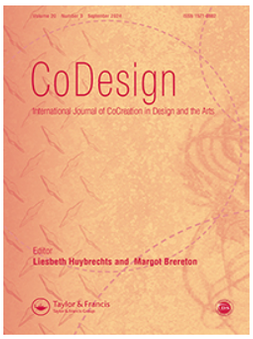

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Dynamics of sustained co-design in Urban Living Labs

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ABSTRACT

Urban Living Labs (ULLs) are increasingly applied to tackle wicked design challenges in smart cities and smart mobility contexts. A persisting challenge for ULLs in urban contexts is creating engagement and scaling research insights and design findings. Drawing on a case study concerned with the co-design of future mobility services, where private and public sectors collaborated to explore future mobility in two different user communities, we explore co-design and scaling dynamics from a participatory infrastructure perspective. Based on the findings, we introduce the concepts of patching and cogitation. Cogitation is defined as a reflective state, which revolves around the act of embracing co-design methods and logic to address a design challenge. Patching is described as an activity that aids in scaling findings and insights from ULLs to support cogitation within the ULL, and the sustaining of findings into other contexts. We argue that the concepts of patching and cogitation can help researchers and practitioners understand the micro-dynamics of engaged co-design and scaling dynamics and provide support when planning, managing, and analysing participatory infrastructures such as ULLs.

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Word; Urban Living Labs; participatory design; participatory infrastructures; sustaining

1. Introduction

Urban Living Labs (ULLs) are used as a way to explore sustainability challenges in cities and urban areas in order to capture opportunities (Voytenko et al. 2016) by engaging with local communities through pluralistic and inclusive approaches (Hillgren 2017). This paper draws on findings from a ULL where citizens, with stakeholders from two cities in Sweden, public transport providers and an automotive manufacturer, engaged in co-designing future mobility services. The ULL focused on open-ended participatory social innovation based on specific situated needs of communities and stakeholders rather than market or product-driven innovation, thereby adopting a pluralistic approach to the design process (Björgvinsson, Ehn, and Hillgren 2012; Bødker et al. 2022b).

Addressing the challenges of dynamics within co-design processes in ULLs and scaling of its results over time, the paper problematises the notion of sustaining co-design through a lens of participatory infrastructures. Thereby, this paper contributes to an

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under-researched area within ULL literature and practice (Ersoy and van Bueren 2020; Nguyen and Marques 2022; Voytenko et al. 2016).

We conceptualise the design of future mobility services as a wicked problem (Rittel and Webber 1973), where fragmentation increases the complexity of co-designing a future mobility service together. Solving wicked design problems, such as the design of future mobility services, tends to rely on building collective intelligence through bringing knowledge together that is otherwise scattered across many organisations and people (Conklin 2005). In turn, as new stakeholders or sources of knowledge are added, the social and technical complexity increases. This fragmentation can be illustrated by how the understanding of the dynamics of mobility services as a complex sociotechnical system remains a key challenge for mobility service development (Karlsson et al. 2020; Zhao et al. 2020). Simply put, the more we learn about the problem, the more complex it appears to be. Furthermore, future mobility services are often built on data-driven emergent technology and depend on algorithms to balance supply and demand. This can be exemplified in the case of Mobility as a Service, where it may be challenging to grasp the potential output of a service and in worst-case, it becomes a black box experience.

Approaching the design of future mobility services from a pluralistic and inclusive perspective therefore requires setting up participatory infrastructures (Teli et al. 2020) with citizens and local communities (e.g. commoning), as well as collaborations between actors, such as city representatives and automotive developers (e.g. institutioning). In the context of a ULL, there is a need to find ways to operate at the intersection of commoning and institutioning to create a common ground where local values and relationships can be explored in order to help shape the direction of future services in a context rife with challenges. These challenges include tensions and uncertainty (Karlsson et al. 2020), scaling, how to engage actors (Smith and Iversen 2018), and the ability to develop a collaboration culture where tasks can be solved with professionals from other disciplines (Löfgren 2020). Challenges which, if not managed, can lead to situations where stakeholders struggle to find their role and find it hard to deal with the explorative nature of a co-design process (Nguyen and Marques 2022).

To explore these dynamics, we will dive into the ULL and explore both the frontstage and backstage of co-design (Bødker et al. 2022a; Bødker, Dindler, and Iversen 2017) to map out the dynamics at play when stakeholders approach these challenges. Such explorations are key to further the research on ULLs as participatory infrastructures for sustained long-term engagement at the intersection of commoning and institutioning.

The aim of the paper is therefore to contribute to the ongoing work of demystifying Living Lab processes by a) studying them on the micro level to provide concrete empirical examples of practices and b) exploring the dynamics of sustaining in a ULL from a participatory infrastructures perspective (Bødker et al. 2022a; Bødker, Dindler, and Iversen 2017; Teli et al. 2020). We, therefore, ask: ***How can co-design be sustained in Urban Living Labs?***

2. Urban Living Labs as participatory infrastructures

2.1. The concept of Urban Living Labs

Urban Living Labs (ULL) has become a popular way for addressing sustainability challenges through an explorative methodology, often modelled as a quadruple helix public-private partnership (Nguyen and Marques 2022). The concept of the ULL draws upon the notion of the Living Lab as an arena for innovation and exploration with end-users and is often described as a methodology grounded in principles such as openness, influence, realism, value, and sustainability (Bergvall-Kåreborn et al. 2009). A ULL can therefore be characterised as a participatory infrastructure with a specific emphasis on tackling sustainability challenges situated in urban communities (Steen and Van Bueren 2017).

2.2. Participatory infrastructures

In order to create impact with a ULL, it is important to gather and engage all relevant stakeholders in co-design (Paskaleva et al. 2015). Stakeholder engagement has been highlighted as an under-researched area within ULLs, where extant research primarily points towards the importance of early buy-in and involvement, and the setup of heterogeneous groups of stakeholders (Paskaleva et al. 2015). Dindler and Iversen (2014) draws upon the concept of 'knotworks' (Bødker, Dindler, and Iversen 2017; Engeström 2013) to describe how these temporary arrangements of stakeholders can be viewed as developing and dynamic knotworks in the context of co-design. A knotwork consists of loose and fluid couplings where stakeholders collaborate towards a mutual goal. However, these knotworks do not manifest out of thin air but are instead often the fruit of the facilitator's labour, as Dindler and Iversen (2014) describes how the facilitator, or design practitioner through their relational design expertise work towards negotiating and nourishing symbiotic agreements among project partners. This can be illustrated by how facilitators of a Living Lab use participatory methods to create trading zones where negotiation of interests and alignment of perspectives are nurtured (Svensson and Ebbesson 2010).

Given that co-design, during recent years, has been employed as a way of working in quite diverse settings, commoning and institutioning have been highlighted within literature on infrastructuring as two distinct Participatory Design (PD) practices (Huybrechts, Devisch, and Tassinari 2022; Teli et al. 2020). Commoning revolves around PD work focused on work of and with grassroots communities, while institutioning focuses on co-design with institutional dynamics (Huybrechts, Devisch, and Tassinari 2022). While ULLs tend to be described as milieus for co-design, they depend on collaboration between both grassroots and institutional actors, making them a context for PD work where practices of commoning and institutioning can intersect.

The intersection between these practices can be illustrated by how establishing a ULL revolves around using methods that are interactive, inclusive and engaging to fulfil the 'living' aspect when approaching citizens (Franz 2015), while simultaneously considering the power dynamics and potential tensions between stakeholder groups (Fitzpatrick and Malmborg 2018). These tensions can challenge, for example, the perception or understanding of the process, timeframes, logics and objective of a ULL. Some of these

challenges can perhaps be explained by how fragmentation acts as a driving force when approaching wicked problems. Wicked problems are often ill-formulated problems, where there are many decision-makers with conflicting values, the information is confusing, and the ramifications of the whole system are confusing (Rittel and Webber 1973). In this paper, we conceptualise future mobility services as a wicked problem since they rely on complex collaborations between stakeholders, with the aim to design services that are resilient enough to handle uncertainty regarding citizens and city needs, infrastructure, types of vehicles and energy consumption in a sustainable way (Coppola and Silvestri 2019; Quilty et al. 2022). The dynamics of the challenges as forces of fragmentation can be illustrated by how each layer (e.g. wickedness, social, technical) increases the complexity of the solution and makes it harder to solve rather than easier (Conklin 2005). In practice, this can be illustrated by how the enrolment of additional actors with their own expertise increases the complexity of the wicked problem, as the more one learns about the context, the more considerations need to be accounted for.

2.3. Sustaining co-design in ULL

In a ULL, long-term engagement is needed to ensure credibility and authenticity in local communities, which can be challenging to uphold in short-term research projects (Franz 2015). However, the reward for long-term engagement in a well-implemented Living Lab approach lies in the potential for rich, in-depth insights (Ersoy and van Bueren 2020; Franz 2015). While extant research has explored long-term participation and engagement of end-users in Living Labs, concerning, for example, satisfaction, motivations, and expectations (Bossen, Dindler, and Iversen 2016; Leonardi et al. 2014; Menny, Palgan, and McCormick 2018), the engagement also concerns involving and engaging other key stakeholders in the Living Lab, such as relevant organisations and their motivations and barriers. Building communities that last, which can be sustained after project funding ends or when key actors, such as facilitators, exit the community is one of the challenges faced within establishing a ULL (Huybrechts et al. 2018). From the perspective of long-term engagement and continued participation in co-design, the facilitator role, and the ability to transition this role to other actors has, therefore, also been identified as a key challenge for continued engagement (Huybrechts et al. 2018). Transitioning the facilitating role can also be a desired outcome in co-design, as making oneself redundant as a design researcher opens up the possibility for a community or institution to continue working in a co-design way even after time-limited funding ends (Teli et al. 2020).

The challenge of building engagement, and sustaining it over time, is not a challenge which is unique for the context of a ULL. Within PD, in particular within the research stream that focuses on infrastructuring, the question of how to sustain co-design has been a key issue for quite some time (Iversen and Dindler 2014; Teli et al. 2020). From an infrastructuring perspective, it is important to not only focus on the frontstage of design activities but to also focus on the fuzzy and chaotic process that emerges before and after these activities. This will aid in the further understanding of how co-design, as an entangled practice, plays a part in creating the structures, networks, and agreements that are crucial to creating sustainable outcomes. An important part of this concerns the need to manage networks of people, as well as the 'knotworks' consisting of fluid yet momentarily stable constellations that emerge between actors with different

backgrounds, agendas, and perspectives (Bødker, Dindler, and Iversen 2017). These knotworks also have the potential to use co-design as a vehicle for reflection that goes well beyond the design of the artefact at hand, to even stimulate a reflection of roles, values, and logics. Both Matthews et al. (2022) and Hillgren, Seravalli, and Emilson (2011) illustrate how co-design can be used to reveal opportunities and dilemmas as well as challenge assumptions, as stakeholders have to position themselves in relation to other actors, thereby also stimulating reflection. There is, however, a dearth of knowledge concerning how these dynamics play out in practice in the intersection of commoning and institutioning (Teli et al. 2020), as seen in the context of a ULL (Ersoy and van Bueren 2020). Therefore, understanding how participatory infrastructures can be sustained over time remains a cross-disciplinary challenge.

According to Iversen and Dindler (2014), there are four ideal-typical forms in which participatory initiatives are sustained: *maintaining, scaling, replicating*, and *evolving*. *Maintaining* concerns how initiatives are integrated into an existing process after a project has ended. *Scaling* concerns how insights from a project can be scaled to a wider group of people. *Replicating* concerns how lessons learned, or ways of working can be replicated in other settings. Finally, *Evolving* concerns how initiatives can be used as a catalyst for continuous development. Together, these four ideal forms of sustainability of participatory initiatives create a more nuanced vocabulary for exploring and expressing how initiatives are sustained (Iversen and Dindler 2014). Given that ULLs are often limited in scope and time, making it sometimes impossible to set up a stable context for the project to live on after the facilitators leave, it is essential to create a strong community of practice, as emphasised by Smith and Iversen (2018), to achieve long-term impact.

Smith and Iversen (2018) extend the literature on participatory infrastructure by introducing the concepts of *scoping, developing, and scaling*. The *scoping* phase focuses on configuring participation in co-design, and 'inventing' the project's organisational and stakeholder roles while still allowing for flexibility over time. In contrast, the *developing* phase involves building literacy and reflective design practice (see e.g. Valkenburg and Dorst 1998). Smith and Iversen (2018) conceptualisation of *scaling* draws upon the work done on sustaining by Iversen and Dindler (2014), by viewing scaling as a concept that also encompasses initiatives as a catalyst for change. Scaling concerns moving from tangible outcomes from an initiative to sustainable social change through, for example, supporting sustainable infrastructures of engagement (Smith and Iversen 2018).

3. Research design: design ethnography and co-design

The A Human Approach II (AHA II) project ran from the autumn of 2019 to the summer of 2021, run by an interdisciplinary research team at Halmstad University. The project was set up as a collaboration between Halmstad University, CarCompany, the city of Gothenburg, the city of Helsingborg, and representatives from public transport in each city. The AHA II project was a continuation of the AHA project, focused on design ethnographic research to align stakeholders and agendas concerning future mobility. Ethical considerations were made in the funder's approval process of the projects, and by

the time of the funding acceptance, there were no requirements for approval from external ethical boards in these kinds of research and development projects.

The aim of the ULL was to create a place where industry, the cities, researchers, and citizens could meet to explore future mobility services together through a design ethnographic approach (Pink et al. 2022; Smith 2022). The ULL did not have a set 'physical lab' but instead moved between an urban area in Helsingborg and a peri-urban area outside of Gothenburg, through the organisation of workshops, pop-up events, and ethnographic fieldwork where citizens and project stakeholders were involved in co-design. The ULL can therefore be described as an entity that crossed geographic, demographic, and organisational borders throughout the duration of the project.

The collaboration between participating stakeholders in the ULL was organised around a series of larger stakeholder workshops (25–30 participants), where the participants could immerse themselves in ethnographic findings and other research findings from activities in the ULL, such as future workshops with citizens, and other types of co-design workshops. During the span of the project, the ULL organised six stakeholder workshops (see Figure 1). In between these larger gatherings, the ULL also hosted 13 meetups; the meetups acted as open forums where participating stakeholders could bring guests from both inside and outside of their organisation. The focus of the meetups was to inspire, present findings from the project, and discuss or gather feedback on ongoing work.

During the stakeholder workshops and meetups (see Figure 2), two different methodological tools (e.g. catalogues and transformation games) were commonly used to facilitate the co-design between the participants. The first tool consisted of a work-in-progress *catalogue* which documented and communicated methods and findings from

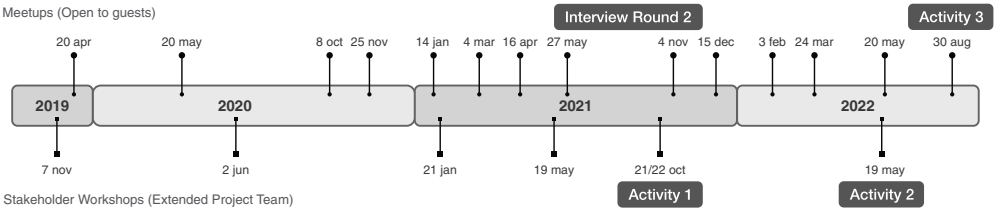

Figure 1. AHA II overview.

Figure 2. Participants creating a service scenario during a stakeholder workshop.

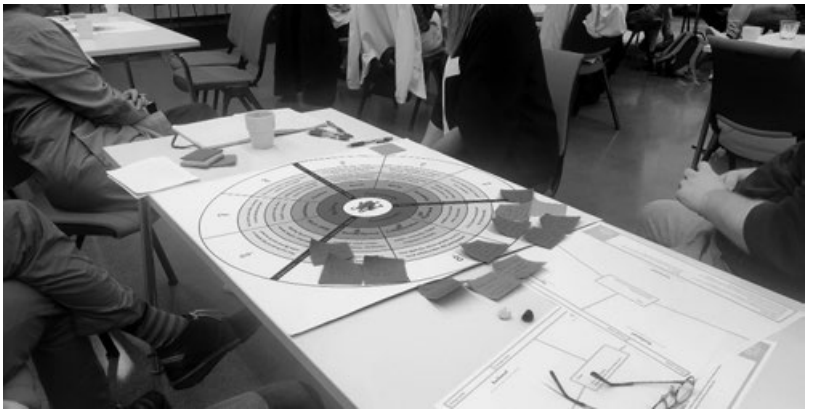

Figure 3. Transformation game in a stakeholder workshop.

the project, the catalogue was continually updated as the work in the ULL progressed and was used as background reading before workshops and referred to during workshops as a way to engage in the material. The second tool was the implementation of different types of *transformation games* (see Figure 3) which were different kinds of workshop methods that aided in making findings from the project more tangible, supporting critical thinking and perspective changes, while providing a playful way of interacting with key findings.

3.1. Data gathering and analysis

In this paper, we draw upon joint experiences from the research team in setting up and organising co-design in a ULL and reflections from three larger co-design activities in the ULL, as well as interviews with representatives from the different stakeholder groups in the project (see Figure 1). When gathering the data, the respondents were informed about the purpose of the data gathering and informed that their involvement was voluntary. During the interviews, we also asked for permission to record the interviews. The interview material used as a basis for analysis was gathered during two different periods. The first data gathering took place before the AHA II project was initiated and consisted of two group interviews with relevant stakeholders in the project (e.g. two city representatives and two business representatives) before the collaboration evolved into a ULL initiative. The second data gathering (see Figure 1) consisted of seven individual interviews with relevant stakeholders (e.g. two city representatives, three business representatives, and two community representatives). The duration of the interviews ranged between 40 and 61 minutes, with an average duration of 55 minutes. During the interviews, topics, such as expectations, roles, collaboration, co-design, and outcomes, were covered. The empirical data from the three workshop activities consisted of workshop outputs such as journey maps, filled out canvases, and written reflection notes (see Table 1).

The data analysis strategy employed drew upon a bottom-up thematic analysis as described by Braun and Clarke (2006), consisting of data familiarisation, code generation, theme search, theme review, theme definition, naming, and finally, writing up the

Table 1. Summary of participants and output from selected activities.

	Participants	Main Activity and Output
Activity 1 – Stakeholder WS	30 participants, evenly distributed among partners.	– Co-design of future mobility services – 106 written reflections
Activity 2 – Stakeholder WS	30 participants, evenly distributed among partners.	– Concepts of mobility services co-designed around local values – 31 written reflections
Activity 3 – Final Meetup	30+ participants, project partners and invited guests.	– Transformation game training session – Panel discussion – 59 written reflections

results of the analysis. Given that the interviews and workshops took place in a project in which all three researchers had been involved, we entered into the analysis with prior knowledge concerning the project. We view this as positive from a data familiarisation standpoint (Braun and Clarke 2006), as the interviews and analysis provided us with a means for digging deeper concerning issues and phenomena we encountered during the span of the ULL, such as alignment, fragmentation, and scaling challenges. To immerse ourselves in the process, we designed the data analysis as a joint effort, where two of the authors coded the material and established themes, which were then discussed before finally being defined and named.

4. Results: dynamics of sustained co-design in ULL

During the analysis we identified two concepts that ran in parallel to one another; *cogitation* and *patching*. These concepts shed light on the faciliatory work on the back-stage of co-design while also capturing the complexity many stakeholders undergo as they envelop themselves in the knotworks around co-design.

4.1. Cogitation: adapting to co-design logic

Our first finding concerns the concept of cogitation as a way to describe and understand a mode of working that the participating stakeholders strived for in the ULL. We define cogitation in co-design as a desired ideal state for the participants, a reflective state which revolves around the act of embracing co-design methods and logic to think deeply about addressing a specific design challenge. The following section will detail how cogitation played out in the case.

4.1.1. Value & fragmentation

The ULL aimed to explore future mobility services through fieldwork and co-design workshops with citizens, focusing on future imaginaries. However, the unfamiliar methods and future-oriented approach posed challenges for many stakeholders. The main challenge was transitioning from the present to the future, involving exploration of unknown areas (i.e. the future) and utilising data from unfamiliar methods like ethnography and co-design, which lead to the perception of the ULL and its output as a moving target. Furthermore, the ULL had a different pacing compared to what many of the stakeholders had experienced in the past, the scope of the ULL was longer and more drawn out, and as such, it was often needed to cognitively 'reconnect', as a city

representative put it, to the project when it was once again time to for a meetup or stakeholder workshop. Reconnecting was tolling, as the stakeholders had to reconnect to a different working style compared to everyday work routines and embrace a 'co-design way', where they interacted with new people in new ways.

It also became evident that working with co-design and addressing the challenge of future mobility services from a bottom-up perspective was difficult, as the focus on citizens and their everyday life brought new types of values to the surface, values that were in stark contrast to the values that dominated the everyday work practice. For example, a stakeholder from Helsingborg described how they often prioritise efficiency and accessibility when it comes to mobility and often do not find themselves in situations where other values or perspectives are brought to the table. She continued to describe how they rarely get to work with industry representatives; an opinion mirrored by the stakeholders from Gothenburg, who described the collaborative work in the ULL as a space where different cultures can meet and an opportunity for sharing their own perspectives while learning more about the perspective and culture of other actors, such as CarCompany. The notion of a place for cultures to meet was also shared by the industry partners, who described the importance of understanding the logic of the city as they move forward with the design of future mobility, while also making their challenges known to the city, to help establish a common agenda and a basis for collaboration.

4.1.2. Alignment and tying knots

Our findings emphasise the significance of stakeholder interfaces in a ULL, supporting defragmentation and reflection. Based on our findings the stakeholder co-design workshops evolved beyond mere collaboration to also serve as a tool for stakeholders to collectively establish their own goals, in a context they previously had perceived to be uncertain and fuzzy. From a knotworks perspective (Engeström 2013), the stakeholder workshops acted to connect new actors to the knotwork by inviting new guests into the already established group of stakeholders within the ULL, concurrently with making the connection between already established stakeholders more explicit and defined. This helped stakeholders understand their stake in the ULLs common goal, thereby turning the common goal into something that could be negotiated through co-design. Co-design and its culture also posed challenges for stakeholders when involving new participants from their organisation in the ULL. The ULL adopted a bottom-up approach to designing future mobility services, relying on design ethnography and co-design activities with citizens and stakeholders. This human-centred approach deviated from the linear projects with defined goals that stakeholders were accustomed to, making it difficult to adapt to the emergent and explorative nature of the process. Inviting new participants from stakeholder organisations therefore proved challenging due to the uncertainty of the co-design process and the inability to pinpoint their exact roles and outcomes.

4.1.3. Drivers for engagement

The AHA II project explored methods for engaged co-design work in a ULL. Hence, methods were one of the expected knowledge outcomes. Even so, the involved actors had additional expectations regarding what insights could and should be gained from being involved. Most of the interviewed participants spoke about the need to gain new perspectives internally within their organisation and as a collective group of actors in

the ULL. For example, a stakeholder from CarCompany expressed the need for the company to widen their perspective and gain new insights to enable them to develop the next generation of mobility solutions. He continued to describe a need for new insights in order to help the company develop and find new customer values. Today, CarCompany primarily conducts evaluations on their products, the stakeholder therefore saw potential for new types of insights driven by co-design, both regarding methods to work with more diverse groups, and findings from the citizen communities. The cities and CarCompany stakeholders agreed on how the two communities in the ULL challenged their views, due to providing contrasting perspectives compared to what they were familiar with.

Collaborating in an effort to gain new insights was a common theme for both the cities and CarCompany. The insights were traced to both the findings from fieldwork in the ULL, as well as to the co-design activities where cultures and terminologies could be blended to form new insights. There was also a realisation that there was a clash between how the ULL functions and the logic of the stakeholders' organisations. A stakeholder from Helsingborg explained how her organisation lacks the experience and competency to work with design ethnography in a ULL manner, and how her organisations logic makes it challenging to incorporate new ways of working. Similar views were expressed by CarCompany, which highlighted the ULL's capacity for a unique collaboration, while also lifting the challenge of achieving this within CarCompany's confines.

4.2. Patching: scaffolding cogitation in co-design

Through our analysis, we identified *patching* as an activity that aids in extending and crystallising the knotwork of partners in a ULL, where tangible design tools and facilitators play an important part in the backstage of co-design to support cogitation.

4.2.1. Tensions in co-design

The empirical evidence highlights numerous challenges that stakeholders encounter through engaged co-design in ULL. Grasping changing goals and having a non-linear process proved difficult, requiring a shift in mindset and embracing a new co-design culture. Additionally, stakeholders also had to navigate the task of expressing their perspective while understanding the viewpoints of others. Together, these challenges create a context where stakeholders need to disconnect and reconnect continuously to an emerging knotwork (Engeström 2013) where actors come and go, formed around a malleable design context, where co-design keeps reframing what we know.

The findings highlight the importance of mending the gaps between stakeholder's perspectives, current and new knowledge, and temporal gaps between activities in the ULL, where stakeholders find it strenuous to disconnect and reconnect. Through our study, we observed how stakeholder workshops around artefacts like *transformation games* and similar types of *tangible carriers* of contextual information generated from the ULL aid in mending these gaps by providing a means to easily 'reconnect' to the 'ways of doing' co-design. We refer to this dynamic as *patching*, as these artefacts were consciously designed to scaffold the co-design process.

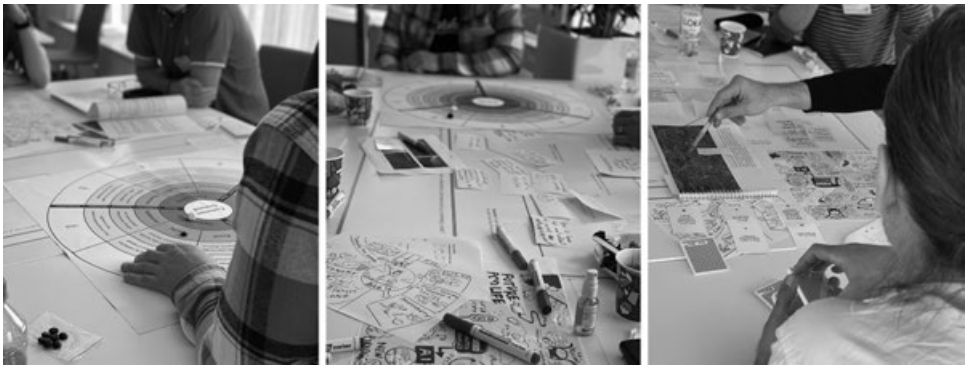

Figure 4. Transformation games and catalogue use during workshop.

4.2.2. Scaling micro to macro

The way of working during the stakeholder workshops was initially hard to grasp for many participants due to being designed around exploration and problematisation through design ethnography, rather than focusing on generating service ideas.

The use of transformation games during the next to last stakeholder workshop (see Figure 4) in the ULL acts as an illustration of this dynamic.

During the workshop, the participants were split into smaller groups of six, with varying backgrounds and expertise. The objective of the workshop was to design a mobility service concept using ethnographic findings from one the ULL sites. To assist them, each group had summaries of ethnographic findings in the shape of a *catalogue* and two different *transformation games*. The workshop props had been prepared in advance to act as methodological scaffolding to support the co-design process. For example, one of the games, 'the common ground game', acted to summarise and aggregate social values around mobility in the context of the ULL sites in Gothenburg and Helsingborg, to promote a playful way to explore these values. During the workshop, the participants first approached the catalogue and used the ethnographic findings in the catalogue to co-design and help populate a user's journey. During the second step, they used the transformation game to explore the service from a social value point of view. Both the catalogue and the transformation game, therefore, served the purpose of bringing design findings into a workshop where the participants could use them as a scaffolding for reflection. As an example of this, the transformation game opened a space for reflections around the impact that mobility has on different groups, the different types of mobility values that exist, and how mobility can support or hamper the daily routines of different people, etc.

4.2.3. Tools of engagement

Methodological tools like the transformation games and the catalogue also became important carriers of the co-design logic. As such, these were helpful when stakeholders wanted to bring findings from the ULL back to their organisation or when engaging participants to join meetups. A Helsingborg stakeholder emphasised her role as a boundary spanner, actively involving more people from her organisation in the ULL process. She believed in the effectiveness of ULL methodology, design

ethnography, and their potential to address mobility-related issues. Engaging the 'right people' became a means of driving impact and promoting co-design within her organisation. She successfully facilitated connections between the city and the ULL, resulting in several city stakeholders showing strong interest and engagement. However, she stressed the importance of committed participation during meetups and workshops, making it clear to participants that active involvement was required.

Onboarding people to the project was sometimes found challenging since stakeholders often had to pitch the project repeatedly. This challenge was offset by the reward of bringing new people into the ULL that could pose new and interesting questions. The Helsingborg stakeholder described her reasoning around what profile to onboard, where she personally pinpointed people based on their competence and what kind of person they were, while expressing it being vital for new people to see the work as something fun and enjoyable. The selection process aimed to engage people with diverse perspectives, professions, and competencies, even those from different management levels within the city, to create ripple effects within Helsingborg. Ultimately, a key criterion for inclusion was curiosity.

CarCompany faced similar challenges in engaging people. According to the CarCompany stakeholder, it was crucial to involve not only a specific group or professionals but rather a cross-disciplinary team to drive progress. Furthermore, merging technical and social insights within the project was key to generating engagement within CarCompany, as that could make findings relevant for a larger audience. To achieve this, tools such as transformation games showed great promise in engaging and creating a common ground between groups with different backgrounds and interests within CarCompany.

4.2.4. The value of methodology

From a patching point of view, the continuous meetups in the project played a key role, as they acted as a glue that helped engaged stakeholders connect to people outside of the core group. The meetups were facilitated by the ULL and were open to guests from all stakeholder organisations, but also to other actors, such as public transit representatives and citizens. In total, there were 13 meetups, where representatives from the ULL presented findings, and organised co-design.

Both business and city representatives emphasised the value of developing a methodology as an outcome of AHA II, albeit for different reasons. The cities saw these methods as useful for guiding citizen and stakeholder engagement, while acknowledging the limitations of implementing every project as a ULL due to resource constraints. Instead, methods offered a middle ground, providing a framework to promote new ways of creating citizen dialogue and aligning interest between actors in the city. However, designing new engagement methods was seen as 'fuzzy' and challenging. They also acknowledged a shortage of skills that would be needed to develop and work with these methods within their organisation. CarCompany appeared to have more leniency towards the perceived 'fuzziness' of the project outcome. For CarCompany, developing methods that can help them narrow down scopes and collaborate when solving complex challenges was seen as valuable for the organisation.

4.3. Summary: dynamics of cogitation and patching

To conclude, through our empirical findings, we can trace how the participating stakeholders strived to reach what we refer to as cogitation in co-design. A reflective space where actors jointly can reconcile conflicting perspectives and agendas, to find a common ground for co-design, where the participant is free to detach from preestablished routines and scripts to explore new values to form new insights. To reach this reflective space, the participant is continuously faced with challenges concerning temporal, and conceptual boundaries, which forces the need to carve out time in order to continuously disconnect and reconnect between organisational logic and co-design logic. The switch in logic effects how co-design is perceived as an explorative method to solving problems versus a more linear process and how other actors and their agendas are approached. The conceptual boundary concerns the ability to align with and embrace new values and perspectives, which might create friction with dominant logics.

Mending gaps between stakeholder's perspectives, knowledge, activities in time, and conceptual gaps between project participants and external guests is challenging, but necessary. Patching, as an activity revolving around consciously designed interventions and tools such as transformation games and catalogues can aid in addressing these challenges though providing means for 'reconnecting' to the 'ways-of-doing' co-design.

The findings show that patching involves two parts: backstage preparation of research findings from the ULL and frontstage sensemaking during stakeholder workshops using transformation games or artefacts like a catalogue. Patching extends beyond the ULL as stakeholders can use the artefacts to bridge gaps within their own organisations and engage new partners. The artefacts support the incorporation of co-design logic into their organisations.

5. Discussion

This paper explores two dynamics in co-design: cogitation and patching. The two concepts extend the literature on participatory infrastructuring and dynamics in a ULL by studying them at the intersection of commoning and institutioning.

5.1. The dynamics of cogitation & patching

Extant literature describes how both commoning and institutioning are challenging areas for design researchers to operate in, as they tend to take on the role of an intermediary to navigate in a setting rife with tensions between competing logics and cultures (Teli et al. 2020). In our case, we have identified two different dynamics which we consider to be key when operating on the interface between commoning and institutioning as a design researcher.

The first dynamic is *cogitation*, which we define as a reflective state which revolves around the act of embracing co-design methods and logic to think deeply about addressing specific design challenges. Cogitation is fluid and dynamic, and constantly challenged by other dominant logics. The case illustrates how participating stakeholders recognised that the ULL's co-design approach did not entail a complete departure from their established practices in their respective organisations. Instead, cogitation acted as

something the participants experienced within the ULL, which they saw potential in bringing back to their organisation piecemeal, through methodology they could adapt to chip away at established routines and ways-of-doing in their everyday work.

These findings highlight the close relationship between temporality and co-design dynamics in a ULL, requiring a capacity to 'reconnect' and 'disconnect' to the co-design process and the emerging knotwork (Engeström 2013) of actors that is formed around a malleable design context where cogitation keeps expanding the boundaries for what each stakeholder perceives. A core challenge to overcome is the alignment of different types of logics which creates tensions in this process, tensions that go beyond competing perspectives in-between actors, to also include a mismatch between the dominant logic governing each stakeholder in relation to co-design as an explorative venture. This creates a fragmented space where business logic, democratic values, and co-design logic need to be aligned. These findings are supported by previous research on ULLs, which highlight the difficulty that stakeholders face in understanding the ULL process, leading to challenges (Nguyen and Marques 2022), as well as research on infrastructuring (Teli et al. 2020). We argue, based on our findings, that the tension between co-design exploration through open-ended and less predefined processes at the intersection of commoning and institutioning and stakeholders' previous experiences with more linear processes, is a source for this type of confusion. However, even though these challenges are frustrating, the empirical findings also illustrate the willingness to cope with these challenges, to reach what we refer to as cogitation. Cogitation therefore reflects a point where participants in need of solving complex problems, can connect to challenge assumptions and familiarise themselves with new perspectives, a state of mind which has been identified by others (Botero and Saad-Sulonen 2010; Hillgren 2017) as key for finding democratic and sustainable solutions to wicked problems.

The second dynamic which we consider to be key when operating on the interface between commoning and institutioning is *patching*. Based on our findings, we view patching as a dynamic which highlights activities that both participants and facilitators do to support cogitation. We conceptualise patching as a dynamic that aids in extending and crystallising the knotwork of partners in a ULL, where tangible design tools and facilitators play an important part in the backstage of co-design. Patching, therefore, becomes a necessary backstage activity to support the need for continuously enrolling new partners and exploring new domains, to support the appropriate conditions (Botero and Saad-Sulonen 2010) for redefining what participation means, and for whom.

Patching as an activity is tightly intertwined with and reliant on the ability of the participatory infrastructure to jointly produce findings that can be sustained. Out of

Table 2. The relationship between cogitation, patching and scaling.

	In situ	In-between	Future (Ambition)
Cogitation	– Negotiating knotwork – Exploring perspectives – Exploring values – Exploring logic	– Extending knotwork – Adding perspectives – Communicating logic	– Communicating Values – Doing Co-design
Patching	– Transformation Games – Catalogue facilitation	– Meetup facilitation	– Transformation games – Catalogue use
Scaling	– Micro to Macro	– Inside to Outside	– After

several sustaining strategies (Iversen and Dindler 2014; Smith and Iversen 2018), scaling appears to be the strategy with the tightest coupling to patching, as it describes how findings can be scaled into other contexts. In the ULL, patching acted as a mechanic that aided in scaling findings from both the micro to macro and from the inside to the outside to facilitate cogitation (see Table 2).

Scaling from the micro to the macro through patching is illustrated by the transformation games and the catalogue. These artefacts helped carry rich findings from commoning activities in the ULL sites, to institutioning activities with other stakeholders. For example, the transformation games (Ebbesson 2022) packaged research findings in a playful manner, where the simple rules of the games allowed for playful exploration together with other stakeholders, where the stakeholders together could challenge their assumptions. This aided in deepening the understanding of the fabric of the knotwork, as the discussions highlighted reflection around a common goal rather than highlighting differences between participants' agendas. The commoning activities therefore acted as a foundation for creating a common ground between stakeholders through institutioning. Furthermore, the transformation games were designed so that the participating stakeholders easily could bring the games with them to new contexts and play them, turning them into scripts for action (Huybrechts et al. 2018).

Scaling from the inside to the outside through patching is illustrated by the meetups, since cogitation is reliant on the ability to problematise and challenge assumptions, there is also a need to involve new actors throughout the process. The primary function of the meetups was to disseminate findings, however, from a patching perspective, the meetups also provided a scaffolding for participating stakeholders to loop new participants into the co-design process focused on institutioning. This also made it easier to articulate the ongoing work in the ULL, through a show and tell, rather than having to explain the ongoing work and methodology to people unfamiliar with co-design. Patching and cogitation, therefore, also extend beyond in situ co-design and offer explanatory power in understanding how exploration through commoning can become an important tool for institutioning, both to negate tensions, but also to enrol new partners into institutioning.

The implications concerning *patching* and *cogitation* have highlighted the need for embracing or understanding co-design as a logic. Furthermore, the findings also illustrate the important role sustaining strategies play for facilitating this understanding through patching strategies that can support cogitation. Out of the sustaining strategies (Iversen and Dindler 2014), we see scaling and replication as a key strategy to use while patching, as patching revolves around planning and designing situations where participating stakeholders can immerse themselves and reflect on relevant findings from the ULL, which helps them challenge assumptions and reshape knotworks in order to support cogitation. An important implication for practice would therefore be to consider sustaining carefully and specify scaling, and replication goals in a ULL to increase the granularity of the potential impact of the ULL. Thereby also increasing the transparency of the Living Lab process, an area previously critiqued to have shortcomings (Ersoy and van Bueren 2020; Nguyen and Marques 2022). A first step could be to define what types of sustaining is relevant for each participating stakeholder, and what other actors could be relevant to extend a knotwork with, already during the scoping phase (Smith and Iversen 2018) of a participatory infrastructure.

6. Conclusion

This article set out to address the research question of: How can co-design be sustained in Urban Living Labs? Through establishing the concepts of cogitation in co-design, and patching as an activity, we conclude that engaged co-design can be sustained in Urban Living Labs through supporting cogitation in co-design through patching. We define cogitation in co-design as a reflective state which revolves around the act of embracing co-design methods and logic to think deeply about addressing a specific design challenge. Furthermore, we define patching as an activity that aids in extending and crystallising the knotwork of partners in a ULL, where tangible design tools and facilitators play an important part in the backstage of co-design. Through the careful planning and design of meetups, transformation games and other tangible carriers of design ethnographic findings, patching can act as a scaffold for both cogitation in co-design and sustaining participatory infrastructures.

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References

Bergvall-Kåreborn, B., C. I. Eriksson, A. Ståhlbröst, and J. Svensson. 2009. "A Milieu for Innovation–Defining Living Labs." Paper presented at the 2nd ISPIM Innovation Symposium, New York.

Björgvinsson, E., P. Ehn, and P.-A. Hillgren. 2012. "Agonistic Participatory Design: Working with Marginalised Social Movements." *CoDesign* 8 (2–3): 127–144.

Bødker, S., C. Dindler, and O. S. Iversen. 2017. "Tying Knots: Participatory Infrastructuring at Work." *Computer Supported Cooperative Work (CSCW)* 26:245–273. https://doi.org/10.1007/s10606-017-9268-y.

Bødker, S., C. Dindler, O. S. Iversen, and R. C. Smith. 2022a. "How Does One Sustain Participatory Design Initiatives?" In *Participatory Design*, edited by J. M. Carroll, 103–109. Cham: Springer.

Bødker, S., C. Dindler, O. S. Iversen, and R. C. Smith. 2022b. "Why is Participatory Design Important Today?" In *Participatory Design*, edited by J. M. Carroll, 111–116. Cham: Springer.

Bossen, C., C. Dindler, and O. S. Iversen. 2016. "Evaluation in Participatory Design: A Literature Survey." *Paper presented at the Proceedings of the 14th Participatory Design Conference: Full papers-Volume 1*, Aarhus, Denmark.

Botero, A., and J. Saad-Sulonen. 2010. "Enhancing Citizenship: The Role of In-Between Infrastructures." *Paper presented at the Proceedings of the 11th Biennial Participatory Design Conference*, Sydney, Australia.

Braun, V., and V. Clarke. 2006. "Using Thematic Analysis in Psychology." *Qualitative Research in Psychology* 3 (2): 77–101. https://doi.org/10.1191/1478088706qp063oa.

Conklin, J. 2005. *Dialogue Mapping: Building Shared Understanding of Wicked Problems*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Coppola, P., and F. Silvestri. 2019. "Autonomous Vehicles and Future Mobility Solutions." In *Autonomous Vehicles and Future Mobility*, edited by P. Coppola and D. Esztergar-Kiss, 1–15. Amsterdam: Elsevier.

Dindler, C., and O. S. Iversen. 2014. "Relational expertise in participatory design." *Paper presented at the Proceedings of the 13th Participatory Design Conference: Research Papers-Volume 1*, Windhoek, Namibia.

Ebbesson, E. 2022. "Towards a Co-Creation Framework Based on Citizens' Dreams of Future Mobility." *Transportation Research Interdisciplinary Perspectives* 16:100686. https://doi.org/10.1016/j.trip.2022.100686.

Engeström, Y. 2013. "From Communities of Practice to Mycorrhizae." In *Communities of Practice: Critical Perspectives*, edited by J. Hughes, N. Jewson, and L. Unwin, 51–64. London: Routledge.

Ersoy, A., and E. van Bueren. 2020. "Challenges of Urban Living Labs Towards the Future of Local Innovation." *Urban Planning* 5 (4): 89–100.

Fitzpatrick, G., and L. Malmborg. 2018. "Quadruple Helix Model Organisation and Tensions in Participatory Design Teams." *Paper presented at the Proceedings of the 10th Nordic Conference on Human-Computer Interaction*, Oslo, Norway.

Franz, Y. 2015. "Designing Social Living Labs in Urban Research." *Info* 17 (4): 53–66. https://doi.org/10.1108/info-01-2015-0008.

Hillgren, P.-A. 2017. "Democratizing the City. Democratic Configurations and Imagination." *Scandinavian Journal of Information Systems* 29 (2): 5.

Hillgren, P.-A., A. Seravalli, and A. Emilson. 2011. "Prototyping and Infrastructuring in Design for Social Innovation." *CoDesign* 7 (3–4): 169–183.

Huybrechts, L., O. Devisch, and V. Tassinari. 2022. "Beyond Polarisation: Reimagining Communities Through the Imperfect Act of Ontologising." *CoDesign* 18 (1): 63–77.

Huybrechts, L., N. Hendriks, S. L. Yndigegn, and L. Malmborg. 2018. "Scripting: An Exploration of Designing for Participation Over Time with Communities." *CoDesign* 14 (1): 17–31. https://doi.org/10.1080/15710882.2018.1424205.

Iversen, O. S., and C. Dindler. 2014. "Sustaining Participatory Design Initiatives." *CoDesign* 10 (3–4): 153–170.

Karlsson, I. C. M., D. Mukhtar-Landgren, G. Smith, T. Koglin, A. Kronsell, E. Lund, S. Sarasini, and J. Sochor. 2020. "Development and Implementation of Mobility-as-a-Service–A Qualitative Study of Barriers and Enabling Factors." *Transportation Research Part A: Policy and Practice* 131:283–295. https://doi.org/10.1016/j.tra.2019.09.028.

Leonardi, C., N. Doppio, B. Lepri, M. Zancanaro, M. Caraviello, and F. Pianesi. 2014. "Exploring Long-Term Participation within a Living Lab: Satisfaction, Motivations and Expectations." *Paper presented at the Proceedings of the 8th Nordic Conference on Human-Computer Interaction : Fun Fast, Foundational*, Helsinki, Finland.

Löfgren, S. 2020. "Designing with Differences, Cross-Disciplinary Collaboration in Transport Infrastructure Planning and Design." *Transportation Research Interdisciplinary Perspectives* 4:100106. https://doi.org/10.1016/j.trip.2020.100106.

Matthews, B., S. Doherty, P. Worthy, and J. Reid. 2022. "Design Thinking, Wicked Problems and Institutioning Change: A Case Study." *CoDesign* 19 (3): 1–17. https://doi.org/10.1080/15710882.2022.2034885.

Menny, M., Y. V. Palgan, and K. McCormick. 2018. "Urban Living Labs and the Role of Users in Co-Creation." *GAIA-Ecological Perspectives for Science and Society* 27 (1): 68–77. https://doi.org/10.14512/gaia.27.S1.14.

Nguyen, H. T., and P. Marques. 2022. "The Promise of Living Labs to the Quadruple Helix Stakeholders: Exploring the Sources of (Dis) Satisfaction." *European Planning Studies* 30 (6): 1124–1143.

Paskaleva, K., I. Cooper, P. Linde, B. Peterson, and C. Götz. 2015. "Stakeholder Engagement in the Smart City: Making Living Labs Work." In *Transforming City Governments for Successful Smart Cities*, edited by M. P. Rodriguez-Bolivar, 115–145. Cham: Springer.

Pink, S., V. Fors, D. Lanzeni, M. Duque, S. Sumartojo, and Y. Strengers. 2022. *Design Ethnography: Research, Responsibilities, and Futures*. London: Taylor & Francis.

Quilty, E., S. Pink, T. Phan, and J. Lee. 2022. "Automated Decision Making in Transport Mobilities: Review of Industry Trends and Visions for the Future."

Rittel, H. W., and M. M. Webber. 1973. "Dilemmas in a General Theory of Planning." *Policy Sciences* 4 (2): 155–169.

Smith, R. C. 2022. "Editorial: Design Anthropology." *Design Studies* 80:101081. https://doi.org/10.1016/j.destud.2022.101081.

Smith, R. C., and O. S. Iversen. 2018. "Participatory Design for Sustainable Social Change." *Design Studies* 59:9–36. https://doi.org/10.1016/j.destud.2018.05.005.

Steen, K., and E. Van Bueren. 2017. "The Defining Characteristics of Urban Living Labs." *Technology Innovation Management Review* 7 (7): 21–33. http://doi.org/10.22215/timreview/1088.

Svensson, J., and E. Ebbesson. 2010. "Facilitating Social and Cognitive Translation in Innovation Networks." In *MCIS 2010 Proceedings*, Tel Aviv, Israel.

Teli, M., M. Foth, M. Sciannamblo, I. Anastasiu, and P. Lyle. 2020. "Tales of Institutioning and Commoning: Participatory Design Processes with a Strategic and Tactical Perspective." *Paper presented at the Proceedings of the 16th Participatory Design Conference 2020-Participation (s) Otherwise-Volume 1*, Manizales, Colombia.

Valkenburg, R., and K. Dorst. 1998. "The Reflective Practice of Design Teams." *Design Studies* 19 (3): 249–271.

Voytenko, Y., K. McCormick, J. Evans, and G. Schliwa. 2016. "Urban Living Labs for Sustainability and Low Carbon Cities in Europe: Towards a Research Agenda." *Journal of Cleaner Production* 123:45–54. https://doi.org/10.1016/j.jclepro.2015.08.053.

Zhao, X., B. Vaddadi, M. Sjöman, M. Hesselgren, and A. Pernestål. 2020. "Key Barriers in MaaS Development and Implementation: Lessons Learned from Testing Corporate MaaS (CMaaS)." *Transportation Research Interdisciplinary Perspectives* 8:100227. https://doi.org/10.1016/j.trip.2020.100227.