

FRONTIERS PAPER

Open Access



Sites for sustainability transitions: the interplay of urban experiments and socio-spatial configurations in transforming habits

Anna Baatz^{1*} , Franziska Ehnert¹ and Kristin Reiß¹

*Correspondence:
baatz@ztg.tu-berlin.de

¹ Leibniz Institute of Ecological
Urban and Regional
Development, Weberplatz 1,
01217 Dresden, Germany

Abstract

Urban experiments intervene in selected sites to initiate transition processes. But how do the socio-spatial characteristics of these sites affect urban experiments and vice versa? We address this question by focusing on everyday habits and their reciprocal relationship with the socially produced space that surrounds them. Using conceptual analysis and by means of empirical examples, we consider which socio-spatial narratives, infrastructures and regulations facilitate or hinder urban experimentation. Rather than treating space as a pre-determined neutral stage, we conceptualise it as socially produced configurations that both affect interventions and are shaped by them. The transactional pragmatist perspective allows us to conceptualise how everyday habits can be disturbed and transformed in experimental processes. This notion is enriched by a socio-spatial categorisation of three aspects that co-constitute space. On this basis we develop an analytical framework to outline four possible dynamics arising from urban experimentation and the changing relations between actors and spaces. Empirical examples from the transdisciplinary research project Dresden – City of the Future: Empowering Citizens, Transforming Cities! illustrate the applicability of the framework. Our conceptual contribution provides a tool for analysing the socio-spatial dynamics of urban experiments. This sheds light on the agency of actors by conceptualising how they engage with socio-spatial configurations. We argue that further research on the role of space in urban experimentation is required to better explicate underlying socio-spatial understandings, while drawing on empirical data to test which socio-spatial concepts provide explanatory power for transition dynamics.

Keywords: Local sustainability transitions and transformations, Urban experimentation, Habits, Space, Transactional pragmatism

Science highlights

- So far, little work has been done to conceptualise how experiments induce changes in habits at particular socio-spatial sites.
- We define socially produced spaces as co-constituted by material, cultural, and regulative elements



© The Author(s) 2024. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

- We develop a framework to analyse how urban experiments can change space and its perception (path creation)...
- ...and, conversely, how space confines actor's scope of action within urban experiments (path dependency)

Policy and practice recommendations

- The relations between urban experiments and habits co-depend on spatial narratives, infrastructures and regulations.
- Therefore, interventions within urban experiments need to engage productively with space to transform habits
- The framework developed in this paper allows to reflect on how space enables and confines (transformative) action.

Introduction

Strategies to initiate sustainability transitions are highly context-dependent, since they only become meaningful through the performance of practices in selected sites (Wittmayer et al. 2014; Bylund et al. 2022; Scholl et al. 2022). Consequently, the specific characteristics of spaces affect the potentials and challenges of sustainability transitions (ST) and, in particular, the transformative potential of urban experiments (UEs). Currently, the analysis of space and ST is the subject of two overlapping debates: (1) The debate on the geographies of ST investigates how “scales, spatialities, and context-specific factors [...] shape transitions” (Binz et al. 2020, p. 1; see also Truffer et al. 2015; Hansen and Coenen 2015). Van den Heiligenberg et al. (2017) and Verhagen (2019), for instance, analyse the habitats in which social and technological experiments emerge and succeed. Habitats are characterised by local or regional aspects such as the presence of tactical knowledge in the form of specialised scientific institutions. (2) The urban transitions and transformations debate “combines complex system studies and urban studies” (Wolfram et al. 2016, p. 18) to investigate “transformations in, of, and by cities” (Hölscher and Frantzeskaki 2021, p. 1). Rejecting the notion of the urban as a neutral stage, relational geographical perspectives are adopted to emphasise the dynamic character of space and its social production (Wolfram et al. 2019; Torrens et al. 2021). Based on this relational understanding, scholars analyse the role of cities and the agency of local actors to (self-) transform. Both debates investigate the dynamics between UEs and their spatial contexts.

Nonetheless, Levin-Keitel et al. (2018) have criticised ST literature as being subject to spatial blindness. One critique is that several domain-based approaches in ST research that focus on specific fields such as energy or agriculture led to a neglect of spatial analyses. This is problematic as many aspects of space are co-produced by various domains: urban areas, for instance, are shaped by practices stretching across domains of mobility, consumption, work, and living. The above introduced fields of geographies of ST and urban transitions and transformations are noteworthy exceptions as they focus on the role of space and emphasise the relevance to integrate single domains and develop a horizontal perspective. However, another point of criticism refers to these two research fields and concerns a lack of understanding of the interdependencies between socially

produced space and UEs (Levin-Keitel et al. 2018; von Wirth and Levin-Keitel 2020; Mölders and Levin-Keitel 2021). On the one hand, critics argue for seeing space as socially produced and relational, and for precisely defining and distinguishing it from other non-spatial configurations. Here they diagnose a lack of analytical clarity and argue for more precise concepts and categories to differentiate what belongs to socially produced space and what does not (von Wirth and Levin-Keitel 2020). On the other hand, they argue to study specific socio-spatial configurations such as concrete regulations regarding the use of streets and to then analyze respective interdependencies such as the ones between legal regulations and mobility modes in a street.

This article aims to generate such knowledge about the reciprocal effects of concrete socio-spatial configurations by focusing on habits at the local level. Based on our understanding of space as socially produced through actions, we argue that it is crucial to investigate the concrete actions that shape space and respectively how they are shaped by space. We thereby adopt a transactional pragmatist perspective that frames actions as habits, emphasising their social nature. We investigate how socio-spatial configurations become relevant for actors and the habits they perform in UE processes. And we analyse how socio-spatial configurations are potentially shaped or changed through habits performed within the UE. By developing our analytical framework with a focus on habits, we depart from previous contributions (e.g. van den Heiligenberg et al. 2017; Verhagen 2019). Van den Heiligenberg et al. (2017), for instance, present aggregated data to argue that UEs led by governmental or economic actors were more often successful in habitats with a regional vision than in habitats without one. In contrast, our analytical perspective aims to open the black box of how specific socio-spatial configurations affect UEs through zooming into processes of spatial (re-)production: First, we explore which socio-spatial dynamics the actors in the UE consider as relevant for the habits they perform. If they mention a regional vision, we subsequently analyse what the vision consists of and which narratives play a role. We delve into how the vision is interwoven with habits of the actors involved in the UE. How does the vision influence habits involved in the UE, or respectively, how is the vision shaped by habits performed in the experimentation process? By focussing on the relations of habits and socio-spatial configurations, we can elucidate the reciprocal dynamics of social space and UEs and better understand how socio-spatial configurations become relevant, influence UEs and are influenced by experimentation. We thus adopt a relational and socio-constructivist perspective to better understand how actors and space are always interrelated.

We thereby understand habits as ways in which actors react to and coordinate with their environment to achieve a certain goal. We argue that capturing the role of space in UEs requires to look at how actors produce space by performing habits and how UEs have an effect on these processes of spatial production and the performance of habits. Thus, we are interested in finding out the extent to which local infrastructures, spatial regulations, norms and narratives facilitate or impede a change in local habits in the context of UEs. Thereby, we do not take socio-spatial configurations as given, but rather investigate how spaces are reciprocally changed through UEs.

This article addresses a specific research gap, namely the interplay of socio-spatial configurations, habits, and UEs (von Wirth and Levin-Keitel 2020). We pursue two research questions: How do interventions by UEs influence habits and, in particular, the socio-spatial aspects that co-constitute those habits? And, conversely, how do the

socio-spatial configurations that co-constitute everyday habits shape, embed, or decouple interventions? By adopting and explicating a socio-constructivist relational perspective on space, we are able to counteract spatial blindness, and contribute to the debates on urban transitions and transformations, geographies of ST and their overlaps (Wolfram et al. 2016; van den Heiligenberg et al. 2017; Verhagen 2019; Torrens et al. 2019, 2021; Dignum et al. 2020; Hölscher and Frantzeskaki 2021). In the next section “[Urban experiments in socio-spatial configurations](#)”, we outline a transactional pragmatist perspective to investigate habits and their changes as well as a socio-spatial categorisation that offers a definition of space and demarcates it from other non-spatial configurations. In the “[Conceptual framework: urban experiments in socio-spatial configurations](#)” section, we develop an analytical framework and distinguish four potential dynamics between actors and socio-spatial configurations that may arise in UEs.

To illustrate these four potential dynamics, we draw on empirical examples from our case study of the transdisciplinary research project Dresden – City of the Future: Empowering Citizens, Transforming Cities!. This research project aimed to co-create knowledge through the collaborative efforts of actors from civil society, politics, public administration, academia and the business sector. To this end, a real-world laboratory was set up, and ten transition experiments were conducted between 2018 and 2022. Here, our focus is on the conceptual aspects. Three UEs serve as empirical examples to illustrate how the theoretical concepts can be applied. The developments of the UEs are elucidated on the basis of interview data. Due to our conceptual stance, the empirical examples integrated in the section “[Conceptual framework: urban experiments in socio-spatial configurations](#)” have an illustrative character. The methodological approach is explained in detail in the [Appendix](#). In the “[Discussion](#)” section four we discuss the analytical framework and the “[Conclusions](#)” section offers some conclusions.

Urban experiments in socio-spatial configurations

This section conceptualises habits and socio-spatial configurations in the context of urban experimentation. The first subsection is dedicated to everyday habits, their interruptions and potential transformations. The second subsection specifies aspects that belong to socio-spatial fabrics of UEs. The concepts are first introduced and subsequently related to each other (“[Conceptual framework: urban experiments in socio-spatial configurations](#)” section).

A transactional conceptualisation of urban experiments at the analytical level of habits

There are different theoretical approaches to the transformations of practices or habits which could serve to analyse the dynamics of UEs and people’s everyday lives. Most prominent are practice theories that were introduced to ST studies to elucidate how current unsustainable dynamics are reproduced in daily life (Shove and Walker 2007, 2010). However, practice theories have recently been criticized for placing too much emphasis on the reproduction of practices (De Roeck and Van Poeck 2023) and thereby neglecting: 1) the actors (Sovacool and Hess 2017); and 2) processes of change (Keller et al. 2022). As actors and processes of change are central to the analysis of experimentation and transformation, we adopt a transactional approach essentially based on the work of pragmatist philosopher John Dewey that “focuses on the continuous, simultaneous and reciprocal transformation of the self and the world and is hence well suited for the study

of processes of societal change” (Van Poeck et al. 2020, p. 7). Matching the problem-orientation of UEs, pragmatism is concerned with real problems emerging in concrete situations rather than hypothetical, abstract or scientific ones (Hollstein 2015). In the following, we outline the transactional pragmatist idea of habits as well as the differentiation between environments and surroundings (Dewey 1938) and argue how these can be conducive for the research endeavour. Dewey and Bentley (1949) describe the relations between humans and the world surrounding them as transactions, characterising these as constant, reciprocal and integrated. This is contrasted with “a mechanistic, interactional perspective where the subject and the environment are seen as independent entities that inter-act” (Van Poeck and Östman 2021, p. 158). The transactional approach thus emphasises that relations between persons and their environments exist constantly. Thereby, actors form habits, “predispositions to act in a certain way in specific activities” (Östman et al. 2019, p. 127). Habits entail ways of thinking, acting and coordinating with environments in order to achieve a specific purpose. Very routinized and rigid habits are summarized as passive ones. Active habits, in contrast, entail potentials for alterations, creativity, and even artistic expression. They can be adapted and oriented towards novel aims (Van Poeck et al. 2020). The use of the word habit further clarifies the references to pragmatist work. In other theoretical lines of thought such as practice theory terms like practices, routines or customs are more familiar. Transactional pragmatism and practice theories both draw attention to the stability and changes of habits or practices and can be applied in order to understand dynamics of sustainability transitions (Shove and Walker 2010; Van Poeck et al. 2020). We further argue that for the capture of spatial effects in processes of change, it is particularly important to consider how space is produced through habits, namely to conceptualise and analyse which socio-spatial aspects actors perceive, and routinely include in their habits, and to analyse when these selection processes deviate from routines and prevalent habits. Striving to better understand how actors coordinate with the external world, we adopt the differentiation between surroundings and environments by Dewey (1938). The former include all physical and non-physical aspects of the world that surround individuals such as discourses, institutions and materials. The environment represents a subset of the surrounding that is relevant for a specific habit of a specific person. Individuals are selectively attentive and do not notice all aspects of their surroundings. Specific elements are “enviored”, that is they are chosen as an environment to perform the habit as intended, they become part of the attentiveness (Bengtsson and Van Poeck 2021; Östman and Öhman 2022). The term *envioring* emphasises that environments are created in actions, dynamically, and based on particularities of specific situations (*ibid.*). *Envioring* ranges from actors noticing novel aspects of the surrounding to their incorporation into long-term habits. These *envioring* processes differ between active and passive habits: while passive habits are characterised by a stable environment, active habits involve intense processes of (re-) *envioring*, so that they can be adjusted to new environments. As expressed by Östman et al. (2019, p. 137), learning an active habit is “to learn specific attentiveness: to select out of the surrounding world a fruitful environment”. Changing the environment is thereby already an integral part of changing the habit. On this basis, the authors define habits in relation to the surrounding world (*ibid.*): habits involve a specific attentiveness and particular strategies for dealing with the surrounding world. We argue that this distinction between surroundings and environments

allows us to analyse which socio-spatial configurations are relevant for the specific habits of actors involved in UEs. Furthermore, it provides us with a vocabulary to describe changes in the selection of environments for habits.

To better understand how such changes take place, we further elucidate how transactional theory conceptualises the formation of active habits. Specifically, passive habits proceed until they are interrupted, at which point the actors hesitate before continuing with the habit. Based on their work in the field of education for sustainable development, Östman et al. (2019) distinguish three types of disturbance that cause people to hesitate: an intellectual disruption challenging the current understanding, a noticed change in the physical environment, and a strongly poignant experience. Similarly, ST scholars identified conversations, the perception of specific narratives and discourses as well as encounters between humans and their material environments as stimuli for reflection (Chabay et al. 2019; Souza et al. 2020). As we are specifically interested in socio-spatial dynamics, which are often difficult to grasp, we provide an example of the latter: Our exemplary person, Martin, drives home and discovers that one of the roads to his house is blocked because of a local festival. This encounter interrupts his driving habit. Actors can deal with disruptions in two different ways. Firstly, they can slightly adapt their habit according to the new situation. Martin could just take a different route home bypassing the blocked street. Secondly, they can reflect on the situation, specify a problematic situation and then develop and test novel solutions. The problematic situation stands hereby not necessarily for something negative, but is to be understood as a disturbance of usual ways of thinking and acting due to a dissonance between the previous understandings of the actor and the interruption, the new encounter (Van Poeck and Östman 2021). The problematic situation depends on the actor, his/her values, emotions, knowledge etc., and can therefore only be defined with regard to a specific dissonance of one or more actors. Actors do not continue with their prior habit as usual and can start an inquiry. Inquiries are experimental processes of meaning-making that incorporate the prevalent knowledge, values, etc. along with the novel encounter. Martin could, for instance, wonder why the street is blocked for cars and be surprised to learn that a festival is going on. He did not know before about the social activities taking place in his neighbourhood. Here, the problematic situation emerges as the dissonance between his previous perception of his neighbourhood and the new encounter of a local festival. In a process of inquiry he might become interested in the festival and stop his habit of driving, park the car and join the people on the street. Inquiries scrutinise the selected environment for habits, actors potentially environ novel aspects while neglecting others. Thereby, inquiries can create new knowledge, norms or skills and induce a replacement of passive habits with active, creative habits (Schubert 2010; Van Poeck et al. 2020).

In the following we aim to apply such transactional terminology to the field of urban experimentation. UEs are designed with the intention of fostering social learning and, as a result, potentially initiating processes of change towards sustainability transitions (Karvonen and van Heur 2014).¹ From a transactional perspective, the experimentation intervenes in people's everyday lives to interrupt unsustainable habits,

¹ Whether UE really do provoke social learning processes, and whether these then contribute to ST, needs to be critically examined both conceptually and empirically (see for instance Von Schönfeld et al. 2020; Baatz and Ehnert 2023).

create problematic situations and potentially engender novel sustainable habits (Hollstein 2015). The transactional understanding of active and creative habits that can be adjusted to novel aims aligns well with the idea of UEs as platforms for creating and testing fresh solutions while also clarifying how such creative solution-seeking can arise. With their intention to interrupt prevalent habits, UEs seem to be constituted mainly by the active type of habits. We argue, however, that passive habits can also co-constitute UEs and single interventions. They can even cause disturbances if frontrunners in the field of sustainability perform routinised sustainable habits that irritate other participants. The emergence of an UE and its interventions are not focused on in this article; this explanation should only enable researchers to identify interventions that build on active and passive habits.

Socio-spatial configurations in urban experiments

Having conceptualised the dynamics of interventions and habits based on the transactional approach, this subsection focuses on space. The terminologies familiar to discussions of space and ST differ from those of transactional theory introduced in the last subsection as they stem from distinct debates. Transactional pragmatism refers to surroundings and environments as concepts that describe the socio-spatial world in relation to performed habits. By writing about socio-spatial fabrics or social space, scholars analysing space and transformations emphasise the social production of space (von Wirth and Levin-Keitel 2020; Bögel et al. 2022). In “[Conceptual framework: urban experiments in socio-spatial configurations](#)” section, we clarify the linkages and distinctions between these terms.

In order to conceptualise space, we introduce a framework developed by von Wirth and Levin-Keitel (2020) to analyse how transition experiments are interrelated with their socio-spatial contexts. The framework has been further developed and empirically illustrated by Bögel et al. (2022) with a focus on socio-psychological aspects of transitions. We appreciate how these articles have distinguished specific dimensions to determine which of these aspects belong to socially-produced space. Such analytical distinctions are particularly useful for conceptualisations and empirical analyses in the field of ST studies, where spatial analyses have often been rather blurred (Levin-Keitel et al. 2018). We argue that such blurriness can be counteracted by defining analytical categories to specify various dimensions of socially-produced space (see also von Wirth and Levin-Keitel 2020). The authors developed such categories by introducing an understanding of space that integrates material and socio-cultural aspects without overemphasising the either one. In line with socio-constructivism, these categories clarify the ways in which space simultaneously structures society and is socially produced, and consequently subject to constant change. As such, space can only be defined as dynamic and processual, which allows us to capture specific processes or states of spatial production, but never persistent characterisations.

Von Wirth and Levin-Keitel (2020) differentiate four dimensions of space, which are interdependent but characterized by specific attributes. The first dimension is the *material-physical* one that “covers all that can be touched and directly perceived in a space” (Bögel et al. 2022, p. 174). This includes nature, materials, infrastructures, and artefacts in space. The material-physical elements of a bicycle road, where bicycles have priority, might, for instance, include the paving stones forming the road surface or installed

street signs. Secondly, the *regulative-institutionalised* dimension refers to laws, regulations, power relations and social norms governing space. These regulate the use of artefacts in space while simultaneously serving to structure space as well as the movements of bodies within space. In our example of the bicycle road, regulative-institutionalised space comprises, for example, speed limits (indicated by traffic signs), which relate to a broader set of road traffic regulations and norms. The third *cultural-symbolic* dimension stands for spatial symbols and meanings attached to materials and spaces. This includes in particular collective symbols. While a resident might associate the bicycle road with their commuting habits, members of a local mobility transition initiative might perceive the street as a manifestation of their successful fight for environment-friendly transport infrastructures. The *action-oriented* fourth dimension refers to the societal production of space. This encompasses local traditions and identities as well as concrete actions that produce space. In the refinement of the framework by Bögel et al. (2022), this dimension is referred to as the “actor and agency” dimension (Bögel et al. 2022). To return to our example, one factor in the spatial production are the users of the exemplary bicycle road who travel along it every day and also park their cars or bikes there.

The four dimensions might not always be readily distinguishable due to their entanglements. This is already visible in our example: street signs clearly have both a material-physical dimension and a regulative-institutionalised dimension – they are associated with specific meanings (cultural-symbolic dimension) and are simultaneously the result and part of spatial production processes (action-oriented dimensions). We do, however, argue that by specifying these socio-spatial dimensions we are able: 1) to systematically analyse socio-spatial relations without overlooking relevant aspects; and 2) to specify those socio-spatial aspects which are relevant to the dynamics under analysis.

Conceptual framework: urban experiments in socio-spatial configurations

In this section we develop a framework for analysing the dynamics that arise from interventions by UEs regarding socio-spatial configurations and their relation to (everyday) habits. We thereby understand urban experiments as purposeful interventions that are observed and reflected upon (Karvonen and van Heur 2014; Ehnert 2022). They involve an open-ended, iterative and collective search for social and technological innovation, and are characterized by their situatedness, contingency and change-orientation (Karvonen 2018). The interventions are supposed to disrupt established habits of persons. Distinguishing between activities of UEs (combining intervention with observation) and other activities is challenging due to their open-endedness. Lang et al. (2012) define three ideal-typical phases of transdisciplinary research processes: co-design, co-production, and evaluation/ reintegration of knowledge into scientific and societal practice. The empirical examples we introduce in the following focus on the co-production phase, in which the experiments were already co-designed and are now being implemented by realizing interventions. To derive the framework, we combine the transactional concepts and the socio-spatial dimensions. Figure 1 illustrates the overall theoretical framework. In particular, it focuses on the processes by which habits are interrupted, problematic situations are experienced, inquiries are initiated and modes of enviroing are changed. Based on the definition of habits as (accustomed) ways of how actors select environments and coordinate with these, we

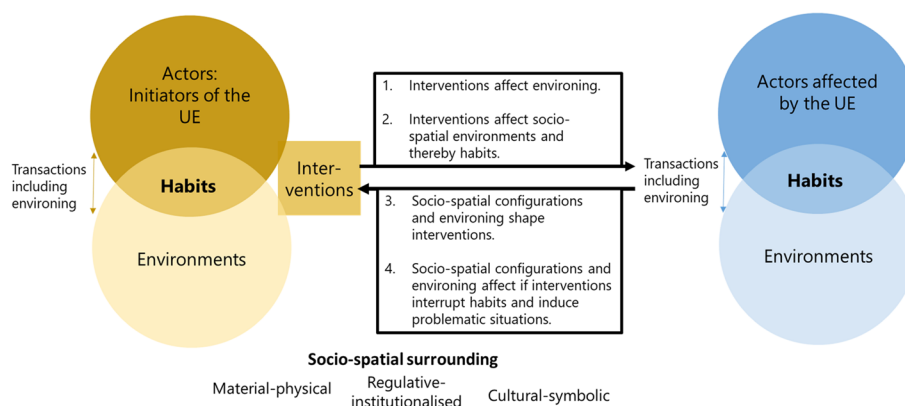


Fig. 1 Dynamics of interventions, habits and space

depict habits as formed out of the transactions of actors and their environments. In Fig. 1, the overlaps of the blue and yellow circles illustrate how actors engage in transactions with their surroundings, select a useful environment (environing) and thereby develop habits.

In our framework, we focus on the transactions of actors with socio-spatial aspects, though researchers can set different foci here and also elucidate transactions with interpersonal aspects (such as interactions or power relations) or institutional aspects (e.g. traditions or discourses) (Van Poeck and Östman 2021). We distinguish between the habits of the persons initiating the UE (yellow circles on the left) and the habits of the persons being affected by those interventions (blue circles on the right). Based on this, we conceptualise interventions by UEs as sequences of active and passive habits of the actors initiating the interventions. Thereby, we acknowledge that roles in UEs are fluid, i.e. persons might become both during an UE, namely an initiator of an intervention *and* a subject to the same intervention. Despite these overlaps between the two actor groups, we argue that the analytical distinction is important because it makes it possible to differentiate the habits performed within or interrupted though the experimentation from the habit performed independently from the UE.

The black arrows in Fig. 1 represent the linkages addressed in our research question: How do interventions by UEs influence habits and, in particular, the socio-spatial aspects co-constituting those habits (upper arrow)? And, conversely, how do socio-spatial configurations and habits of spatial production shape/embed interventions (lower arrow)? In our figure, the arrows are intended to depict a transactional rather than an interactional understanding. Unfortunately, it is difficult to illustrate transactions by means of a two-dimensional static figure – particularly when the aim is also to illustrate specific dynamics and not just mutual entanglements. Therefore, we specifically emphasise the transactional nature of the arrows, which represent constant and reciprocal relationships between interventions and habits.

In the course of this section, we aim to analytically distinguish between:

- how interventions shape socio-spatial configurations, enviring and habits;
- and how socio-spatial configurations and enviring shape interventions.

On the basis of transactional theory, we assume interdependencies between these two directions of effect, however, we argue to separate them to be able to identify and investigate specific relations. To conceptualise space, we turn to the previously introduced framework of von Wirth and Levin-Keitel (2020) that distinguishes between physical-material, regulative-institutionalised, cultural-symbolic, and action-oriented space. While adopting the first three dimensions, we adapt the action-oriented dimension based on a criticism of the frequently used territory-place-scale-network framework (TPSN) developed by Jessop et al. (2008). Similar to the framework of von Wirth and Levin-Keitel, the TPSN framework outlines four dimensions of socio-spatial relations: territories, places, scales, and networks. Equivalent to the action-oriented dimension, TPSN defines place as a dimension that captures the production of space. This definition attributes a superior role to the dimension of place; the other dimensions in the TPSN framework constitute the foundation for and the result of processes of spatial production, and are consequently less generative than place (Casey 2008; Gailing et al. 2020). We find that a similar theoretical inconsistency applies to the action-oriented dimension. Consistent with the argument that actions produce space, we decided to place our analytical focus on habits. This allows us to investigate how change emerges from the practices of particular actors (Van Poeck and Östman 2021, p. 168). Accordingly, we do not position actions or habits as part of any socio-spatial configuration; rather, we view actors and socio-spatial configurations as counterparts that constantly transact and thereby co-constitute habits.

Further, in applying the transactional line of thought, we are only referring to the socio-spatial aspects of environments and surroundings. Although these terms sound like spatial concepts, they originally also included non-spatial aspects such as discourses or power relations. We refer to all three dimensions as socio-spatial “configurations” to make clear that: 1) spaces are sites of UEs as well as subjects of change; 2) spaces are processual, i.e. they underlie constant social production; and 3) their dimensions are highly entangled. We further distinguish between surroundings and environments when this helps to specify changes in perceptions (on the added value, see 2.1). Although originating from different debates, the fact that the transactional pragmatist approach and the socio-spatial frame both consider materials and spaces in relation to their context of use (Löw 2016, p. xiv) enables their integration in our overall framework. In the following, we distinguish between two dynamics of how interventions shape spaces (1. and 2. in Fig. 1), as well as two dynamics of how socio-spatial configurations shape interventions (3. and 4. in Fig. 1). These are briefly summarised in the black boxes in Fig. 1. Transactional pragmatism conceptualises habits as being formed by enviroing, by using and relating to existing socio-spatial configurations. This is mirrored in the first two dynamics. The first one describes how interventions might change modes of enviroing and the second one how interventions might cause changes in socio-spatial configurations (such as the introduction of novel infrastructures) that then might affect habits. The third and the fourth dynamics describe how interventions are shaped through socio-spatial relations. The third dynamic focuses on how the intervention itself is shaped and potentially embedded or detached from local particularities. The fourth dynamic deals with the potential effects of interventions on habits. It analyses how socio-spatial configurations

and environing modes reproduce habits (stability) or potentially disrupt habits (disruption).

After elaborating on each of the four dynamics in the following four subsections, we will provide empirical illustrations from three UEs. The main source for identifying relations were qualitative semi-structured interviews with initiators, participants or affected persons of the UEs (for detailed information on the interviews and the qualitative content analysis, see the [Appendix](#)). To analyse the data, we searched first for passages that deal with socio-spatial configurations and how they became relevant. Then, we reconstructed whether habits were interrupted, if and how socio-material configurations mattered in this process, and if modes of environing changed.

Interventions affect environing

The first dynamic refers to how interventions shape actor-environment transactions and the selection of specific socio-spatial aspects that form an environment for a habit (environing). The interventions of UEs may induce a disruption of prevalent habits. Thereby, habits of the initiators of the intervention can be interrupted as they encounter surprises in implementing the intervention, as well as, habits of persons who are not involved in the organisation but are just affected by it. As part of an inquiry, the actor(s) might direct their attention to aspects that were not previously included in the environment for a habit; they environ novel aspects out of the surrounding that then become part of an actualised environment. Actors could also engage in novel habits in the course of the UE and then need to select an environment for the new habit. Thereby, the interventions affect which aspects of the three socio-spatial dimensions constitute the environment for a habit. For the analysis of transformative potentials, it is important to determine how persistent the change of the environing is: Does the renewed environing occur exclusively during the participation in the UE, with participants later returning to the passive habits they carried out before the intervention? Or are the environing processes of habits also altered outside the UE? Further, it is vital to consider the extent to which the reconfigured environments function to transform prevalent habits.

In the following, we will illustrate this dynamic with an empirical example from the UE Edible City District Plauen (EP). This experiment aims to increase the consumption of locally grown and publicly accessible food. The initiators state that their vision is for an “edible district” in which residents appreciate and consume locally grown food. To realise this vision, the UE intends to change human-food relations by enhancing the appreciation of food. Interventions by the UE include district walks and workshops aimed at imparting knowledge of wild plants already growing locally as well as on the processing of those plants.

One of the two coordinators of the UE set up a district walk led by an expert on wild-plants. In a qualitative interview, she reports how she was affected by attending this district walk and the insights conveyed by the expert. She outlines how – even though she organized the district walk- she encountered novel knowledge and developed a fascination for wild-plants: *“I now have an intense interest in edible plants and actively search for them. I wasn’t that much of a plant specialist before. But now I think I have a pretty good knowledge; and no matter where I am in the city, I’m now always fascinated by what’s growing there. I think that I also move differently in other parts of the city, just*

because I know what kind of diversity there often is.” [EP1] In the following analyses, we rely on the statements made in the interviews and interpret in how far changes in habits and respective environments were reported. In this quote, there is no clear description of the habits prior to the intervention of the district walk, but formulations such as “I now” or “I wasn’t [...] before” indicate that the interviewee is talking about changes or at least alterations. The interviewee outlines how the workshop gave her knowledge about wild plants that she did not have before and that she found fascinating. The sentence about the fascination is especially interesting because it entails an information about environing: She states that now, after the district walk, she notices the wild plants around her and is fascinated by them. For her, this seems to be an interruption of prior environing routines. She adds that she moves around the city differently now that she notices the biodiversity. This indicates a new way of relating to the environment and a change in habit. Although she is one of the coordinators, she is surprised by certain aspects: The intervention of the district walk made her aware of the diversity of edible plants growing in her district. This change refers to a habit of moving around the city *outside* the UE. She further explains that this environing applies not only to the district but also other parts of the city. The changed perception seems to relate to the physical-material dimension of the plants. However, in other parts of the interview she also addresses the cultural-symbolic dimension, or more precisely the meanings attached to the district: *“You do not specifically have to go somewhere else, but in every district there are certainly edible plants or fruit trees.” [EP1]* This indicates that, by beginning to acknowledge the provision of edible plants for residents of the district, the meaning of the district has changed. This is also evident from the last sentence of the first quote, which relates to the diversity available in the district. Here, not only physical-material configurations have become environed but also novel cultural-symbolic aspects have become part of the environment of her local habits.

Interventions affect socio-spatial configurations

Interventions by UEs can engender new active habits with a specific purpose or directionality. These habits can actively change infrastructures (physical-material space), shift collective spatial meanings and narratives (cultural-symbolic space), or influence norms and laws (regulative-institutionalised space). The changes in socio-spatial configurations can then affect the everyday habits of people who become aware of the changes. In contrast to the dynamic discussed in the last subsection, here the focus is not on the environing process but on the creation of novel socio-spatial configurations and the resulting changes in habits. Both initiators and affected persons can react to new socio-spatial configurations, although the surprise effect is likely to be greater for persons who were not involved in the creation of the infrastructures, narratives or regulations.

Again, we use an empirical example to illustrate the dynamics. The UE District Funds and Councils for Sustainable and Active Neighbourhoods (DF) aims to initiate a sustainable local development by strengthening participation and self-organisation in two districts. The initiators outlined that they assume that residents identify with their districts and are therefore particularly motivated to engage in development measures. The UE sets up district funds to support micro-projects initiated by residents or local associations. Elected district councils then decide how to distribute the funds, based

on (sustainability) criteria. According to the initiators, the underlying objective of the UE is to try to alter the habits of co-living in the district. This includes the everyday interaction of residents as well as shopping habits and, in some cases, the professional practices of people working in the district. In our example for this subsection, a project applicant describes how her institution used district funds to purchase a cargo bike to transport people and bulky goods. The idea, however, goes beyond the mere acquisition of the bicycle: the cargo bike, called a rickshaw, is used to take elderly or disabled people to events, thus promoting multigenerational dialogue. Moreover, the rickshaw is not only available to the applicant's institution, but can be borrowed by anyone in the district: *"We were encouraged to think about what we could do in accordance with the funding guidelines. And so we came up with projects that would certainly not have come about in this way, and which almost all have to do with environmental sustainability. For example, we certainly would not have purchased the rickshaw. That was a big investment. The idea of a cargo bike came up and then people asked: Who could organise that? Who has a shed? And we said, yes, we have a garage. And we can also look after it there. This is a really nice project. And it's also very exciting. People come to us who would never come to us otherwise because they have nothing to do with our institution. And yes, it's also a project that brings together different social groups, because they borrow the rickshaw. We have placed it on a rental platform. And you can pick it up and return it to us. And that's also where you get into conversation."* [DF9] From the quote it appears that the availability of district funding encouraged and enabled the purchase of the rickshaw. In other words: the intervention of setting up a district fund stimulated changes in the physical-material infrastructure of the district. Subsequently, the infrastructural novelty of a cargo bike also affected habits of co-living. While we do not get any insight into how residents became aware of the new rickshaw, the interviewee reports that, due to the new socio-spatial configurations, persons took the chance to rent the rickshaw (new habit) and by doing so encounters were facilitated between people who had not previously met (new habit 2). Here, persons from the district got involved who were previously not (as they did not participate in the district council, as well as the acquisition of the rickshaw). The availability of the rickshaw was the trigger for adopting new habits.

Socio-spatial configurations and envioning modes shape interventions

Socio-spatial configurations can also affect the transformative potential of interventions by UEs. Again, we distinguish two dynamics. First, socio-spatial configurations, as well as modes of envioning, can shape interventions. They can strengthen the perception and reception of interventions, facilitate their embedding in local contexts, or encourage the adaptation of an intervention to socio-spatial particularities. Equally, spatial configurations and envioning patterns can also contribute to counter-dynamics that tend to result in interventions receiving little attention or being perceived as inappropriate to the spatial context. Envioning patterns of both, the initiators of interventions and the persons affected by the interventions can play a role. This subsection captures all those unforeseeable dynamics that can arise during experimentation in real-world settings and affect the intervention itself or its perception. Our example stems from the UE Week of the Good Life (WL). The WL aims to redistribute public spaces within the district Dresden Neustadt. The original idea of a car-free week was adapted during the

experimentation process to a car-reduced week, while retaining the aim of creating free spaces for non-commercial activities by residents, associations and institutions. The experiment questioned the primacy of cars in public spaces to demonstrate that the district would be more liveable without cars. Non-commercial activities were planned, such as a neighbourhood dinner, an exchange platform and sports events. Further, a mobility concept was developed and coordinated with the relevant authorities. Unfortunately, due to the pandemic lockdown and administrative challenges, the car-free week could not be implemented. However, the UE caused several discussions within the district during the planning process. It addressed mobility habits as well as habits of co-living in the district with a focus on non-commercial activities in public spaces. The main intervention was supposed to be the liberation of the district from cars for one week, a step that had to be authorised by and coordinated with the public administration. The initiators explicitly located their UE at the scale of the urban district Dresden Neustadt, so that the mobility intervention could be applied to this respective area, addressing all residents and commuters in this district. In our qualitative interviews, we explicitly asked if and to what extent the scale of urban districts was a favourable or obstructive space for the UE. One interviewee, who was involved in the approval procedures for the mobility experiment and mobilised support for the UE within the public administration, outlined his perspective that, on the one hand, locating UEs in districts enables the intervention to be adapted to the local conditions, specifically to the ways *“the district ticks and functions, [...] to the local actors”* [WL1]. While acknowledging that there are differences between districts, he argues that this socio-spatial scale is generally highly suitable for the identification and activation of local people. He reasons that these aspects relating to cultural-symbolic space support the implementation of a car-free week as well as the emergence of collective, non-commercial activities. On the other hand, he believes that districts are not an adequate scale for mobility experiments in terms of regulative-institutionalised space: *“The challenge is, of course, that a district cannot manage such things as the WL on its own. It requires the support of the entire city. If it remains just a district project, the impact will probably be insufficient, and the WL is clearly a project of citywide significance. The entire administration must support this.”* [WL1] He elaborates that the mobility intervention as intended by the initiators was difficult to implement at the district level due to the interdependencies with higher governance levels. He further emphasises that the intended impact of the UE, namely to alter mobility habits, might be diluted if the UE is conducted only within one district. Here, the socio-spatial configurations are characterised as unfavourable for the implementation of the intervention. Later in the interview, he clearly states that the success of implementing a Week of the Good Life depends on the support of local politicians and the public administration, thus highlighting the relevance of regulative-institutionalised space for the mobility intervention.

Socio-spatial configurations and enviroing co-determine the triggering of problematic situations

The socio-spatial configurations and the modes of enviroing can co-determine whether interventions trigger problematic situations and initiate inquiries to find novel solutions. As defined in above ([A transactional conceptualisation of urban experiments at the analytical level of habits](#) section), problematic situations resemble

an interruption of a habit due to an irritation of the actor – a dissonance between the actor's previous understandings and what (s)he encounters newly. Interventions are intended to interrupt the everyday habits of participants, to make them hesitate to continue with their habit (problematic situation) and to reflect on their own habits (inquiry). In this process, it cannot be foreseen just when and how problematic situations may emerge and inquiries be induced. The personal values of individuals can, for instance, affect whether they experience problematic situations. Persons who are not interested in ecological issues, may simply disregard information about the climate crisis and continue with their everyday lives as usual. Equally, socio-spatial configurations and modes of enviroing can determine whether problematic situations and inquiries are triggered or business goes on as usual.

Once more we take as our empirical example the UE Week of the Good Life, introduced in the last subsection. Here the intended intervention was to close the street to cars and open it to local residents. The aim was to trigger problematic situations and inquiries by encouraging people to experience and reflect on the disadvantages of cars and the advantages of a reduction in their use. In this example, we consider the reactions of a resident to the proposed car-free week, who followed the announcements of the week but was not further involved in organizing it: *"The project team seem to be yuppies. The website comes across as very dreamy and the social issue is not sufficiently addressed. I'm worried it will strengthen gentrification. It used to be a rundown neighbourhood with people who wanted it that way. Now it's being taken over by financially strong parties. Pubs are being pushed out. The ecological aspiration is good. Basically, the cars bug me too."* [WL_short11]. The resident would have been affected by the intervention and states to worry about gentrification. He underlines his perception that the initiators do not understand the district and are therefore part of the problem. Later in the interview, he reports that he had planned own activities during the Week of the Good Life that should thematise housing development and gentrification, but that he did not want to reveal any more insights. While acknowledging the benefits of car reduction, he is concerned by aspects of cultural-symbolic space ("the website comes across as very dreamy") and cultures of coexistence in the neighbourhood. The planning of his own contribution to the week demonstrates that his habits were interrupted by the planned intervention of a car-free week and that he felt the need or wish to react. This shows that a problematic situation arose. He needed to make sense of the planned mobility experiment and had the desire to position himself in relation to it. In his statement, the interviewee focuses on the main problem he identified: the threat of gentrification. He describes how the images transported by the experiment triggered this concern in him and how that troubled him, causing a dissonance, a problematic situation. Although in principle he also feels disturbed by the cars in the district, he does not environ this aspect, because this is overlaid by his concern about gentrification. This reaction and the enviroing of these cultural-symbolic aspects of space, do, on the one hand, support the planned intervention as the coordinators wished for the participation of the residents such as this (critical) contribution. His enviroing aligns with the enviroing of the initiators in so far as both see advantages in reducing the number of cars. On the other hand, he opposes the mobility experiment, and questions the

legitimacy of the coordinators, which probably rather hindered the implementation of the car-reduced week and undermined the idea of the experimentation.

Discussion

In this article we develop and empirically illustrate a framework for analysing the social production of space in and through UEs. The focus is on the interplay between transformation-oriented interventions and socio-spatially located habits. We conceptualise how actors perform habits within socio-spatial configurations and potentially transform them. In this discussion section, we reflect on our analytical framework and argue that it can enhance the understanding of the relationship of agency and space in ST studies. Ongoing debates in ST studies focus on both, agency and space, and outline their relevance in understanding how to initiate and accelerate STs (Truffer et al. 2015; Pesch 2015; Fischer and Newig 2016; Binz et al. 2020; Hölscher and Frantzeskaki 2021; De Roeck and Van Poeck 2023). On the basis of our framework, we argue that agency in ST should be understood as embedded in socio-spatial configurations. Our analytical framework elucidates the conditions for and limits of agency by shedding light on how space becomes relevant in action.

Here, space is understood as a relational arrangement of bodies and materials as produced through actions as well as pre-structuring actions (Löv 2016, p. xiv). Our framework conceptualises how actors involved in UEs can environ novel socio-spatial aspects out of their surrounding while excluding others; and transform socio-spatial configurations by changing these physically (physical-material), assigning different meanings to them (socio-cultural), or regulating their use in new ways (regulative-institutionalised). Both of these actions serve to change the socially-produced space (path creation) and mirror how actors can exercise agency by enviroing or transforming specific socio-spatial aspects. Conversely, (the stability of) socio-spatial configurations act to limit actors' scope of action. These configurations co-determine whether interventions can be implemented and to which extent they transform habits (path dependency). The relationships outlined by the analytical framework allow us to pinpoint those instances where agency is exercised within or beyond existing socio-spatial configurations and those situations where existing socio-spatial configurations or respectively actor-environment transactions hinder change and confine the agency of the persons aiming for transitions.

We introduced a transactional perspective to depict how agency is exercised in action in UEs (for a detailed analysis of agency in action see also De Roeck and Van Poeck 2023). In doing so, we follow the understanding of agency as emerging in specific situations and relations instead of being a property of persons due to their profession, or belongingness to a regime or niche. By foregrounding socio-spatial configurations and how they enable or constrain agency, we background several other factors that are relevant to pinpoint agency such as intrapersonal, interpersonal and institutional factors (for an introduction of these factors see Van Poeck et al. 2020).

Our contribution further refers to the debates on space in transitions (Hansen and Coenen 2015; Wolfram et al. 2019; Binz et al. 2020). By adopting and adapting the socio-spatial categories developed by von Wirth & Levin Keitel (2020), we make our understanding of socio-spatial configurations explicit, demarcate them from other non-spatial aspects and thus provide a tool for empirical analysis. However, empirical work

is still needed to review how well they capture socio-spatial dynamics in UEs. To this end, it would also be conceivable to include other socio-spatial concepts in the analytical framework in order to reflect empirical findings and to enhance the understanding of surroundings, environments and their relationship. Here, different concepts of space (place, network, scale, territory as the most commonly listed in the debate, cf. Jessop et al. 2008) could be relevant. An especially insightful concept in this respect refers to different notions of *proximity* (Boschma 2005). Stemming from an interest in the emergence of innovations, Boschma (2005) argues for considering not only geographical, but also cognitive, organisational, social and institutional proximity relations. These represent the field of tension between proximity and distance in a physical-spatial sense (geographical) with regard to similarities in states of knowledge (cognitive), shared norms and rules of conduct (institutional), capacities to coordinate (organisational), personal ties and social relations (social). Ibert et al. (2014) reason that the various proximity-distance relations co-constitute lived space. For a long time, studies on the relevance of these different proximity dimensions have been conducted exclusively in economic-geographical contexts and drawn primarily on collective actors (companies). Currently, there is an increasing commitment, especially in ST studies, to examine the proximity dimensions in social networks between individuals and in the emergence of e.g. social innovations (Lopolito et al. 2022; Reiß and Artmann 2023). Analyses of social innovation that entail (amongst other processes of change) reconfigurations of practices (Howaldt and Schwarz 2010, p. 54), strike a substantive link to the habits examined in the context of this study. Subsequently, the concept of proximity could sharpen our understanding of surroundings and environments. Combined with empirical findings on how proximity becomes relevant in action, we could gain insights into the conditions of environing socio-spatial aspects. For instance, do close personal ties involved in a transaction increase the probability of environing specific socio-spatial aspects? The various types of proximity could expand the analytical framework presented in this paper, directing attention towards the role of networks, personal relations as well as institutionalised norms and codes of conduct.

A particular challenge in developing the framework was to define which habits are included in the analysis. The challenge stems from the fact that urban experiments dealing with real-world problems and being characterized through openness (Karvonen 2018) do not have clearly delineated target groups or habits they target. In order to identify the dynamics associated with the UEs, we refer to the habits of the initiators of interventions and the habits that were affected by the experiment. However, a theoretical and empirically informed discussion on how to identify the habits that co-constitute an UE and habits that are affected by it could sharpen research endeavours concerning urban experimentation. A similar argument is made by R uchle (2021) with regard to better conceptualising the relations and boundaries between habits of experimentation and professional habits of urban planning.

Conclusions

In this article we develop and empirically illustrate an analytical framework for analysing the interplay of UEs and socio-spatial configurations by focusing on the habits of the different actors involved in the experimentation. We argue that the debate on

space in ST should be broadened to include a perspective on concrete transactions between actors in UEs and local socio-spatial conditions, thereby shedding light on socio-spatially embedded agency. In accordance with von Wirth and Levin-Keitel (2020), we emphasise the importance of explicating a socio-spatial understanding by formulating what belongs to socially produced space and demarcating it from other, non-spatial aspects. To answer our research questions on the interplay of interventions, habits and socio-spatial configurations we derive four potential dynamics: First, interventions within UEs can change enviroing modes, the ways in which actors perceive their environments and select aspects as relevant for inclusion in their habits. Second, interventions can change physical-material, cultural-symbolic or regulative-institutionalised aspects of space, which might than affect prevalent habits. Third, socio-spatial configurations and modes of enviroing can shape interventions and how they are received. The fourth dynamic captures how socio-spatial configurations and prevalent modes of enviroing shape the extent to which interventions interrupt existing habits of actors. These four dynamics can be used as an analytical lens to reflect in how far socio-spatial configurations became relevant, enabling or confining agency. They can further deepen our understanding of transactions that define and are evoked by particular UEs.

In conclusion, we would like to pinpoint three areas where further research is needed to extend our conceptual contribution. First, the extent to which the three dimensions of physical-material, socio-cultural and regulative-institutionalised space specified in this paper can help us understand socio-spatial dynamics in UEs should be explored. Data indicating socio-spatial dynamics not captured by these three dimensions could provide some counterevidence, revealing which socio-spatial concepts should be considered instead.

Second, research needs to refine methodologies that capture how physical-material, socio-cultural and regulative-institutionalised space become relevant in transactions. Augenstein et al. (2022) map suitable methods for the integrated data collection on socio-spatial and socio-psychological mechanisms of change in real-world laboratories. In doing so, they identify specific methods, such as the analysis of physical-material changes using maps, as well as more generic methods, such as interviews or actor analyses to collect data on various socio-spatial and socio-psychological mechanisms. We agree with their plea for methodological pluralism and propose that methods capturing socio-spatial configurations should be combined with methods providing access to people's enviroing processes. In particular, methods such as Think-Alouds (also proposed by Augenstein et al. 2022), which encourage respondents to comment on maps or policy documents, can complement other data collection methods. Both, methods of data collection and analysis require further development and, in particular, empirical testing. One starting point for an analytical method could be Practical Epistemological Analysis (Wickman and Östman 2002), which was found to be well suited for transactional analyses (Van Poeck and Östman 2021). Its added value lies in the systematic identification of disturbances and gaps, and the subsequent tracing of how enviroing occurs (Van Poeck and Östman 2021, p. 160).

Third, further empirical research could identify patterns of agency-space dynamics to suggest new strategies for dealing with specific socio-spatial configurations, while

delivering useful approaches to both the scaling up of UEs and the reconfiguration of habits at the original sites.

Appendix

Appendix A. Overview of “blinded project 1”

The empirical examples presented in “[Conceptual framework: urban experiments in socio-spatial configurations](#)” section, stem from the transdisciplinary research project Dresden – City of the Future: Empowering Citizens, Transforming Cities!. Actors from civil society, politics, public administration, academia and the business sector were involved in the research project to co-create knowledge on fostering sustainability transformations in Dresden and to experiment with novel ideas. The empirical examples presented in this article were implemented during the third phase of the research project, the experimentation phase between 2019 and 2022 (see [Appendix B](#)). A real-world laboratory was set up and ten transition experiments were conducted to encourage the co-production of knowledge. Based on the principle of triangulation, several methods of data collection were combined (see [Appendix C](#)). Important background information and documents relating to the UEs were collected through desktop research. For participatory observation, strategic project meetings and events were attended. Protocols of observations were prepared in such a way as to be able to trace the enviroing of persons when it became visible in the meetings. Moreover, key actors were interviewed and invited to workshops/focus groups. Interview questions related to the role of space for the experimentation processes and the interviewees’ perceptions of it. The data were analysed according to a transactional pragmatist understanding. Categories for the qualitative content analysis were derived from the conceptual framework developed in this article (see [Appendix D](#)).

Appendix B. Overview of the three urban experiments

	Blinded UE1	Blinded UE2	Blinded UE3
Domain of action	Participation	Mobility, urban development	Edible city
Aim	Strengthen decentralisation and participation and thereby initiate local sustainable development	Reduce cars in the district for a week, use free spaces for humans and non-commercial activities to contribute to 1) a mobility transition and 2) to sustainable co-living in the district	Increase consumption of locally grown food and thereby change food consumption and production habits
Motivation	Enable self-organisation and sustainable districts	Change unjust space allocation, create non-commercial areas	Change human-food relations and increasing local food consumption
Actors/ initiators	Civil society actors: district associations, two coordinators were employed that both live in the respective district	Civil society actors: residents cooperated with a local association, two coordinators were employed that do not live in the district	Civil society actors: cooperation with a local sustainability initiative, two coordinators were employed that do not live in the district
District	Johannstadt and Pieschen Süd/ Mickten	Äußere Neustadt	Plauen

	Blinded UE1	Blinded UE2	Blinded UE3
Characteristics of the districts	Residential areas, in Johannstadt very multi-cultural, in Pieschen mainly young families	Trendy neighbourhood with many cafés, bars, and restaurants, rich in (sub-)culture	Residential area, some active initiatives

Appendix C. Overview of collected data by UE

Data collection	Cases: Urban experiments		
	DF	WL	EP
Number of qualitative semi-structured interviews	13	6	3
Participatory observations	26	18	8
Short interviews	n = 11	n = 14	-
Focus groups	4	4	4

Appendix D. Coding scheme for qualitative content analysis

Code	Description	Example
Socio-spatial configurations <i>Only used if no clear classification of a sub-code possible</i>		
1) Physical-material	Everything that can be seen or touched, physical infrastructures, objects within the room	“Well, I think that in order to really involve the people, I think that a... project area would have been quite good, where people could have joint planting activities and think about things together. So a kind of community garden with a focus on wild fruit or perennial plants, maybe even? Then also vegetables and so on. That would have been nice, but somehow we couldn't find suitable field. There was once an area under discussion, but it was also very shady” [EP2]
2) regulative-institutionalised	Laws, regulations, power relations and norms that regulate the use of space	“This big question of ownership. Which was also very, very difficult in the mapping. What is perceived as public? And what is perceived as private? Sometimes you can't tell. If there's a fence in front of it, it doesn't have to be private, and vice versa. I think that's the biggest question that people often ask about orchards: Yes, who does this actually belong to? Are we allowed to harvest it at all?” [EP1]
3) cultural-symbolic	Spatial symbols, meanings, identities (collective and individual ones)	“And they have overreached themselves a bit. They said ‘We're empowering ourselves now.’ But the New Town is relatively colourful and individual. So not everyone is immediately impressed. When they say the Federal Ministry, the Chancellor is coming. It didn't make an impression. And people said, ‘I'll always decide that for myself. What happens here or whether it has to happen to me.’ [Wdgl6]

Code	Description	Example
Agency: Habits		
<i>Only used if no clear classification of a sub-code possible</i>		
1) Active, creative habits	Habits that deal with solving existing problems through new behaviours, creative, experimental, “searching” habits, there must also be a reference to socio-spatial configurations in the interview passage	“[name] then asked someone in the municipal administration whether she could install insect hotels on this meadow at the Waldschlösschenbrücke and plant these bulbs. And they already said I think in October or November because of Corona you don’t need to expect a feedback before the middle of next year. That is of course problematic, when we see our implementation periods, that it has to be completed in the old year.” [DF4]
2) Passive habits	Existing, routinised, unquestioned habits, in the interview site there must also be a reference to socio-spatial configurations	“I don’t think there were many projects registered by citizens [<i>as contributions to the week of the good life</i>]. So I would put the participation of the 15,000 residents concerned here at almost zero. From my impression, however, it can be wrong.” [WL4]
3) Environing	The process of selecting a socio-spatial environment (out of the surrounding) for a habit	“I walk more consciously through the streets, look more consciously and think about whether the traffic situation can perhaps be changed. I have to say that awareness of the problems has increased through the project.” [WL1]

Abbreviations

- ST Sustainability transitions
- UE Urban experiment
- UEs Urban experiments
- EP Edible City District Plauen
- DF District Funds and Councils for Sustainable and Active Neighbourhoods
- WL Week of the Good Life

Acknowledgements

The interviews that serve as empirical examples have been conducted in cooperation with Martina Artmann, researcher in the project „Dresden – City of the Future: Empowering Citizens, Transforming Cities!”. We thank her very much for the cooperation. We further thank Katrien van Poeck, Martina Artmann, Meike Levin-Keitel, Paula Bögel and Karoline Augenstein for their valuable feedback on earlier versions of the article. We particularly thank the TE teams for their commitment and inspiration. We also thank two anonymous reviewers for their valuable feedback.

Authors’ contributions

Anna Baatz: Conceptualization, Methodology, Formal analysis, Investigation, Writing- Original Draft, Writing—review & editing, Visualization. Franziska Ehnert: Conceptualization, Methodology, Investigation, Writing—review & editing, Supervision, Project administration, Funding acquisition. Kristin Reiß: Conceptualization, Methodology, Investigation, Writing—review & editing

Funding

Open Access funding enabled and organized by Projekt DEAL. This work was supported by the German Federal Ministry of Education and Research [grant number 13ZS0057B], which played no role in framing the research or interpreting results.

Availability of data and materials

The authors confirm that the data supporting this conceptual contribution are available within the article.

Declarations

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Received: 10 March 2023 Accepted: 20 December 2023

Published online: 31 January 2024

References

- Augenstein K, Bögel PM, Levin-Keitel M, Trenks H. Wie entfalten Reallabore Wirkung für die Transformation? Eine embedded-agency perspective zur Analyse von Wirkmechanismen in Reallaboren. *GAIA*. 2022;31:207–14. <https://doi.org/10.14512/gaia.31.4.4>.
- Baatz A, Ehnert F. Reframing places, communities and identities: social learning in urban experimentation. *Sustain.: Sci. Pract.* 2023;19:2207369. <https://doi.org/10.1080/15487733.2023.2207369>.
- Bengtsson S, Van Poeck K. What can we learn from COVID-19 as a form of public pedagogy? *RELA*. 2021;12:281–93. <https://doi.org/10.3384/rela.2000-7426.3386>.
- Binz C, Coenen L, Murphy JT, Truffer B. Geographies of transition—from topical concerns to theoretical engagement: a commentary on the transitions research agenda. *Environ Innov Soc Transit.* 2020;34:1–3. <https://doi.org/10.1016/j.eist.2019.11.002>.
- Bögel PM, Augenstein K, Levin-Keitel M, Upham P. An interdisciplinary perspective on scaling in transitions: connecting actors and space. *Environ Innov Soc Transitions.* 2022;42:170–83. <https://doi.org/10.1016/j.eist.2021.12.009>.
- Boschma R. Proximity and innovation: a critical assessment. *Reg Stud.* 2005;39:61–74. <https://doi.org/10.1080/0034340052000320887>.
- Bylund J, Riegler J, Wrangsten C. Anticipating experimentation as the 'the new normal' through urban living labs 2.0: lessons learnt by JPI Urban Europe. *Urban Transform.* 2022;4:8. <https://doi.org/10.1186/s42854-022-00037-5>.
- Casey E. Questioning "theorizing sociospatial relations." *Environ Plan D.* 2008;26:402–4. <https://doi.org/10.1068/d9107a>.
- Chabay I, Koch L, Martinez G, Scholz G. Influence of narratives of vision and identity on collective behavior change. *Sustainability.* 2019;11:5680. <https://doi.org/10.3390/su11205680>.
- De Roeck F, Van Poeck K. Agency in action: towards a transactional approach for analyzing agency in sustainability transitions. *Environ Innov Soc Trans.* 2023;48: 100757. <https://doi.org/10.1016/j.eist.2023.100757>.
- Dewey J. *Experience and Education*. New York/ London/ Toronto / Sydney New Delhi: Free Press; 1938.
- Dewey J, Bentley AF. *Knowing and the Known*. Carbondale: Southern Illinois University Press; 1949.
- Dignum M, Dorst H, van Schie M, et al. Nurturing nature: exploring socio-spatial conditions for urban experimentation. *Environ Innov Soc Transitions.* 2020;34:7–25. <https://doi.org/10.1016/j.eist.2019.11.010>.
- Ehnert F. Review of research into urban experimentation in the fields of sustainability transitions and environmental governance. *Eur Plan Stud* 2022:1–27. <https://doi.org/10.1080/09654313.2022.2070424>
- Fischer LB, Newig J. Importance of actors and Agency in Sustainability Transitions: a systematic exploration of the literature. *Sustainability.* 2016;8:476. <https://doi.org/10.3390/su8050476>.
- Gailing L, Bues A, Kern K, Röhring A. Socio-spatial dimensions in energy transitions: applying the TPSN framework to case studies in Germany. *Environ Plan A.* 2020;52:1112–30. <https://doi.org/10.1177/0308518X19845142>.
- Hansen T, Coenen L. The geography of sustainability transitions: review, synthesis and reflections on an emergent research field. *Environ Innov Soc Transitions.* 2015;17:92–109. <https://doi.org/10.1016/j.eist.2014.11.001>.
- Hollstein B. Vom Experiment zur Transformation: Handlungstheoretische Anmerkungen. *zfwu.* 2015;16:24–8. <https://doi.org/10.5771/1439-880X-2015-1-24>.
- Hölscher K, Frantzeskaki N. Perspectives on urban transformation research: transformations in, of, and by cities. *Urban Transform.* 2021;3:2. <https://doi.org/10.1186/s42854-021-00019-z>.
- Howaldt J, Schwarz M. "Soziale Innovation" im Fokus Skizze eines gesellschaftstheoretisch inspirierten Forschungskonzepts. Transcript, Bielefeld. 2010
- Ibert O, Müller FC, Stein A. *Produktive Differenzen. Eine dynamische Netzwerkanalyse von Innovationsprozessen*. Transcript-Verlag, Bielefeld. 2014
- Jessop B, Brenner N, Jones M. Theorizing socio-spatial relations. *Environ Plan D.* 2008;26:389–401. <https://doi.org/10.1068/d9107>.
- Karvonen A. The city of permanent experiments? In: Turnheim B, Kivimaa P, Berkhout F, editors. *Innovating Climate Governance: Moving Beyond Experiments*. Cambridge: Cambridge University Press; 2018. p. 201–15.
- Karvonen A, van Heur B. Urban Laboratories: experiments in reworking cities: introduction. *Int J Urban Reg Res.* 2014;38:379–92. <https://doi.org/10.1111/1468-2427.12075>.
- Keller M, Sahakian M, Hirt L. Connecting the multi-level-perspective and social practice approach for sustainable transitions. *Environ Innov Soc Transitions.* 2022;44:14–28. <https://doi.org/10.1016/j.eist.2022.05.004>.
- Lang DJ, Wiek A, Bergmann M, et al. Transdisciplinary research in sustainability science: practice, principles, and challenges. *Sustain Sci.* 2012;7:25–43. <https://doi.org/10.1007/s11625-011-0149-x>.
- Levin-Keitel M, Mölders T, Othengrafen F, Ibbendorf J. Sustainability transitions and the spatial Interface: developing conceptual perspectives. *Sustainability.* 2018;10:1880. <https://doi.org/10.3390/su10061880>.
- Lopolito A, Falcone PM, Sica E. The role of proximity in sustainability transitions: a technological niche evolution analysis. *Res Policy.* 2022;51:104464. <https://doi.org/10.1016/j.respol.2021.104464>.
- Löw M. *The Sociology of Space: Materiality, Social Structures, and Action*. New York: Palgrave Macmillan US; 2016.
- Mölders T, Levin-Keitel M (2021) Sustainable (Post-) Pandemic Cities?: Contested forms of knowledge in urban transformation. *PND Rethinking Planning.* 2021;2:151–63. <https://doi.org/10.18154/RWTH-2021-10426>.
- Östman L, Van Poeck K, Öhman. A transactional theory on sustainability learning. In: Poeck KV, Östman L, Öhman J, editors. *Sustainable development teaching: ethical and political challenges*. London: Routledge; 2019. p. 127–39.
- Östman L, Öhman J. A transactional methodology for analysing learning. *Mind Cult Activity* 2022:1–17. <https://doi.org/10.1080/10749039.2022.2042029>
- Pesch U. Tracing discursive space: agency and change in sustainability transitions. *Technol Forecast Soc Change.* 2015;90:379–88. <https://doi.org/10.1016/j.techfore.2014.05.009>.
- Van Poeck K, Östman L, Block T. Opening up the black box of learning-by-doing in sustainability transitions. *Environ Innov Soc Transit.* 2020;298–310. <https://doi.org/10.1016/j.eist.2018.12.006>
- Räuchle C. Zum Verhältnis von Reallabor, Realexperiment und Stadtplanung am Beispiel kooperativer Freiraumgestaltung. *RuR.* 2021;79:291–305. <https://doi.org/10.14512/rur.41>.
- Reiß, K, Artmann, M. The role of spatial and relative proximity while transforming towards an edible city – The case of the City of the Future Dresden (Germany) *EIST.* 2023; 49100778-10.1016/j.eist.2023.100778

- Scholl C, de Kraker J, Dijk M. Enhancing the contribution of urban living labs to sustainability transformations: towards a meta-lab approach. *Urban Transform*. 2022;4:7. <https://doi.org/10.1186/s42854-022-00038-4>.
- Schubert H-J (ed). *Pragmatismus zur Einführung*. Junius, Hamburg. 2010
- Shove E, Walker G. Caution! transitions ahead: politics, practice, and sustainable transition management. *Environ Plan A*. 2007;39:763–70. <https://doi.org/10.1068/a39310>.
- Shove E, Walker G. Governing transitions in the sustainability of everyday life. *Res Policy*. 2010;39:471–6. <https://doi.org/10.1016/j.respol.2010.01.019>.
- Souza DT, Jacobi PR, Wals AEJ. Overcoming socio-ecological vulnerability through community-based social learning: the case of Lomba do Pinheiro in Porto Alegre, Brazil. *Local Environ*. 2020;25:179–201. <https://doi.org/10.1080/13549839.2020.1714569>.
- Sovacool BK, Hess DJ. Ordering theories: typologies and conceptual frameworks for sociotechnical change. *Soc Stud Sci*. 2017;47:703–50. <https://doi.org/10.1177/0306312717709363>.
- Torrens J, Schot J, Raven R, Johnstone P. Seedbeds, harbours, and battlegrounds: on the origins of favourable environments for urban experimentation with sustainability. *Environ Innov Soc Transitions*. 2019;31:211–32. <https://doi.org/10.1016/j.eist.2018.11.003>.
- Torrens J, Westman L, Wolfram M, et al. Advancing urban transitions and transformations research. *Environ Innov Soc Transitions*. 2021;41:102–5. <https://doi.org/10.1016/j.eist.2021.10.026>.
- Truffer B, Murphy JT, Raven R. The geography of sustainability transitions: contours of an emerging theme. *Environ Innov Soc Transit*. 2015;17:63–72. <https://doi.org/10.1016/j.eist.2015.07.004>.
- van den Heiligenberg HARM, Heimeriks GJ, Hekkert MP, van Oort FG. A habitat for sustainability experiments: success factors for innovations in their local and regional contexts. *J Clean Prod*. 2017;169:204–15. <https://doi.org/10.1016/j.jclepro.2017.06.177>.
- Van Poeck K, Östman LO. Learning to find a way out of non-sustainable systems. *Environ Innov Soc Transitions*. 2021;39:155–72. <https://doi.org/10.1016/j.eist.2021.04.001>.
- Verhagen P. Frontrunner regions for urban sustainability experimentation in Europe: A quantitative approach - SHARE-CITY. Master thesis. 2019
- Von Schönfeld KC, Tan W, Wiekens C, Janssen-Jansen L. Unpacking social learning in planning: who learns what from whom? *Urban Res Pract*. 2020;13:411–33. <https://doi.org/10.1080/17535069.2019.1576216>.
- von Wirth T, Levin-Keitel M. Lokale Nachhaltigkeitsexperimente als raumwirksame Interventionen: Theoretische Grundlagen und Handlungskonzepte. *GAIA*. 2020;29:98–105. <https://doi.org/10.14512/gaia.29.2.7>.
- Wickman PO, Östman L. Learning as discourse change: a sociocultural mechanism. *Sci Educ* 2002;601–623
- Wittmayer JM, Schöpke N, van Steenbergen F, Omann I. Making sense of sustainability transitions locally: how action research contributes to addressing societal challenges. *Crit Policy Stud*. 2014;8:465–85. <https://doi.org/10.1080/19460171.2014.957336>.
- Wolfram M, Frantzeskaki N, Maschmeyer S. Cities, systems and sustainability: status and perspectives of research on urban transformations. *COSUST*. 2016;22:18–25. <https://doi.org/10.1016/j.cosust.2017.01.014>.
- Wolfram M, Torrens J, Castan Broto V, et al. Urban pathways towards sustainability: concepts, knowledge boundaries and a transformative future agenda. In: *Proceedings of the International Sustainability Transitions Conference*, Carleton University, Ottawa. 2019

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.