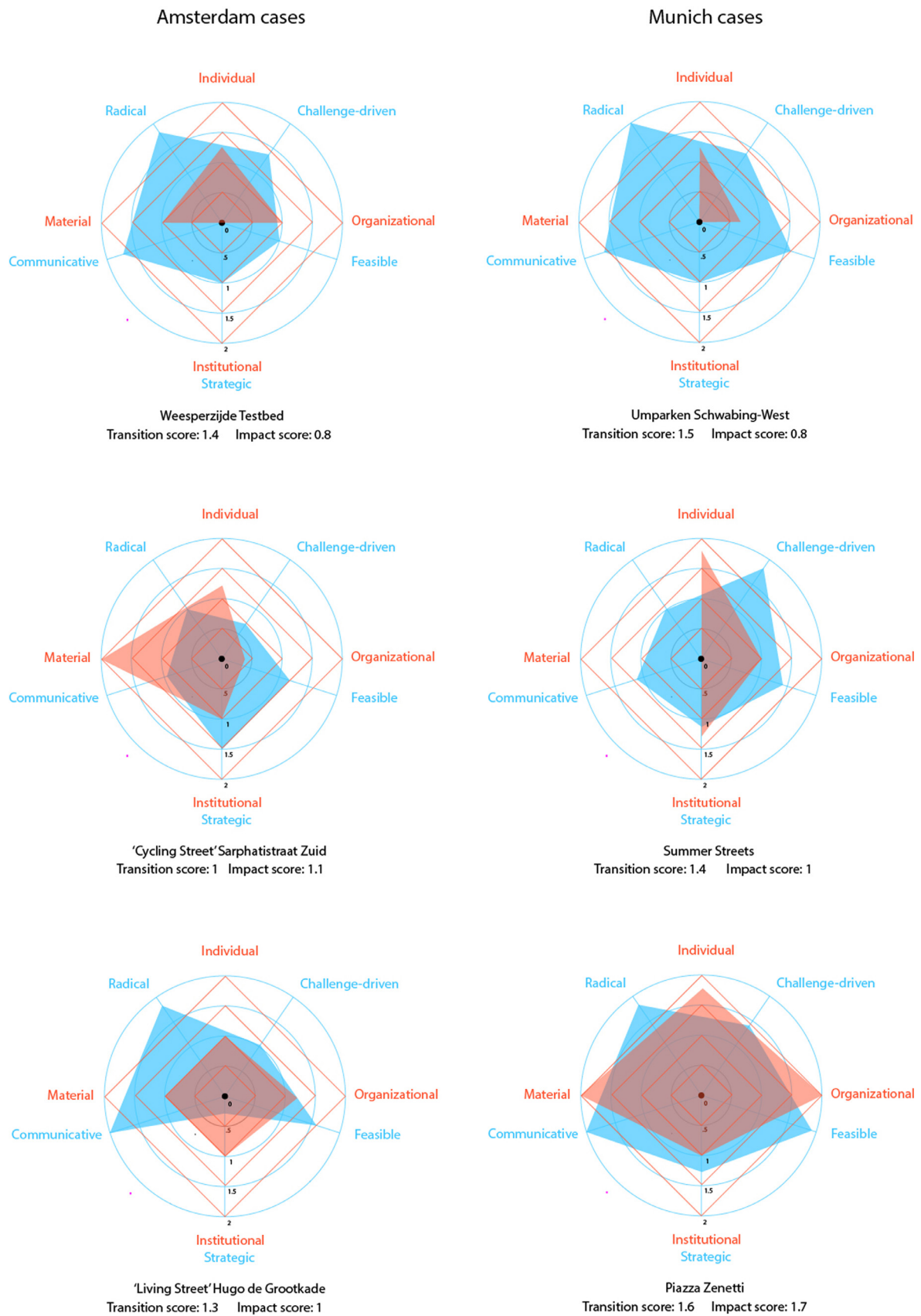


Fig. 9. Aggregated assessment of transitional capacity components and dimensions of change of six of city street experiments in Munich and Amsterdam (scale: 0 = weak, 1 = average, 2 = strong).

- *Communicative* is a strong characteristic and may be a necessary condition for the more *radical* projects. It could also act as the ‘saving grace’ for projects that are less *strategic*.
- The combination of (a) broad correlation between characteristics and change but (b) unclear individual correlations, opens the possibility that different mixes of characteristics, rather than across the board maximization should be pursued in order to deal with trade-offs and acknowledge contextual conditions, while still achieving change.

Our comparative analysis further revealed two important avenues for research and practice. First, the transitional capacity of city street experiments cannot be understood independent from the context and system in which they occur. Regardless of their strengths, experiments are influenced by shifts at the landscape level and dynamics of the mobility regime. The dominance of private mobility revealed a barrier for the city street experiments showcased in this study in several ways. First, the task of arranging permits for using the street as something other than for traffic proved to be the most time-consuming and posed a potential threat to the success of the experiments. Second, general opinions concerning such ‘border-pushing’ practices’ (Bertolini, 2020) did not always align. Users who were not in favor of giving up parking spots resisted the implementation of the experiments. While city street experiments aim to change the local urban planning system, existing regimes, both formal and informal, have the potential to either limit or nurture them. One way to potentially combat this, would be for organizers to involve the local government and educate themselves on the conditions of the system they are operating within and for whom they are experimenting. For researchers, while this study specifically viewed this relationship from the perspective of the experiment, future studies would be advised to observe it from the position of the urban mobility system, analyzing its ‘readiness’ for such activities and own transformative capacity.

Second, while our study revealed a broad correlation between the five transition experiment characteristics and change, the results give us reason to explore the possibility that certain characteristics of city street experiments are non-negotiable while others are dispensable. This possibility might help address the trade-offs between different characteristics that also emerged, including that between *radical* and *feasibility* and also how certain characteristics interact with each other (e.g. more radical projects should be more communicative) If all five characteristics cannot be maximized, which combinations should initiators of street experiments then focus on? While the scope of this paper did not allow for a deeper assessment of the relationships between characteristics, we believe this to be an important next step in further understanding city street experiments and their transitional capacity.

#### Declaration of Competing Interest

No potential conflict of interest was reported by the author(s).

#### CRediT authorship contribution statement

**Katherine VanHoose:** Conceptualization, Methodology, Investigation, Formal analysis, Writing – review & editing, Visualization. **Ana Rivas de Gante:** Investigation, Formal analysis, Visualization, Writing – review & editing. **Luca Bertolini:** Conceptualization, Methodology, Supervision, Project administration, Funding acquisition. **Julia Kinigadner:** Investigation, Methodology, Formal analysis. **Benjamin Büttner:** Investigation, Formal analysis, Funding acquisition.

#### Funding

This research has benefited from participation in the “City LiveAbility by Redesign” (CLEAR) innovation project, funded by the European Institute of Innovation and Technology (EIT) “Urban Mobility” initiative.

#### References

- Bertolini, L. (2020). From “streets for traffic” to “streets for people”: can street experiments transform urban mobility? *Transport reviews*, 40(6), 734–753.
- Berger, Gerald, Feindt, Peter, Holden, Erling, Rubik, Frieder, et al. (2014). Sustainable Mobility—Challenges for a Complex Transition. *Journal of Environmental Policy & Planning* In press. 10.1080/1523908X.2014.954077.
- Bertolini, Luca (2012). Integrating Mobility and Urban Development Agendas: a Manifesto. *disP - The Planning Review* In press. 10.1080/02513625.2012.702956.
- Cleophas, C., Cottrill, C., Ehmke, J. F., & Tierney, K. (2019). Collaborative urban transportation: Recent advances in theory and practice. *European Journal of Operational Research*, 273(3), 801–816.
- City2Share. (2020). Emissionen sparen, platz schaffen, mobil sein. Handlungsleitfaden City2Share. Retrieved December 15, 2020 from [https://repository.difu.de/jspui/bitstream/difu/578537/1/DIFU\\_C2S\\_Handlungsleitfaden\\_final\\_web.pdf](https://repository.difu.de/jspui/bitstream/difu/578537/1/DIFU_C2S_Handlungsleitfaden_final_web.pdf).
- Coenen, L., Raven, R., & Verbong, G. (2010). Local niche experimentation in the energy transitions: A theoretical and empirical exploration of proximity and disadvantages. *Technology in Society*, 32(4), 295–302.
- Combs, T. (2020). Local Actions to support walking and cycling during social distancing dataset. *Pedestrian & Bicycle Information Center*. Retrieved March 08, 2021 from [www.pedbikeinfo.org/resources\\_details.cfm?id=5209..](http://www.pedbikeinfo.org/resources_details.cfm?id=5209..)
- de Boer, Maarten (2019). “Plan Herinrichting Weesperzijde Verre Van Democratisch.”
- D’Haese, S., Van Dyck, D., De Bourdeaudhuij, I., Deforche, B., & Cardon, G. (2015). Organizing “Play Streets” during school vacations can increase physical activity and decrease sedentary time in children. *International Journal of Behavioral Nutrition and Physical Activity*, 12(1), 14.
- Dill, J., Smith, O., & Howe, D. (2017). Promotion of active transportation among state departments of transportation in the U.S. *Journal of Transport and Health*, 5, 163–171.
- Ehnert, F., Frantzeskaki, N., Barnes, J., Borgström, S., Gorissen, L., Kern, F., et al. (2018). The acceleration of urban sustainability transitions: A comparison of Brighton, Budapest, Dresden, Genk, and Stockholm. *Sustainability*, 10(3), 612.
- Evans, J., & Karvonen, A. (2016).&, R. Raven (Eds.). *The experimental city*. Routledge.
- Evans, J., Vácha, T., Kok, H., & Watson, K. (2021). How cities learn: From experimentation to transformation. *Urban Planning*, 6(1), 171–182.
- Eyler, A., Hipp, J., & Lokuta, J. (2015). Moving the barricades to physical activity: A qualitative analysis of open streets initiatives across the United States American. *Journal of Health Promotion*, 30(1), e50–e58.
- Geels, F. (2005). The dynamics of transitions in socio-technical systems: A multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930). *Technology Analysis & Strategic Management*, 17(4), 445–476.
- Geels, F. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, 1(1), 24–40.
- Geels, F. (2012). A socio-technical analysis of low-carbon transitions: Introducing the multi-level perspective into transport studies. *Journal of Transport Geography*, 24, 471–482.
- Gemeente Amsterdam. (2016). Evaluatie pilot Sarphatistraat Zuid OV-fietsstraat. Team Onderzoek & Kennis.
- Gemeente Amsterdam. (2020). Amsterdam maakt ruimte agenda amsterdam autoluw.
- Geels, F. W., Sovacool, B. K., Schwanen, T., & Sorrell, S. (2017). The socio-technical dynamics of low-carbon transitions. *Joule*, 1(3), 463–479.
- Gehl, J. (2010). *Cities for People*. Island Press.
- Glaser, M., & Krizek, K. (2021). Can emergency response measures trigger a transition to new transport systems? Exploring the role of “street experiments” from 55 US cities. *Transport Policy* in press.
- Goossens, C., Oosterlynck, S., & Bradt, L. (2020). Livable streets? Green gentrification and the displacement of longtime residents in Ghent, Belgium. *Urban Geography*, 41(4), 550–572.
- Grin, J., Rotmans, J., Schot, F., Geels, F., & Loorbach, D. (2010). *Transitions to sustainable development – part 1: New directions in the study of long-term transformative change*. London & New York: Routledge.
- Hensher, D.A., Mulley, C., & Nelson, J.D. (2021). Mobility as a service (MaaS)—going somewhere or nowhere?.
- Hipp, J., Bird, A., van Bakergem, M., & Yarnall, E. (2017). Moving targets: Promoting physical activity in public spaces via open streets in the US. *Preventive Medicine*, 103, S15–S20.
- Iverson, K. (2013). Cities within the city: Do-it-yourself urbanism and the right to the City. *International Journal of Urban and Regional Research*, 37(3), 941–956.
- Kuhlberg, J., Hipp, J., Eyler, A., & Chang, G. (2014). Open streets initiatives in the U.S.: Closed to traffic, open to physical activity. *Journal of Physical Activity and Health*, 11(8), 1468–1474.
- Landeshauptstadt München. (2019). Rathaus Umschau. Retrieved December 15, 2020 from <https://ru.muenchen.de/pdf/2019/ru-2019-06-14.pdf>.
- Lindenau, M., & Böhrler-Baedeker, S. (2014). Citizen and stakeholder involvement: A precondition for sustainable urban mobility. *Transportation Research Procedia*, 4, 347–360.
- Littke, H. (2016). Revisiting the San Francisco parklets problematizing publicness, parks, and transferability. *Urban Forestry & Urban Greening*, 15, 165–173.
- Loorbach, D., Wittmayer, J., Shiroshima, H., Fujino, J., & Mizuguchi, S. (2016). *Governance of urban sustainability transitions*. Berlin Heidelberg: Springer.
- Lydon, M., & Garcia, A. (2015). *Tactical urbanism: Short-term action for long-term change*. Washington, DC: Island Press.
- Mehta, V., Zavestoski, S., & Agyeman, J. (2015). The street as ecology. In *Incomplete streets: Processes, practices, and possibilities* (pp. 94–115). London & New York: Routledge.

- Meyer, M. R. U., Bridges, C. N., Schmid, T. L., Hecht, A. A., & Porter, K. M. P. (2019). Systematic review of how play streets impact opportunities for active play, physical activity, neighborhoods, and communities. *BMC public health*, *19*(1), 1–16.
- Moloney, S., & Horne, R. (2015). Low carbon urban transitioning: From local experimentation to urban transformation? *Sustainability*, *7*(3), 2437–2453.
- Montero, S. (2017). Worlding Bogotá's ciclovía: From urban experiment to international "best practice". *Latin American Perspectives*, *44*(2), 111–131.
- Moradi, A., & Vagnoni, E. (2018). A multi-level perspective analysis of urban mobility system dynamics: What are the future transition pathways? *Technological Forecasting and Social Change*, *126*, 231–243.
- Norton, R. (2008). Using content analysis to evaluate local master plans and zoning codes. *Land Use Policy*, *25*(3), 432–454. [10.1016/j.landusepol.2007.10.006](https://doi.org/10.1016/j.landusepol.2007.10.006).
- Prytherch, D. L. (2021). Reimagining the physical/social infrastructure of the American street: Policy and design for mobility justice and conviviality. *Urban Geography*, 1–25.
- Referat für Stadtplanung und Bauordnung. (2020). Grundsatzbeschluss „Autofreie Altstadt“ und „Altstadt-Radring“. Retrieved December 21, 2020 from <https://www.ris-muenchen.de/RII/RII/DOK/SITZUNGSVORLAGE/5472337.pdf>.
- Rip, A., Kemp, R., Rayner, S., & Malone, E. L. (1998). Technological change. In *Human choice and climate change* (pp. 327–399). Columbus, OH: Batelle Press.
- Roorda, C., Wittmayer, J., Henneman, P., Steenbergen, F., van Frantzeskaki, N., & Looibach, D. (2014). *Transition management in the urban context: Guidance manual*. Rotterdam: DRIFT, Erasmus University Rotterdam.
- Rydin, Y., Gallent, N., & Ciaffi, D. (2014). Communities, networks and social capital. *Community action and planning: Contexts, drivers and outcomes* (1st ed.). London: Policy Press.
- Sadik-Khan, J., & Solomonow, S. (2017). *Streetfight: Handbook for an urban revolution*. Penguin New York.
- Sarmiento, O., Díaz Del Castillo, A., Triana, C., Acevedo, M., Gonzalez, S., & Pratt, M. (2017). Reclaiming the streets for people: Insights from Ciclovías Recreativas in Latin America. *Preventive Medicine*, *103*, S34–S40.
- Savini, F., & Bertolini, L. (2019). Urban experimentation as a politics of niches. *Environment and Planning A: Economy and Space*, *51*(4), 831–848.
- Späth, P., & Rohracher, H. (2012). Local demonstrations for global transitions—Dynamics across governance levels fostering socio-technical regime change towards sustainability. *European Planning Studies*, *20*(3), 461–479.
- Switzer, A., Bertolini, L., & Grin, J. (2013). Transitions of mobility systems in urban regions: A heuristic framework. *Journal of Environmental Policy & Planning*, *15*(2), 141–160.
- Transport for London. (2021). School streets: Intervention sites vs. Control sites full report.
- VanHoose, K., & Savini, F. (2017). The social capital of urban activism: Practices in London and Amsterdam. *City*, *21*(3–4), 293–311.
- Vasconcellos, E. A. (2018). Urban transport policies in Brazil: The creation of a discriminatory mobility system. *Journal of Transport Geography*, *67*.
- Wolfram, M. (2016). Conceptualizing urban transformative capacity: A framework for research and policy. *Cities*, *51*, 121–130.
- Zieff, S. G., Chaudhuri, A., & Musselman, E. (2016). Creating neighborhood recreational space for youth and children in the urban environment: Play(ing in the) streets in San Francisco. *Children and Youth Services Review*, *70*, 95–101.
- “Park(ING) Day.” 2021. *Park(Ing) Day*, <https://www.myparkingday.org/>.