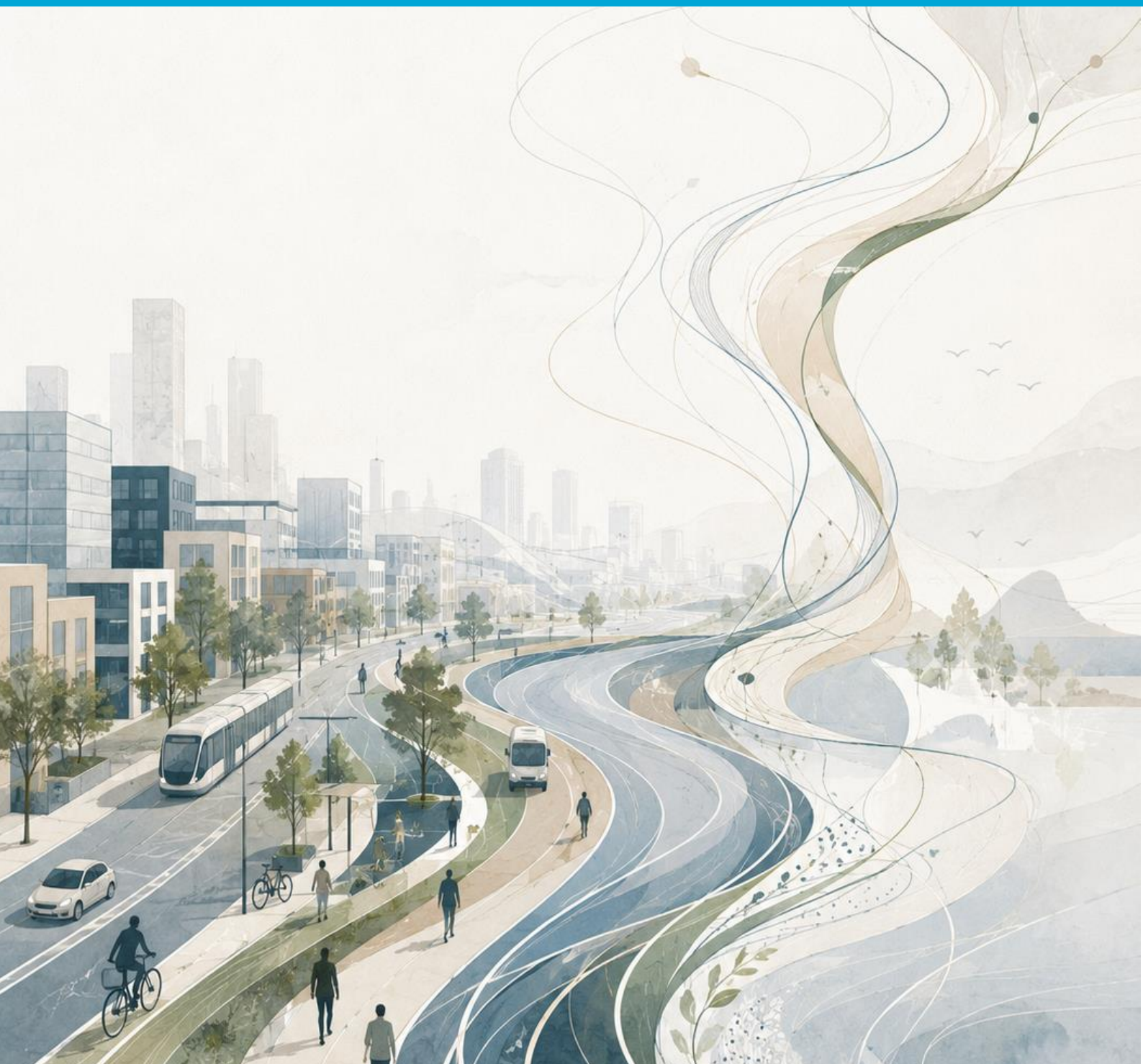
J.P. Wendling

Steering the story

Assessing narrative-shift potential in mobility-focused urban living labs



Don’t be satisfied with stories, how things have gone with others.

Unfold your own myth.

- Rumi (translated by Coleman Barks in ‘The Essential Rumi’)

Steering the Story

Assessing narrative-shift potential in mobility-focused urban living labs

By
J.P. Wendling

in partial fulfilment of the requirements for the degree of

Master of Science
in Communication Design for Innovation

at the Delft University of Technology,
to be defended publicly on July 10, 2026 at 10:00.

Supervisor:	Caroline Wehrmann	
Thesis committee:	Steven Flipse	TU Delft
	Udo Pesch	TU Delft
	Hanno van Keulen	TU Delft

An electronic version of this thesis is available at http://repository.tudelft.nl/.

TU Delft

Preface

This thesis is the last step of a longer journey than I originally expected. The process was never straightforward, and the direction of the research changed more than once along the way. If it is truly about the journey rather than the destination, then I certainly made the most of it.

I would first like to thank Caroline Wehrmann for her supervision and for helping push me over the finish line when it was needed most. I am also grateful to Steven Flipse for taking on this multi-year endeavour with me, and for continuing to support me throughout the many turns this project took. I would like to thank Udo Pesch for his thoughtful and articulate feedback, which helped sharpen both the content and form of the research.

Heartfelt thanks also go to Sybe Andringa for opening his network to me, and to all interviewees and participants who generously shared their time, experience and knowledge. Without their willingness to contribute, this thesis would not have been possible.

On a personal note, I want to thank my wife for putting up with me throughout this process. I am well aware that, especially during the final weeks, this thesis took more than only my own energy, time and attention. I am also grateful to my employer, zepp.solutions, for providing flexibility when it was needed.

Finally, I want to thank everyone who, directly or indirectly, helped me bring this thesis to completion. This work is the result of many conversations, decisions and small acts of support along the way.

J. Wendling

The Hague, July 2026

Contents

Preface 6

Contents *7*

Executive summary 11

1 Introduction *12*

1.1 Context 12

1.2 Project aim 12

1.3 Research questions 13

1.4 Design questions 14

1.5 Research and design relevance 14

1.6 Thesis approach 15

1.7 Reading guide 16

PART I - RESEARCH ASSESSING NARRATIVE-SHIFT POTENTIAL *18*

2 Theoretical framework *19*

2.1 Literature review method 19

2.2 Narratives as structures for shared understanding 20

2.3 Narrative shifts at an individual level 22

2.4 Urban living labs as environment for narrative shifts 24

2.5 Mechanisms associated with narrative-shift potential in ULLs 27

3 Assessing narrative-shift potential through mechanism expression *30*

3.1 Requirements for assessing mechanism expression 30

3.2 Options for assessing mechanism presence in real-world ULLs 32

3.3 Empirical assessment strategy 35

3.4 ULL characterisation rubric 36

4 Case studies *41*

4.1 Case study selection 41

4.2 Data collection and case reconstruction 43

4.3 Case study 1: GEMINI 45

4.4 Case study 2: ALTHEA 47

4.5 Case study 3: sCOOL2walk 49

5 Analysis and interpretation 52

5.1 Methodology for data analysis 52

5.2 Within-case analysis 54

5.3 Cross-case analysis 59

6 Research conclusion 66

6.1 Answer to the research question 66

6.2 Main research findings 67

6.3 Transition to design phase 67

PART II - DESIGN DEVELOPING A ULL OPTIMISATION TOOL 69

7 Design methodology and requirements 70

7.1 Purpose of the design phase 70

7.2 Double Diamond method 71

7.3 Discover: research input 72

7.4 Define: design challenge, users and requirements 73

7.5 Develop: From requirements to tool concept 76

7.6 Deliver: initial ULL Optimisation Tool concept 78

8 Validation of initial tool 80

8.1 Validation approach 80

8.2 Retrospective application to GEMINI 80

8.3 Expert feedback session 85

8.4 Revisions based on validation 89

9 ULL Optimisation Tool 93

9.1 Tool materials 94

9.2 Workshop process 95

9.3 Practical use of the tool and expected output 100

9.4 Design conclusion 101

GENERAL DISCUSSION AND CONCLUSION 102

10 Overall discussion 103

10.1 Reliability of the data 103

10.2 Validity of the research approach 104

10.3 Validity of the design output 105

10.4 Generalisability of the findings 105

10.5 Theoretical and practical contribution 106

10.6 Personal reflection 107

10.7 Implications for future research 107

11 Overall conclusion 109

11.1 Answer to the research question 109

11.2 Answer to the design question 109

12 Bibliography 111

Appendix A ULL rubric 117

Appendix B Narrative snapshot questionnaire 119

B.1 Methods of measuring internal narratives 119

B.2 Design considerations 120

B.3 Implementation 120

B.4 Narrative snapshot questionnaire 121

Appendix C Laddering interview technique 124

Appendix D Interview guide for case study methodology - organisers 125

D.1 Semi-structured interview guide 125

Appendix E Methodology exploratory test 130

E.1 Case study summary 130

E.2 Interview with organisers 131

Appendix F Collected case study data 133

F.1 Case study 1: GEMINI cooperative car sharing living lab 133

F.2 Case study 2: ALTHEA transition super living lab 135

F.3 Case study 3: sCOOL2walk living lab 137

Appendix G Pre-validation workshop 139

G.1 Tool overview 139

G.2 Workshop process 141

G.3 Practical use of the tool 144

Appendix H Final workshop materials 146

Executive summary

Mobility transitions are shaped not only by infrastructure, technology and policy, but also by narratives: shared understandings, in this case about what forms of mobility are considered normal, desirable, feasible and acceptable. These days, dominant mobility narratives are often car-centred, which can limit the adoption of more sustainable mobility practices. Urban living labs may offer conditions in which alternative mobility narratives can be experienced, discussed and developed, because they combine real-world experimentation, local embedding, stakeholder collaboration and participant involvement. However, it remains unclear how the narrative-shift potential of mobility-focused urban living labs can be assessed or strengthened in practice.

This thesis investigates how the narrative-shift potential of mobility-focused urban living labs can be assessed and translates this into a practical design-support tool for organisers. Narrative-shift potential is defined as the extent to which a living lab contains theoretically grounded design conditions that may support participants or relevant actors in engaging with, reflecting on and possibly adopting or diffusing an alternative mobility narrative. The thesis does not measure actual participant-level narrative change.

The thesis consists of two main sections: a research and design section. The research section is aimed at answering the research question: “How can the narrative-shift potential of mobility-focused urban living labs be assessed?”. The design section is aimed at answering the design question: “How can the assessment of narrative-shift potential be translated into a practical design-support tool for organisers of mobility-focused urban living labs?”.

The research combines a targeted literature review, rubric development and qualitative multiple-case study analysis. Literature on mobility narratives, narrative persuasion and urban living labs is synthesised into six mechanisms associated with narrative-shift potential: deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion. These mechanisms are operationalised into a ULL characterisation rubric and applied to three real-world cases: GEMINI, ALTHEA and sCOOL2walk.

The analysis shows that across cases, socio-spatial relevance, deep immersion and network nurturing are relatively strong, while reflexivity and social network inclusion are less deliberately developed. This suggests that mobility-focused urban living labs may already contain implicit narrative-shift potential, but that this potential is not always intentionally recognised or designed for.

The design phase translates these findings into the ULL Optimisation Tool, consisting of a ULL framing canvas, assessment rubric, mechanism prompt cards and optimisation canvas. A validation step led to the addition of a living lab fit check, a clearer distinction between target groups, users and enabling actors, and an explicit access check before participant-facing interventions are selected. The final output is a workshop-based tool that helps organisers define the intended narrative shift, assess mechanism expression, prioritise improvement opportunities and translate them into design interventions.

The tool helps organisers make narrative-shift potential explicit and identify context-specific opportunities for strengthening it. The thesis contributes a theoretically grounded and practically usable approach for assessing and designing conditions associated with narrative-shift potential in mobility-focused urban living labs.

1 Introduction

1.1 Context

When it comes to mobility, narratives play a crucial role in shaping our understanding, decision-making, and actions. Narratives are vehicles of meaning and common understanding that shape our perceptions, values, and beliefs about, for instance, mobility systems (Hermwille, 2016). While narratives start as individual and local stories, they can grow into dominant, global paradigms by influencing policy, planning, design, and innovation. In the case of mobility this can be understood as the way we view, design and use transportation systems. The currently dominant mobility narrative favours unsustainable and car-centric approaches, hindering the transition towards more sustainable mobility systems (Brömmelstroet et al., 2022; Holden et al., 2020). This suggests that mobility transitions are not only technical or infrastructural challenges, but also involve changing what people consider normal, desirable, feasible and acceptable in everyday mobility.

In recent years, the concept of urban living labs (ULLs) has gained increasing attention as a means to drive innovation and address complex societal challenges (Nesterova et al., 2021; Steen & Van Bueren, 2017; von Wirth et al., 2019). Living labs provide real-life environments for experimentation, collaboration, and co-creation involving various stakeholders, such as governments, academia, industry and civil society. This quadruple helix approach facilitates the development and testing of innovative solutions and alternative narratives in a context that reflects the complexities and dynamics of the real world (Nesterova et al., 2021; Nguyen & Marques, 2022; von Wirth et al., 2019). Because ULLs are locally embedded and involve participants in real-world experimentation, they may create conditions in which alternative mobility narratives can be experienced, discussed and further developed.

However, it remains unclear how the narrative-shift potential of mobility-focused ULLs can be assessed. While ULLs may contain conditions that literature associates with narrative persuasion and narrative change, these conditions are not always made explicit or deliberately designed. This creates a practical and methodological problem: organisers may want to use ULLs to support more sustainable mobility narratives, but lack a structured way to assess whether their living lab contains the conditions that could support such a shift, or how those conditions could be strengthened. This thesis addresses that gap by developing a way to assess and improve the narrative-shift potential of mobility-focused ULLs.

1.2 Project aim

ULLs combine real-world experimentation, stakeholder collaboration and local embedding, which may create favourable conditions for participants to experience, discuss and develop alternative mobility narratives. Urban living labs differ substantially in their topic, in how they are organised, how participants are involved and how activities are structured (Nesterova et al., 2021). It is therefore relevant to understand which characteristics of mobility-focused ULLs

may contribute to narrative-shift potential, and how these characteristics can be assessed and improved in practice.

This thesis aims to contribute to the understanding of how ULLs can support mobility transitions by connecting literature on narratives, narrative shifts, and ULLs. More specifically, the aim is twofold: first, to develop and apply a structured way of assessing the narrative-shift potential of mobility-focused ULLs and second, to translate the resulting insights into a practical design-support tool for ULL organisers.

In this thesis, narrative-shift potential refers to the extent to which a ULL contains mechanisms that, based on literature, may support participants in engaging with, reflecting on, and possibly adopting alternative mobility narratives. The thesis does not aim to prove that participation in ULLs causes narrative shifts among participants. Instead, it assesses whether ULLs contain design conditions that literature associates with such potential.

The research first identifies these mechanisms through literature, then translates them into a characterisation rubric that can be used to assess selected ULL case studies. By comparing how these mechanisms are present across cases, the thesis aims to identify strengths, weaknesses, and design opportunities. These insights are then used to develop a ULL optimisation tool that can support organisers in reflecting on and improving the design of mobility-focused living labs. Understanding these mechanisms may help future ULL organisers design living labs in ways that are more likely to support narrative-shift potential.

The intended contribution of this research is twofold. First, methodologically, it proposes a structured way to assess narrative-shift potential in real-world ULLs. Second, practically, it translates this assessment into a design-oriented tool that can help organisers strengthen future ULLs. These two contributions are separated in the thesis into Part I (research) and part II (design).

1.3 Research questions

Based on the aim described above, this thesis investigates how the design and functioning of mobility-focused ULLs can be assessed in terms of their narrative-shift potential. The research part of the thesis focuses on assessment: identifying relevant mechanisms, operationalising them, and examining how they are expressed in selected mobility-focused ULL cases. The design part of the thesis is addressed separately in section 1.4.

The main research question and sub-questions are formulated as follows.

1.3.1 Main research question

How can the narrative-shift potential of mobility-focused urban living labs be assessed?

1.3.2 Sub research questions

1. Which mechanisms associated with narrative-shift potential in mobility-focused ULLs can be identified from literature?

2. How can these mechanisms be operationalised into an empirical assessment framework?
3. How are these mechanisms expressed in selected mobility-focused ULL cases?

1.4 Design questions

In addition to the research question, this thesis contains a design-oriented part. The research part develops and applies an assessment approach, while the design part translates the resulting insights into practical support for ULL organisers.

1.4.1 Main design question

How can the assessment of narrative-shift potential be translated into a practical design-support tool for organisers of mobility-focused urban living labs?

1.4.2 Sub design questions

1. What design requirements follow from the assessment of narrative-shift potential in selected mobility-focused ULLs?
2. What tool format can support organisers in assessing and improving narrative-shift potential in practice?
3. How can the proposed design-support tool be validated and refined?

1.5 Research and design relevance

Scientific literature discusses the significance of narratives in shaping sustainable transitions, and the conditions for narratives to take root and develop into the new status quo (Braddock & Dillard, 2016; Brömmelstroet et al., 2022; Chabay et al., 2019; Frantzeskaki et al., 2018; Hermwille, 2016; Holden et al., 2020; Murrar & Brauer, 2019). One of those conditions is an inclusive process: Brömmelstroet et al. (2022) describe involving not just academia and governments but also the general public in the process of developing and discussing potential future transition scenarios is essential for effectively implementing major changes in lifestyle and behaviour.

The potential of urban living labs (ULLs) as such inclusive environments for innovation and collaboration has been described (Steen & Van Bueren, 2017; von Wirth et al., 2019), and their ability to drive innovation and address complex societal challenges has been recognized (Nesterova et al., 2021; Steen & Van Bueren, 2017; von Wirth et al., 2019). Puerari et al (2018) argue that ULLs can lead to behavioural change amongst participants and can be considered potential triggers of systemic change in urban environments. However, it remains unclear how their potential to support narrative shifts can be assessed or strengthened in practice.

This is the gap this thesis targets. If ULLs are one of the tools that can be used to support more sustainable mobility narratives, it is relevant to understand which characteristics of ULLs may contribute to that potential, how these characteristics can be assessed, and how organisers of ULLs can use such assessment to improve the design of future ULLs.

This thesis therefore focuses on how mobility-focused ULLs can be assessed and improved based on theoretically grounded mechanisms associated with narrative-shift potential. Its relevance is both research-oriented and design-oriented.

The research relevance lies in connecting literature on narratives, narrative persuasion and urban living labs into a mechanism-based overview of the design conditions within ULLs that literature associates with narrative-shift potential. This makes it possible to assess the narrative-shift potential of ULLs.

The design relevance lies in translating this assessment into practical support for ULL organisers. ULLs are often designed around experimentation, collaboration and local problem-solving, but their possible contribution to narrative-shift potential may remain implicit. By turning the assessment into an optimisation tool, this thesis supports organisers in making these conditions more explicit and in identifying context-specific opportunities for improvement.

1.6 Thesis approach

This thesis combines desk research, multiple-case study analysis and a design methodology. It is structured in two main parts. Part I focuses on research: assessing narrative-shift potential in mobility-focused ULLs. Part II focuses on design: translating the assessment into a practical design-support tool for ULL organisers.

This two-part structure follows a Double Diamond logic, as shown in Figure 1. The first diamond, explores and defines the research problem by developing the theoretical framework, assessment approach and case study analysis. The second diamond translates these findings into a design-support tool and validates the resulting concept.

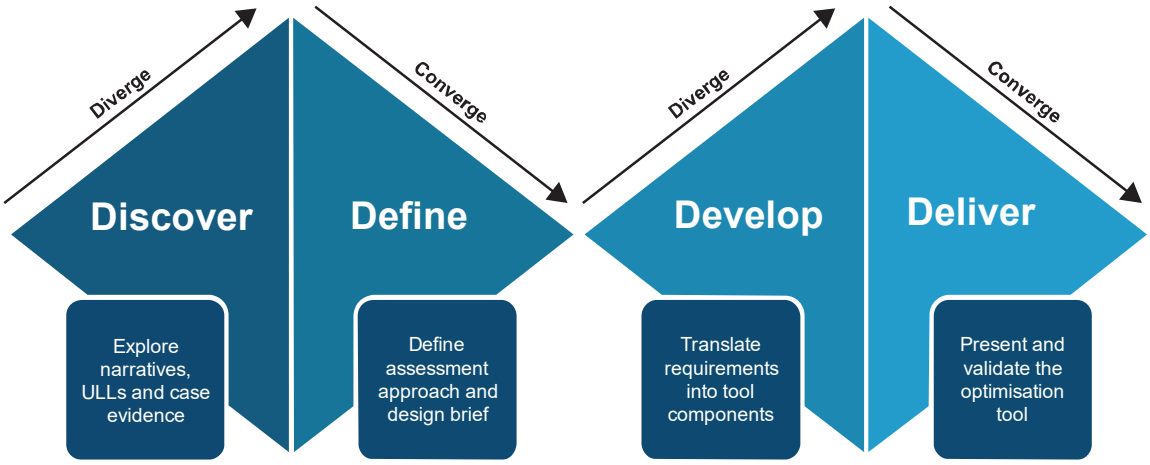


Figure 1 - Thesis approach structured according to the Double Diamond model (based on Design council (n.d.))

Part I develops the conceptual and empirical basis of the thesis. It starts with a theoretical framework that brings together literature on narratives, narrative persuasion and urban living labs. This framework is used to identify six mechanisms associated with narrative-shift potential. These mechanisms are then operationalised into the ULL characterisation rubric. The empirical part of Part I consists of a qualitative multiple-case study. Three mobility-focused

ULLs, GEMINI, ALTHEA and sCOOL2walk, are reconstructed based on organiser interviews and supporting documentation. The ULL characterisation rubric is then used to assess how the six mechanisms are expressed in each case. The cases are compared to identify recurring strengths, weaknesses, trade-offs and design opportunities.

Part II builds on the findings of Part I. The research findings are first translated into a design challenge and a set of design requirements. These requirements, together with validation through retrospective application and expert feedback, led to the ULL optimisation tool: a workshop-based design-support tool that helps organisers assess, discuss and strengthen narrative-shift potential in their own ULL context.

1.7 Reading guide

As described above, this thesis follows a two-part structure.

Part I:

Chapter 2 Theoretical framework introduces the theoretical framework, discussing the role of narratives in personal mobility transitions and identifying six mechanisms through which ULLs may create conditions that support narrative shifts.

Chapter 3 Assessing narrative-shift potential through mechanism expression presents the empirical assessment strategy, explaining the operationalisation of the theoretical mechanisms into the ULL characterisation rubric.

Chapter 4 Case studies introduces the three selected case studies: GEMINI, ALTHEA, and sCOOL2walk, providing a contextual reconstruction of each.

Chapter 5 Analysis analyses the case studies by applying the ULL characterisation rubric and comparing the expression of the mechanisms across cases to identify recurring strengths, weaknesses, and trade-offs.

Chapter 6 Research conclusion presents the research conclusion, answering the main research question and bridging the analytical research phase with the practical design phase.

Followed by Part II

Chapter 7 Design methodology and requirements outlines the design methodology and requirements for translating the research findings into a design-support tool.

Chapter 8

Validation discusses the validation of the tool through a retrospective application to the GEMINI case and insights from expert feedback.

Chapter 9 ULL Optimisation Tool presents the final ULL optimisation tool, detailing its format, the workshop process, and how it can be used in practice.

And finally, two overarching chapters bringing these parts back together:

Chapter 10 Overall discussion discusses the reliability, validity, and generalisability of the research, along with the theoretical and practical contributions of the thesis and a personal reflection.

Chapter 11 Overall conclusion presents the overall conclusion, answering the main research question and the main design question.

PART I - RESEARCH
ASSESSING NARRATIVE-SHIFT POTENTIAL

2 Theoretical framework

This chapter develops the theoretical basis for assessing narrative-shift potential in mobility-focused urban living labs. It answers the first research sub-question: **"Which mechanisms associated with narrative-shift potential in mobility-focused ULLs can be identified from literature?"**.

The chapter first introduces narratives as shared structures through which mobility problems, practices and futures are understood. It then discusses how dominant mobility narratives can shape what is considered normal, desirable and feasible in mobility transitions. The chapter then moves to participant-level narrative shifts by discussing narrative persuasion: the process through which exposure to a narrative can influence beliefs, attitudes and behaviour. Finally, it introduces urban living labs as real-life, participatory and locally embedded environments in which alternative mobility practices can be explored.

The chapter uses literature on narratives, narrative persuasion and ULLs to identify six mechanisms that may be present to some degree in ULLs that are associated with narrative-shift potential: deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion. These mechanisms form the conceptual basis for the empirical assessment developed in chapter 3

2.1 Literature review method

The theoretical framework of this thesis was developed through a targeted, thematic literature review. The aim was not to provide a systematic overview of all literature on narratives, mobility transitions or urban living labs, but to identify concepts that could support the development of an assessment framework for narrative-shift potential in mobility-focused ULLs.

The review developed along two main branches. The first strand focused on narratives and mobility transitions. This strand started from Brömmelstroet et al. (2022), which connects mobility transitions to dominant and alternative mobility narratives. This publication was used as an initial seed because it directly matched the problem framing of this thesis: mobility systems are shaped not only by infrastructure, technologies and policies, but also by shared narratives about what forms of mobility are considered normal, desirable and feasible.

The second branch focused on urban living labs. This strand was developed through recurring overview and framing sources in the ULL literature, especially sources on mobility-focused living labs, ULL characteristics and ULLs as settings for experimentation and co-creation. Nesterova et al. (2021) was used as an important initial source for understanding variation among mobility-focused ULLs.

From these starting points, relevant literature was identified mainly through backward and forward snowballing. Backward snowballing was used by reviewing the reference lists of relevant publications. Forward snowballing was used where useful by identifying later publications that cited key sources using the 'cited by' function in Google Scholar. This process

expanded the literature base across four related areas: mobility narratives, narrative persuasion, sustainability transitions and urban living labs.

Sources were selected based on their conceptual relevance to the research aim. Peer-reviewed academic literature was used as the main basis for the theoretical framework, for all claims about narrative persuasion, mobility narratives, sustainability transitions and ULL characteristics. Grey literature and institutional sources were used only for definitions, contextual information and, in later chapters, case identification.

Because the review was targeted rather than systematic, it does not claim to provide a complete overview of these fields. Its purpose was to identify concepts that could be translated into an assessment framework for this thesis.

2.2 Narratives as structures for shared understanding

To understand how urban living labs can influence individual perspectives on mobility, it is first important to establish what (mobility) narratives are and how they shape the current status quo. This section introduces the concept of narratives and their significant role in shaping societal systems. It explains how narratives are not just stories, but cognitive and cultural frameworks that encode meaning, dictate actions, and establish what is considered the norm in personal mobility.

2.2.1 Context: narratives as frameworks for meaning

Narratives are not just words strung together into a coherent story; they are vehicles of meaning that structure common understanding of complex issues. Consider the narrative of “the street”: a street, for centuries, was a shared space for multiple users. The place where children played, people socialized, and goods were transported. A modern-day square might come closest. This is how streets were seen and understood by all of society. However, with the rise of privately owned cars, an alternative narrative emerged in which streets were presented as ‘channels for vehicular throughput’. Over the years, this narrative shift has significantly impacted urban planning, influencing how streets are designed and used. A modern-day street is a vastly different place than a street in the pre-car era, both in its physical presence and in our understanding of what it is and should be (Brömmelstroet et al., 2022).

Gadinger et al (2014) further underline this view of narratives as more than just “conventional information transmission”. They present narratives as powerful frameworks that encode meaning in language. They convey more than just their content; they also structure our understanding of the world around us. In other words: the way a narrative is constructed can influence how people make sense of the information it presents. It’s not just public transport versus cars, but it’s the expensive public transport versus the convenient cars, or the environmentally friendly public transport versus the polluting cars. Narratives have an ordering function and are the guiding frameworks that dictate the actions of actors, even beyond the information they convey (Byrne et al., 2011; Chabay et al., 2019; Guske et al., 2019).

2.2.2 Dominant mobility narratives

The recurring use and communication of narratives strengthens their embedding within the collective understanding. This embedding impacts individuals' exposure to narratives, thereby overshadowing their theoretical autonomy in selecting, using and communicating narratives based on what they themselves deem credible (Hermwille, 2016). Most people pick what's on the menu, after all. This echo chamber or feedback loop can be seen as a form of path dependence, where the trajectory of development is reliant on historical factors rather than objective properties like truth or technical superiority.

The dominant car-focused mobility system is shaped by a combination of physical and mental path dependence (Liebowitz & Margolis, 1995). The prevailing (motorized) transportation systems and travel behaviours are widely regarded as unsustainable and a major contributor to anthropogenic climate change (Economides et al., 2012; Holden et al., 2020; Johansson et al., 2016; Rollin et al., 2021; Thombre & Agarwal, 2021; Tillema, 2014). However, dominant narratives, such as the often repeated "Americans love their cars", and physical infrastructure that's already in place reinforce the personal car-centred status quo and influence our understanding of the challenges and possibilities in achieving a more sustainable mobility transition (Brömmelstroet et al., 2022; Wells & Xenias, 2015). We don't do what we currently believe to be 'the right thing', because of decisions made in the past.

Hawxwell et al. (2024) add that the dominance of car-centred mobility is not only embedded the dominant narrative through existing infrastructure and behaviour, but also through the way future mobility systems are imagined. They show that many sustainability transition studies still frame plausible mobility futures around personal motorised vehicles.

2.2.3 Alternative narratives

If dominant narratives help stabilise the current mobility system, alternative narratives are needed to make different mobility futures imaginable and actionable. However, not every alternative narrative is equally likely to become embedded. Holden et al. (2020) state that the chance of an alternative narrative becoming embedded and part of the status quo depends on its credibility. For alternative narratives in sustainable mobility, three factors are proposed: feasibility, acceptability, and centrality (Holden et al., 2020).

1. **Feasibility**

   Feasibility describes whether the narratives are possible: do we have the technology, the funding, the space. A narrative must align with the practical realities of the situation. For instance, a narrative advocating for a transition to electric vehicles should consider the existing infrastructure and state of technology.

2. **Acceptability**

   Acceptability is about societal approval. Narratives must resonate with the values and aspirations of the public.

3. **Centrality**

   Centrality describes the long-term contribution of the narrative to the goal, in this case: creating a more sustainable mobility system.

Narratives must tick all three boxes to effectively guide transitions. For instance, a narrative that is both feasible and acceptable but fails to deliver on centrality, for instance by not proposing a more sustainable solution (e.g. “Business as usual”), would not drive a meaningful shift towards a sustainable mobility system. Similarly, a narrative that delivers on centrality and feasibility but is not acceptable would never be executed and therefore also not have the intended impact (e.g. “No more transport for pleasure”).

Summarizing: narratives are more than descriptions; they contain and make up our values, beliefs, and perspectives. Narratives define what is politically feasible and socially acceptable, and thus contribute to the inertia of the status quo and influence the trajectories of socio-technical changes (Hermwille, 2016; Tillema, 2014). Narratives have the power to shape perceptions and actions, and can be used as tools for learning, sense-making, and envisioning desirable futures (Chabay et al., 2019; Guske et al., 2019). They can empower ideas by combining them into shared visions (Holden et al., 2020). The role of narratives in sustainability on a societal scale is therefore significant (Braddock & Dillard, 2016; Chabay et al., 2019; Guske et al., 2019; Hermwille, 2016; Veland et al., 2018). However, because these macro-level narratives are ultimately sustained by collective belief, shifting the dominant mobility paradigm requires changing internal narratives of individuals. The process of how individuals engage with and adopt new narratives is explored in the next section.

2.3 Narrative shifts at an individual level

There is a positive relation between exposure to a narrative and narrative-consistent beliefs, attitudes, and behaviours (Braddock & Dillard, 2016). These changes in attitudes and behaviour are caused by an alignment of personal beliefs with the values and goals embedded in the narrative. This process, called narrative persuasion, involves three stages: absorption, reflection, and persuasion (Hamby et al., 2018).

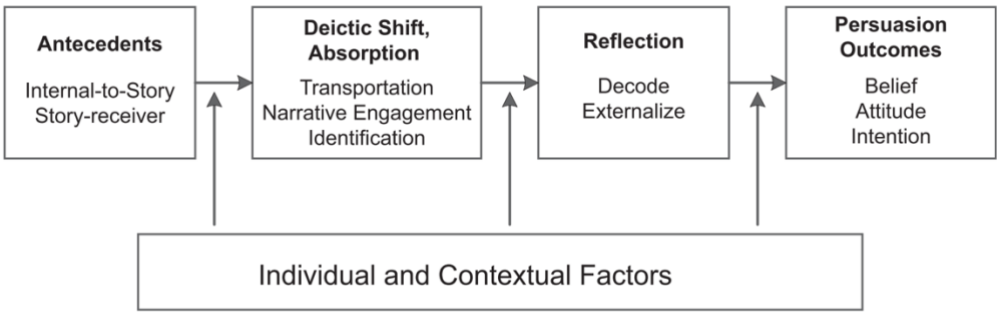


Figure 2 - Narrative persuasion process by Hamby et al. (2018)

2.3.1 Absorption: immersion in the narrative world

The process of narrative persuasion begins with absorption, where individuals become immersed in the narrative and new perspective. Individuals temporarily set aside their personal viewpoints and fully engage with the mechanics of the world outlined by the alternative

narrative (Green & Brock, 2000; Hamby et al., 2018; Slater & Rouner, 2002). There are several mechanisms that contribute to this phenomenon:

1. **Transportation**

   Transportation refers to the cognitive and emotional engagement experienced while interacting with a narrative. It involves mental imagery and emotional connection (Green & Brock, 2000).

2. **Narrative Engagement**

   Narrative engagement emphasizes active interaction with societal narratives. It encourages individuals to delve into the narrative's implications (Hamby et al., 2018).

3. **Identification**

   Identification occurs when individuals align their perspective with that of specific aspects or implications within the narrative, recognizing their own role or contribution (de Graaf et al., 2012). The more alike the narratives and individual's perspectives are, the deeper the absorption (Chen et al., 2016).

4. **Relevance**

   Perceived relevance of the narrative to the individuals' real-world experiences and beliefs impacts the degree of absorption of the individual into the narrative (Hamby et al., 2018).

2.3.2 Reflection: constructing meaning

Following absorption, individuals enter the phase of reflection, where they interpret the narrative and derive meaning from it (Hamby et al., 2016, 2018). In this phase, two mechanisms play an important role:

1. **Decoding**

   Decoding involves the comprehension of the narrative's implications at various levels. Individuals may grasp the narrative's surface-level implications or engage in a deeper understanding of its overarching themes.

2. **Externalising**

   Externalization is connecting the implications and beliefs implied in the narrative with the individuals' real-world mental models. The extent to which the narrative resonates with personal beliefs and experiences influences the degree of externalization. Greater personal relevance enhances the narrative's potential to shape individuals' real-world beliefs, attitudes, and behaviours.

Reflection not only shapes current views and intentions but can also lead to reinterpretation of past experiences. Individuals may recognize parallels between the narrative and their own experiences, prompting them to reframe past events and derive new relevance from them.

2.3.3 Persuasion: shaping beliefs and actions

The final step is persuasion itself. Once individuals have absorbed the narrative and reflected upon its meaning they will integrate it into their real-world mental models (Hamby et al., 2016). While even just exposure to a narrative often leads to an increase in narrative-consistent

beliefs, attitudes and behaviours (Braddock & Dillard, 2016), a deeper immersion into the narrative perspective results in more significant changes in individual beliefs consistent with the narrative (de Graaf et al., 2012; Green & Brock, 2000; Hamby et al., 2018; Slater & Rouner, 2002).

Another factor influencing the degree of persuasion is 'processing fluency'. In essence, the easier it is for individuals to process the narrative, the more likely they are to be persuaded (Bullock et al., 2021). How easy is it to process a narrative can for instance depend on its content. Presenting a familiar perspective that requires minimal effort to identify with makes it easier to process and leads to a higher degree of persuasion (Chen et al., 2016). Alternatively, the delivery of the narrative can also affect processing ease. For example, participants were less persuaded when an audio recording of a narrative was overlaid with white noise, compared participants listening to the same audio recording without white noise (Bullock et al., 2021).

2.4 Urban living labs as environment for narrative shifts

The European Network of Living labs (ENoLL) defines living labs as "user-centred, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings." (ENoLL, n.d.). They can be considered inclusive environments that facilitate innovation and collaboration among various stakeholders, including academia, governments, and the general public (Loorbach & Rotmans, 2006; von Wirth et al., 2019; Voytenko et al., 2016).

2.4.1 Introduction into ULLs

In recent years, the concept of ULLs has gained increasing attention as a means to drive innovation and address complex societal challenges (Nesterova et al., 2021; Steen & Van Bueren, 2017; von Wirth et al., 2019). Living labs provide real-life environments for experimentation, collaboration, and co-creation involving various stakeholders, such as governments, academia, industry, and civil society (Nesterova et al., 2021; Puerari et al., 2018). This 'quadruple helix' approach (Figure 3) allows for the development and testing of innovative solutions and alternative narratives in a context that reflects the complexities and dynamics of the real world (Loorbach, 2010; Nesterova et al., 2021; Nguyen & Marques, 2022; Schütz et al., 2019; von Wirth et al., 2019).

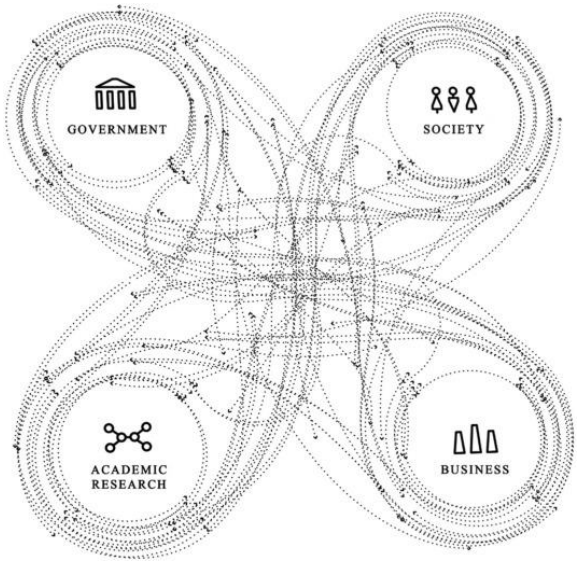


Figure 3 - The Quadruple Helix Model adapted by Fraunhofer (2016), originally developed by Carayannis and Campbell (2009). Copyright © 2015 Fraunhofer. (Schütz et al., 2019)

As stakeholders work together within ULLs to explore and test alternative narratives, they build a foundation of collaboration and shared vision that may extend beyond the lab environment. Furthermore, co-creation can create new social relations and partnerships that may continue after the formal project or experiment has ended (Frantzeskaki et al., 2025). The networks and relationships that develop in the ULL can be vital for the eventual large-scale implementation of the new technology or alternative narrative in the future. This process of 'nurturing networks' within ULLs also helps to develop trust among the key stakeholders (Mahmoud et al., 2021; Puerari et al., 2018).

Living labs are not limited to the field of sustainable mobility or even to urban settings. They have been applied in various sectors such as healthcare, agriculture or digitization (A. V. Hansen et al., 2021; Haug & Mergel, 2021; McPhee et al., 2021; Zipfel et al., 2022). For example, in the field of healthcare, living labs have been used to co-create new methods of patient engagement, or to address issues related to the implementation of healthcare innovations such as limited public trust or clinical resistance (Archibald et al., 2021; Zipfel et al., 2022). The agricultural sector uses living labs to research agroecosystems and to develop and test innovative farming practices, technologies, and policies (McPhee et al., 2021). In Austria and Germany, the government employs living labs to tackle challenges in the digitization of their operations (Haug & Mergel, 2021).

2.4.2 Establishing ULLs

ULLs are typically initiated by research institutions or universities (Voytenko et al., 2016). Municipalities also play a significant and often facilitating role in the establishment of ULLs. As gatekeepers for local infrastructure, they can be enablers or inhibitors through their policies and by facilitating necessary resources and support (Kronsell & Mukhtar-Landgren, 2018)

The establishment of ULLs often relies on external funding, with JPI Urban Europe being a key funding institution for ULL projects in Europe (Voytenko et al., 2016). ULLs focusing on

urban mobility sustainable urban mobility initiatives may receive funding through programs such as CIVITAS (City-Vitality-Sustainability) or EIT Urban Mobility (Nesterova et al., 2021). Additionally, ULLs may receive funding from national and local governments, research institutions, and private sector partners (Voytenko et al., 2016)

2.4.3 Participant experiences in ULLs

The participatory way of collaborating that is used in living labs creates a sense of ownership and empowerment amongst participants, as they actively contribute to the design and implementation of interventions (Puerari et al., 2018). In mobility-focused living labs, this also means participants can be considered not only users of mobility services, but also as citizens who hold local knowledge about everyday travel and sustainable mobility challenges (Henriksson et al., 2024). This is an essential aspect of creating societal change by crafting and embedding new narratives; Brömmelstroet et al. (2022) describe involving not just academia and governments but also the general public in the process of developing and discussing potential future transition scenarios is essential for effectively implementing major changes in lifestyle and behaviour. This co-creative process also promotes (inter-) personal reflection. Individuals can critically examine their own beliefs and behaviours, opening the door to transformative learning (Frantzeskaki et al., 2018; Mahmoud et al., 2021; Puerari et al., 2018).

Inclusivity in ULLs goes beyond quadruple helix integration. Also within the civil society pillar, the opportunities for increased inclusion and representation ULLs offer could lead to improved narratives.

Because ULLs are ‘spatially embedded’, situated in a specific urban context, the solutions developed are contextually relevant and address the needs and possibilities of that particular local community (Puerari et al., 2018; Sharp & Salter, 2017). Participants are fully immersed in the alternative way of working or collaborating in the ULL. Looking at the narrative persuasion model introduced in chapter 2.3 (Hamby et al., 2018), this ‘deep immersion’ may strengthen narrative-shift potential by making alternative mobility practices more concrete and relevant to participants (Brömmelstroet et al., 2022; Hamby et al., 2018; Nesti, 2018). Furthermore, by creating a strong sense of place within the lab, participants can develop a deeper connection to their environment (Frantzeskaki et al., 2018). Improving this connection can lead to a heightened sense of responsibility and stewardship towards the local environment (McMillen et al., 2016).

Participants in ULLs will share experiences and engage in discussions both within and outside the lab context. These social interactions can create a ripple effect, where individuals influence their social networks by sharing the alternative narratives they have encountered, helping to diffuse these narratives in the broader community. This ripple effect was one of the findings of the Resilience Lab in Carnisse, Rotterdam, where participants engaged in transformative learning experiences and shared their perspectives with their social networks (Frantzeskaki et al., 2018).

2.5 Mechanisms associated with narrative-shift potential in ULLs

Urban Living Labs (ULLs) serve as more than just sources and testing grounds for new ideas. They can also contribute to the diffusion of these ideas, potentially creating an impact beyond the boundaries of the lab (Bulkeley et al., 2016; von Wirth et al., 2019). According to Puerari et al. (2018), ULLs can lead to behavioural change amongst participants and can be considered potential triggers of systemic change in urban environments.

Throughout chapter 2 , several mechanisms through which ULLs may create conditions that support narrative-shift potential have been discussed. Six mechanisms were selected by combining the insights from literature on narratives, and insights from the literature on ULLs. The literature on narrative persuasion discussed in chapter 2.3 describes conditions under which narratives may affect beliefs, attitudes and behaviour, especially absorption, reflection, personal relevance, identification and diffusion through social interaction. Second, the ULL literature discussed in chapter 2.4 identifies typical features of living labs, such as real-life experimentation, co-creation, local embedding, multi-stakeholder collaboration and learning.

The six mechanisms cover the overlap between these two fields: they are ULL characteristics that may support narrative-shift potential. In the following sections, these mechanisms will be listed and summarized. Together, these mechanisms form the theoretical basis for the assessment framework developed in chapter 3.4.

2.5.1 Deep immersion

Urban living labs (ULLs) offer participants an opportunity for deep immersion in alternative narratives about mobility. By actively engaging in co-creation and experimentation within the ULL environment, individuals may temporarily set aside their personal viewpoints and fully engage with the mechanics of the world outlined by the alternative narrative (Hamby et al., 2018, chapter 2.3.1).

This immersion may strengthen narrative-shift potential by making the alternative narrative more concrete, feasible and personally relevant. (chapter 2.2.3, chapter 2.3.1, chapter 2.4).

Deep immersion therefore refers to the extent to which participants are meaningfully exposed to, and involved in, the alternative mobility practices or perspectives explored in the ULL.

2.5.2 Reflexivity

ULLs offer opportunities for participants to reflect on their experiences, challenge existing assumptions and practices, and critically examine their own beliefs and behaviours (Frantzeskaki et al., 2018; Puerari et al., 2018). Reflexivity can be supported by co-creative processes, especially when participants are invited to discuss, evaluate or reinterpret their experiences (chapter 2.4).

Reflexivity is important for narrative-shift potential because narrative change does not only depend on exposure to the alternative narrative. Participants also need opportunities to interpret what they have experienced and connect it to their own values, routines and assumptions about mobility. Henriksson et al. (2024) show how living lab participants can be encouraged to reflect on mobility not only through use of a service, but also through questions

about their everyday travel practices, local mobility conditions and their own role in a future sustainable transport system. In the narrative persuasion model discussed in chapter 2.3, this corresponds especially to the reflection stage, where participants interpret the implications of a narrative and externalise them in relation to their own real-world mental models. Reflection can help participants compare the dominant mobility narrative with alternative possibilities and consider whether their existing beliefs still feel appropriate.

In this thesis, reflexivity refers to the extent to which the ULL creates moments or structures that encourage participants to critically examine their experiences, assumptions, and possible changes in perspective.

2.5.3 Participatory approach

ULLs use an inclusive quadruple helix approach (von Wirth et al., 2019). This inclusive environment allows for diverse perspectives and ideas to be considered, which can lead to the development of narratives that are acceptable (chapter 2.2.3) and that resonate with a wide range of individuals (Brömmelstroet et al., 2022; Puerari et al., 2018, chapter 2.4) Important to note is that participation does not automatically equal co-creation. Frantzeskaki et al. (2025) argue that co-creation requires participants to have meaningful space to shape problem definitions, visions, solutions and relations, rather than only providing input or feedback.

In this thesis, participatory approach refers not only to the presence of different actors, but to the degree to which participants can influence problem definitions, decisions and interpretations within the ULL.

2.5.4 Socio-spatial relevance

ULLs are situated in specific urban contexts, addressing the unique needs and possibilities of local communities (Puerari et al., 2018; Sharp & Salter, 2017). This local embedding is important because participants' thoughts on mobility are shaped by concrete places, infrastructures and everyday constraints, such as access to public transport, cycling routes, parking pressure, perceived safety and car dependence.

In the narrative persuasion literature discussed in chapter 2.3.1, perceived relevance influences the extent to which individuals become absorbed in a narrative (Hamby et al., 2018). In mobility-focused ULLs, alternative narratives may therefore become more meaningful when participants can connect them to their own streets, neighbourhoods, routes and mobility barriers. Henriksson et al. (2024) show that participants' views on mobility are shaped by local conditions such as transport access, infrastructure, amenities and safety. By ensuring contextual relevance, the alternative narratives generated are tailored to the specific challenges and opportunities of the urban area, making them more relatable and applicable to participants (chapter 2.4), and feasible in that context (chapter 2.2.3).

Furthermore, this socio-spatial embedding of ULLs can strengthen participants' sense of place (Frantzeskaki et al., 2018). By creating a strong sense of place within the lab, participants can develop a deeper connection to their environment. This heightened sense of stewardship may support narrative-shift potential by changing how participants understand their own role in relation to the local environment (McMillen et al., 2016).

In this thesis, socio-spatial relevance refers to the extent to which the ULL is embedded in a specific local context and addresses mobility challenges, routines and possibilities that are meaningful to the participants and communities involved.

2.5.5 Network nurturing

The quadruple helix approach that ULLs use involves academia, government, industry, and civil society (von Wirth et al., 2019). ULLs offer space for the deliberate development of the networks and relationships necessary for the successful operationalization of alternative narratives. Within the 'safe space' offered in ULLs, these networks can develop and strengthen, which could be a first step towards future, larger scale, implementation. This nurturing process also helps to build trust and cooperation among all parties in the quadruple helix (Mahmoud et al., 2021; Puerari et al., 2018; chapter 2.4). Alternative narratives are more likely to survive when they are carried by relationships, organisations and routines beyond the initial experiment.

Network nurturing refers to the extent to which the ULL deliberately builds relationships between actors who can support, continue or scale the alternative mobility practice and the narrative attached to it after the initial experiment.

2.5.6 Social network inclusion

ULLs can use the power of participants' social networks to accelerate in the broader diffusion of narrative shifts. Participants in ULLs could influence their social networks by sharing the alternative narratives they have encountered in the ULL (Frantzeskaki et al., 2018; chapter 2.4), showing their approval of this alternative narrative (chapter 2.2.3). Designing ULLs to maximize the social network ripple effect involves encouraging participants to share their experiences and learnings, also outside of the immediate lab environment.

Social network inclusion refers to the extent to which a ULL enables participants to share, discuss or demonstrate the alternative mobility narrative within their own everyday social networks, such as neighbours, families, colleagues, school communities or local associations.

2.5.7 Towards a ULL assessment framework

Together, the mechanisms discussed above describe different ways in which ULLs may create conditions that support narrative-shift potential. Each mechanism highlights a different aspect of how participants may encounter, interpret and potentially integrate alternative mobility narratives within a living lab setting.

However, these mechanisms are still theoretical. To use them in the empirical analysis, they need to be translated into observable aspects of ULLs. This requires developing a framework that makes it possible to assess how strongly these mechanisms are present in real-world mobility-focused ULLs.

The development of this assessment framework is part of the methodological design of this thesis and is discussed in chapter 3.4. The full ULL characterisation rubric is included in Appendix A

3 Assessing narrative-shift potential through mechanism expression

Chapter 2 identified six mechanisms that literature suggests are associated with narrative-shift potential in mobility-focused urban living labs: deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion. These mechanisms provide the conceptual basis for this thesis, but they are still theoretical constructs. To study how they appear in real-world ULLs, they must be translated into observable indicators and an empirical assessment strategy.

This chapter explains that translation. In doing so, it answers the second research sub-question: **"How can these mechanisms be operationalised into an empirical assessment framework?"**

The chapter first sets out the requirements for such an assessment. It then explains why this thesis assesses narrative-shift potential rather than measuring actual participant-level narrative change. After that, it presents the chosen empirical assessment design: a qualitative multiple-case study based on organiser-led case reconstruction, supporting documentation and rubric-based assessment. Finally, it introduces the ULL characterisation rubric and explains how it was operationalised, scored and refined through a pretest.

3.1 Requirements for assessing mechanism expression

This section defines the requirements that the empirical assessment strategy needs to meet. These requirements follow from two sources: the research question and the theoretical framework.

3.1.1 Requirements derived from the research question

The main research question of this thesis is:

“How can the narrative-shift potential of mobility-focused urban living labs be assessed?”

Answering this question requires an empirical assessment strategy that can do several things:

The assessment methodology must make it possible to understand how mobility-focused ULLs function in practice. ULLs are not isolated interventions with one clearly defined input

and one clearly measurable output. They are context-dependent environments in which different activities, actors, interactions, locations and organisational decisions come together. An assessment of narrative-shift potential therefore needs to allow for this complexity to influence and shape the understanding of how the identified mechanisms are expressed within each case.

Furthermore, the methodology must allow for systematic comparison between cases. The aim of this assessment is not only to describe individual living labs, but also to compare how the six mechanisms are expressed across different ULLs. To make this comparison possible, the mechanisms identified in chapter 2.5 need to be translated into a structured assessment framework.

Third, the assessment strategy should support the identification of design opportunities. Although part I of the thesis is analytical, the wider thesis also has a design-oriented aim. The assessment should therefore not end with case descriptions or scores. It should help identify where mechanisms are strongly expressed, where they are weak or underdeveloped, and which aspects of ULL design could be adjusted by organisers in future projects.

Finally, the methodology must remain feasible within the constraints of a master thesis. The research had to be carried out with limited time, limited access to cases, and limited access to participants.

Together, these requirements point towards an assessment strategy that combines qualitative case reconstruction with structured rubric-based assessment. Qualitative reconstruction makes it possible to understand each ULL in its specific context, while the rubric makes it possible to compare mechanism expression across cases.

3.1.2 Requirements derived from the theoretical framework

The theoretical framework developed in chapter 2 also shapes the requirements for the empirical assessment strategy.

Chapters 2.2 and 2.3 showed that narrative shifts are complex and difficult to observe directly. Internal narratives are not visible in themselves. They are expressed through what people say, how they interpret experiences, what they consider desirable or realistic, and how they connect individual experiences to broader ideas about mobility. Directly studying such shifts would therefore require participant-level data, preferably collected before and after participation. Since such data was not available for this thesis, the empirical assessment focuses instead on the conditions that literature associates with narrative-shift potential.

Chapters 2.4 and 2.5 connected narrative theory to the ULL context and identified six mechanisms through which ULLs may contain design conditions associated with narrative-shift potential: deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion.

These mechanisms form the basis for the comparative assessment. This assessment therefore needs to identify whether and how these mechanisms are expressed in real-world ULLs. It needs to capture how the ULL was organised, how participants were involved, how the ULL was embedded in its local context, how stakeholders interacted, and whether participants were given opportunities for reflection, engagement and sharing beyond the ULL.

This requires an assessment strategy that is both flexible and structured. It needs flexibility because the presence of mechanisms needs to be understood in relation to each specific case context. It should be structured because the same mechanisms must be assessed across different cases.

3.1.3 Overview of assessment requirements

The requirements discussed above are summarised in Table 1.

Table 1 - Requirement overview for empirical assessment of mechanism expression in real-world ULLs

Requirement	Derived from	Meaning for the empirical assessment
Context sensitivity	Research question + ULL theory	The assessment must preserve enough contextual detail to understand how each ULL functioned in practice.
Comparability	Research question	The assessment must make it possible to compare mechanism expression across cases.
Mechanism focus	Theoretical framework	The assessment must focus on the six literature-derived mechanisms associated with narrative-shift potential.
Focus on narrative-shift potential	Theoretical framework + data constraints	The assessment must evaluate design conditions associated with narrative-shift potential.
Design relevance	Research and design aim	The assessment must generate insights that can be used in Part II as input for the design step.

3.2 Options for assessing mechanism presence in real-world ULLs

Several methodological options could be used to study the relationship between ULLs and narrative shifts. These options offer different possibilities, have different data requirements, and can support different kind of claims. Three options were considered: a pre- and post-intervention participant measurement, retrospective participant interviews, and organiser-led case reconstruction combined with rubric-based assessment. Each of these three will be discussed in this section.

3.2.1 Pre- and post-intervention participant measurement

One methodological option to study narrative shifts would be to measure participants' internal narratives before and after participation in a ULL. This could be done using a questionnaire, interviews, or a combination of both. The main strength of such a pre- and post-intervention design is that it allows for comparison between two moments in time. If participants' responses change after participation, this could indicate that their internal narratives shifted.

A version of this approach that would fit within the context of a thesis could use a simulated ULL intervention, for instance in the form of a serious game. In such a setup, participants would first complete a baseline measurement. They would then participate in a serious game that simulates a ULL-like situation, after which the same measurement would be repeated. By changing the degree to which certain ULL mechanisms are present in the game, it might seem possible to explore how those mechanisms relate to changes in participant responses.

After detailed discussions with Dr. Bekebrede of the TU Delft Gamelab, several challenges were identified:

1. **Isolating mechanism effects**

   Altering only the degree of expressions for different mechanisms within a serious game would be (too) complex. The different elements present in a serious game together form its design. The mechanisms are just some of those elements. Altering the degree of expressions of these mechanisms would impact other elements too, making it almost impossible to isolate the effect of the mechanism's presence.

2. **Validity of in-game measurements**

   Serious games cannot be used as an alternative to real-world situations when in this context. A serious game inherently cannot accurately reflect real-world (ULL) scenarios. Measurements made in a simulated ULL are not generalizable to actual ULLs.

3. **Resource intensiveness**

   Developing a robust serious game requires significant resources, including time, expertise and access to participants. Constructing such a game would be substantial enough to form an entire thesis.

The decisive factor in deciding not to pursue the serious game approach was the expert advice from the TU Delft Gamelab. They emphasized that serious games, while useful for the purpose of emulating reality for training purposes or for preliminary explorations, are not reliable for drawing concrete conclusions about real-world interventions. The interactions that are typical for ULLs are complex and heavily depend on the specific context. The fact that these interactions take place over an extended amount of time could also alter the effect they have on the participants. The absence or presence of a certain mechanism in an actual ULL wouldn't necessarily have the same effect in the simulated version of that ULL and vice versa. The inability to replicate these intricacies within a game setting would undermine the validity of any findings.

A pre- and post-intervention design would be useful for future research that aims to measure actual narrative change in participants of actual ULLs. For this thesis, however, it is less suitable.

3.2.2 Retrospective participant interviews

A second methodological option would be to conduct retrospective interviews with participants of existing ULLs. Instead of measuring their internal narratives before and after participation, participants would be asked to reflect on whether and how their views, beliefs or behaviours related to mobility changed through their involvement in the ULL.

This approach has several strengths. Interviews allow participants to describe their experiences in their own words. They can provide richer contextual information than questionnaire responses and can help uncover how participants interpret specific moments, activities or interactions. Techniques such as laddering could also be used to explore the underlying values and assumptions behind participants' statements (Appendix C

Retrospective participant interviews would therefore be a valuable addition to a study on narrative shifts. They could help connect the ULL mechanisms identified in chapter 3 to participants' own experiences and reflections.

However, there are some limitations. Most importantly: this approach relies heavily on having access to participants. In practice, recruiting sufficient participants across multiple cases proved to be infeasible. For most ULLs that had already concluded, organisers no longer had active contact with participants. For others, participant data could not be shared due to privacy considerations. In cases where ULLs were still ongoing, participant access was often tied to the organisers' own project goals and not easily available for this thesis.

Additionally, retrospective participant interviews introduce recall bias. Participants may not accurately remember what they thought before participating in the ULL, or they may interpret or reconstruct earlier views through their current perspective. This does not make retrospective interviews useless, but it does limit the strength of claims that can be made about actual narrative shifts and their causes.

While participant interviews remain theoretically valuable, they were ultimately infeasible as a methodological foundation for this thesis. Access to participant interviews was requested through organisers, but this did not result in usable participant interview data. A participant-facing questionnaire was later shared as a lower-effort alternative, but no responses were received. The absence of participant data limits the ability to assess actual participant-level narrative shifts, but it does not prevent the assessment of ULL design and narrative-shift potential.

3.2.3 Organiser-led case reconstruction and rubric assessment

The third methodological option is organiser-led case reconstruction combined with rubric-based assessment. This is the approach that will be used.

Rather than attempting to directly measure participant-level narrative shifts, this approach focuses on reconstructing how selected ULLs functioned in practice and assessing the extent to which mechanisms associated with narrative-shift potential that were identified in chapter 2.5 were present. The focus is therefore on the ULL rather than its participants.

Organisers are suitable information sources for this purpose because they have insights into the goals, structure, activities, stakeholder relations and participant involvement of the ULL. They can explain why the ULL was set up in a certain way, what activities took place, how

participants were involved, which stakeholders played a role, and how the project developed over time.

Organisers can not fully represent participant experiences. They cannot provide direct insights into participants' internal narratives or prove whether participants experienced narrative shifts. However, they can provide the information needed to reconstruct the ULL and assess the presence of the identified mechanisms that literature associates with narrative-shift potential.

To make comparison between cases possible, this approach uses a rubric based on the mechanisms identified in chapter 2.5. The rubric provides a structured way to assess the degree to which each mechanism is present in each ULL. The combination of organiser-led reconstruction and rubric-based assessment therefore makes it possible to allow for lots of contextual detail while still enabling cross-case comparison.

3.3 Empirical assessment strategy

The final assessment methodology is a qualitative multiple-case study combined with rubric-based assessment. This approach allows each ULL to be reconstructed in context, while still enabling comparison across cases.

This empirical assessment proceeds in four steps: first, the literature-derived mechanisms are translated into rubric indicators (chapter 3.4). Second, selected cases are reconstructed through organiser interviews and supporting documentation (chapter 4 Third, each case is assessed using the rubric (chapter 5.2) and fourth, the resulting mechanism profiles are compared across cases (5.3).

3.3.1 Qualitative multiple-case study design

The final methodological design of this thesis is a qualitative multiple-case study. A case study approach is appropriate because ULLs are strongly context-dependent. They are embedded in specific urban environments and shaped by unique actors, governance structures, funding conditions, participant groups, goals and local conditions.

Controlled experimental designs risk oversimplifying this complexity. While they make isolating variables easier, they also remove the contextual dynamics that are typical of ULLs. Since we are especially interested in how ULL mechanisms appear in practice, the influence of this complex context needs to remain visible.

A case study approach allows each ULL to be reconstructed as a whole. It makes it possible to look at the interaction between activities, stakeholders, participants and that local context. It also makes it possible to analyse how mechanisms associated with narrative-shift potential are expressed or implemented differently across cases. By comparing several ULLs, the thesis can identify patterns, differences and design opportunities that would not be visible in a single case.

3.3.2 Mobility-focused ULLs as the focus of assessment

The object of assessment is the mobility-focused ULL rather than the individual participants. Participants remain important in the analysis, but mostly through the way they are included in the design and functioning of the ULL.

This focus also fits with the design-oriented aim of the thesis that will be introduced in part II. If the goal is to develop a tool for organisers, the analysis needs to produce insights into design choices that organisers can influence, which will always be design choices within the ULL itself. Organisers cannot directly design internal narrative shifts, but they can design conditions that may support them. They can, for instance, design participation formats, reflection moments, stakeholder interactions or communication opportunities.

3.3.3 Organisers as experts for case reconstruction

The main empirical source for the case studies will be interviews with organisers or key stakeholders involved in the selected ULLs, as they are experts on the design, implementation and functioning of their own ULLs. Supporting documents were used to complement and check organiser accounts where possible.

It's important to note that organisers are not neutral observers or representatives of all participants. Their accounts are shaped by their role, perspective and involvement in the project. However, they are well positioned to provide information about the setup of the ULL, the intended goals, the activities that took place, the way participants were recruited and involved, the role of different stakeholders, and the practical challenges or constraints encountered during implementation.

The organiser interviews were therefore used to reconstruct the cases. The reconstruction focusses on understanding the context and how each ULL functioned in practice before assigning rubric scores.

The organiser interviews also helped identify the boundaries of each case. Several projects described as living labs were not clearly demarcated in time or structure. In some cases, activities slowly tapered off rather than ending formally. In other cases, the living lab label referred to a broader programme rather than one clearly defined intervention. Without interviews, it would be difficult to understand what exactly was being assessed.

3.4 ULL characterisation rubric

To compare the selected living labs, the theoretical mechanisms identified in chapter 2.5 need to be translated into a structured assessment tool. This is the role of the ULL characterisation rubric. The rubric makes it possible to assess the extent to which mechanisms associated with narrative-shift potential are present in each case.

A high score does not prove that participants will change or have changed their internal mobility narratives, but it does indicate that the ULL contains conditions that literature suggests may contribute to such change.

This section explains how the mechanisms were operationalised, how the scoring logic works, and how the rubric use was refined through an exploratory interview.

3.4.1 Operationalising narrative-shift mechanisms

The assessment tool used in this thesis is the ULL characterisation rubric. The rubric translates the mechanisms identified in chapter 2.5 into observable indicators that can be assessed across cases.

The mechanisms themselves are theoretical. They describe conditions that may support narrative-shift potential. To use these mechanisms in case study analysis, they need to be operationalised. This means translating them into aspects of a ULL that can be observed, described and compared.

The resulting rubric (Appendix A contains the ten indicators linked to the mechanisms discussed in chapters 2.5.1 to 2.5.6:

Deep immersion refers to the extent to which participants are meaningfully exposed to, and involved in, the alternative narrative that is explored in the ULL. It is operationalised through indicators that assess the duration and depth of participant engagement.

Indicator 1: Time spent in engagement

The amount of time participants spend in co-creation activities, experiments, and interactions within the ULL.

Indicator 2: Depth of involvement

The degree of emotional and cognitive investment participants put into the activities, and the intensity of their interactions with other stakeholders.

Reflexivity refers to the extent to which the ULL contains moments or structures that encourage participants to examine their experiences, assumptions and possible changes in perspective. It is operationalised through an indicator that assesses the presence and frequency of reflective activities.

Indicator 3: Frequency of reflective activities

How often participants take part in in activities that encourage reflection, such as debrief sessions or (facilitated) group discussions.

Participatory approach refers to the extent to which participants and stakeholders that are representative of the real-world situation are meaningfully involved in shaping the ULL, rather than only being consulted or observed. It is operationalised through indicators that assess diversity of perspectives and cooperative decision-making.

Indicator 4: Diversity of perspectives

The variety of participant backgrounds, age, occupation, and other socio-cultural factors.

Indicator 5: Cooperative decision-making

The number of ULL experiments and activities where participants from different sectors (of the four quadruple helix parties) collectively contribute to the decision.

Socio-spatial relevance refers to the extent to which the ULL is embedded in a specific local context and addresses mobility challenges, routines and possibilities that are meaningful to those involved. It is operationalised through indicators that assess local tailoring and community engagement.

Indicator 6: Tailored aspects

The numbers of ULL experiments and activities that address local challenges or opportunities.

Indicator 7: Engagement of local communities

The degree of representation of diverse local community members.

Network nurturing refers to the extent to which the ULL deliberately builds relationships between actors who can support, continue or scale the alternative mobility narrative beyond the initial experiment. It is operationalised through an indicator that assesses interdisciplinary interaction.

Indicator 8: Interdisciplinary interaction

The number of planned events within the ULL that facilitate connections and collaborations across the quadruple helix parties

Social network inclusion refers to the extent to which the ULL enables participants to share, discuss or demonstrate the alternative mobility narrative within their everyday social networks. It is operationalised through indicators that assess external communication opportunities and post-ULL feedback.

Indicator 9: External communication opportunities

To what extent participants are motivated and offered opportunities to share ULL experiences and alternative narratives with their external social networks.

Indicator 10: Feedback loop (post-ULL)

The number of times external individuals provide feedback, ask questions, or express interest in ULL activities (indicating the initiation of a potential ripple effect)

These indicators assess the extent to which the ULL contains design conditions associated with narrative-shift potential. For instance, time spent in engagement and depth of involvement are used to assess deep immersion. Frequency of reflective activities is used to assess reflexivity. Diversity of perspectives and cooperative decision-making are used to assess the participatory approach.

The rubric makes the theoretical framework usable for assessing real-world ULLs. A high score indicates that the ULL contains conditions that literature suggests may support such a shift.

3.4.2 Scoring logic

Each indicator in the rubric is scored on a five-point scale, ranging from minimal presence to strong presence. The purpose of the scale is to make nuanced distinctions between cases without asking for a level of precision that the method cannot support.

A five-point scale was chosen because it allows for more differentiation than a simple binary assessment, while still remaining manageable for qualitative analysis. Each score is linked to a description in the rubric. These descriptions help make the assessment more transparent and consistent.

The rubric scores should be interpreted as structured qualitative assessments rather than objective measurements. The scores indicate the degree to which a mechanism appears to be present based on the available evidence from organiser interviews and supporting documentation.

Where evidence was incomplete or ambiguous, scoring was done conservatively. This means that higher scores were only assigned when the available data clearly supported the corresponding rubric description. If an organiser described a mechanism only indirectly, or if the evidence was unclear, the score was kept lower unless there was sufficient reason to assign a higher score. This conservative scoring approach was used to avoid overestimating the narrative-shift potential of cases

The scoring process followed three steps. First, the case was reconstructed based on the interview and supporting documentation. Second, relevant evidence was linked to the rubric indicators. Third, a score was assigned for each indicator, accompanied by a short justification.

The outcome of this process is a structured score profile for each ULL, consisting of ten numerical scores (one per indicator) showing which mechanisms were strongly present and which were not prominent. Because all cases are evaluated using the same rubric criteria, it becomes possible to directly compare different ULLs on each mechanism

The full rubric is included in Appendix A

3.4.3 ULL rubric pretest: Tunnelvisionair

This assessment approach was further shaped by an exploratory interview conducted with the organiser of the (self-identified) ULL Tunnelvisionair. This case was used as a methodological pre-test and trial application of the rubric.

Tunnelvisionair was useful for this purpose because it raised questions about what should and should not be considered a living lab in the context of this thesis. The case included elements that were relevant to mobility, participation and reflection, but it did not match the definition of a ULL as used in this thesis. This was something that would not have been captured by solely focused on filling in the rubric. As a result, only focussing on assigning the most appropriate rubric score for each indicator risked oversimplifying the differences in the practical reality of the cases. Important contextual differences, the main reason for going for case studies, such as the actual duration and intensity of participation or the distinction between a broader living lab and a more isolated experiment within it, could easily be overlooked if the rubric were treated as a stand-alone scoring instrument.

Therefore, the methodological approach was adjusted. Rather than using the rubric on its own, an organiser interview guide was developed (Appendix D The initial focus is on understanding of how the case functioned in practice, before moving to questions that help collect the input needed to score each of the ten indicators in the rubric.

The Tunnelvisionair case is not treated as one of the three main case studies, but results of the interview and the assigned rubric scores are included in Appendix E

4 Case studies

This chapter presents the three mobility-focused urban living labs selected for the case study analysis: GEMINI, ALTHEA and sCOOL2walk. This chapter presents descriptive reconstructions of the three selected cases. It focuses on the problem addressed by each ULL, its goals, stakeholders, participants, activities, local context, available data and practical implementation. Interpretive assessment and comparison are reserved for chapter 5 .

4.1 Case study selection

The goal of this case selection process is to identify mobility-focused ULLs that can be reconstructed and assessed based on the presence of mechanisms associated with narrative-shift potential. Since the methodology relies on organiser interviews, supporting documentation and rubric-based assessment, the selected cases needed to be both theoretically relevant and practically accessible.

To identify suitable case studies, this thesis uses an assessment framework based on the EIT Urban Mobility Knowledge Base (Nesterova et al., 2021). The database is a good match for this research because it provides a curated overview of European urban mobility living labs and identifies key distinctions that capture differences in ULL structure. This report was used as a reference for understanding what kinds of variation exist within mobility-focused ULLs and which selection criteria would be relevant for this thesis.

Nesterova et al., (2021) define the living labs in their database as initiatives “that actively apply core living lab principles, including an uncontrolled real-life setting, co-creation and active end-user involvement, triple or quadruple helix stakeholder participation, and a multi-method approach.” This definition is in line with the understanding of ULLs used in this thesis. The database also distinguishes between governance models, facilities and structure, and functional elements. These distinctions helped shape the selection logic for this thesis, by making explicit how mobility-focused ULLs can vary in scale, location, stakeholder composition and type of intervention.

The final case selection was guided by three criteria: focus on personal mobility, variation in ULL type, and accessibility for empirical reconstruction. These criteria are discussed below.

4.1.1 Selection criteria

For this thesis there are 3 key criteria to be taken into account in the ULL selection process.

Criterium 1: The ULL should focus on personal mobility

The research questions specifically focus on personal mobility. Therefore, it’s important that selected ULLs target changes in how individual users perceive and/or practice mobility (e.g., public transport, shared mobility).

Criterium 2: We need a variety of ULL types

ULLs differ in their governance model, physical structure, duration, scale, participant involvement and stakeholder composition. A neighbourhood-based cooperative initiative, for example, creates different conditions for participant involvement than a city-wide or programme-based living lab. Including different types of cases makes it possible to identify which mechanisms appear across cases and which seem more dependent on the specific ULL configuration.

Criterium 3: Interviewees should be accessible

The methodology depends on organiser interviews and supporting documentation. This means that selected cases needed to have identifiable organisers or key stakeholders who were willing and able to discuss the design, implementation and functioning of the living lab. Cases also needed to have enough available information to reconstruct what happened in practice.

4.1.2 Recruitment and data availability

The first stage of case exploration focused on Dutch or Dutch-connected mobility living labs. This focus was chosen for practical reasons. Dutch cases, or cases with strong Dutch involvement, were expected to be easier to access through existing networks and more feasible for organiser interviews within the timeframe of this thesis. The Dutch focus also made it easier to interpret the local context context, local mobility challenges and stakeholder roles.

Initially, several potential cases were identified through the EIT Urban Mobility Knowledge Base and related mobility innovation networks. These included established Dutch living labs such as the Helmond smart mobility living lab, Brainport Smart District and Marineterrein Amsterdam Living Lab. However, in practice, recruitment proved to be one of the main constraints in the case selection process. Some of these initially identified cases did not respond to contact attempts. Others had already ended, and the people listed in public sources were no longer directly involved. In several cases, ULL activities had gradually slowed down or disappeared without a clear formal ending, making it difficult to determine who was responsible or able to speak about the case. In other cases, organisers were unable or unwilling to participate within the timeframe of this thesis.

The final sample was therefore shaped by both methodological relevance and practical accessibility. The selected cases were chosen because they matched the research focus, could be reconstructed through available data, and provided useful variation in how mobility-focused ULLs are organised.

4.1.3 Realised sample

The three main cases selected for this thesis are GEMINI, ALTHEA and sCOOL2walk. In addition, Tunnelvisionair was used as an exploratory trial case to test and refine the methodological approach, but it is not included as one of the three main cases in the analysis.

GEMINI focuses on cooperative car sharing in Amsterdam neighbourhoods. It was selected because it is strongly connected to personal mobility, takes place in real neighbourhood contexts, and involves residents not only as users but also as co-organisers of a shared mobility solution.

ALTHEA is a broad transition-oriented living lab programme that covers mobility and energy challenges across several European regions, including the Rotterdam-Antwerp region. It was selected because it represents a different type of ULL from GEMINI: larger in scale, more programme-based, and more strongly oriented towards stakeholder coordination.

sCOOL2walk focuses on active school travel through walking groups through a supporting digital platform. It was selected because it addresses a concrete everyday mobility practice: the journey to school. The case involves parents, children, schools and public actors, and includes co-creation around route safety, platform design and local school 'mobility barriers'.

Together, the three cases provide useful variation in mobility focus and ULL configuration. This variation supports the analytical aim of this thesis: to compare how mechanisms associated with narrative-shift potential appear across different types of mobility-focused ULLs.

The realised sample is not statistically representative of all mobility-focused urban living labs, such a sample is not feasible within the scope of this thesis. It is also not the aim for this sample, the aim is to make an analytical comparison across contrasting cases to assess how the theoretically identified mechanisms are present in different living lab settings, identify recurring strengths and weaknesses, and translate these findings into design opportunities for future ULLs.

4.2 Data collection and case reconstruction

The empirical data for this reconstruction was collected through semi-structured organiser interviews, supplemented with publicly available documentation where possible. Since direct participant data was not available, organisers and key stakeholders were used as the primary source for understanding how each ULL was set up, how it functioned, and how participants and stakeholders were involved.

4.2.1 Organiser interviews

The primary data collection method was semi-structured organiser interviews. These interviews have two main purposes. First, they will be used to reconstruct the ULL environment. This includes the goals of the living lab, the context in which it took place, the activities that were organised, the role of participants, the role of stakeholders, and the way the project developed over time. This reconstruction is what is presented in this chapter.

Second, the interviews will be used to collect information relevant to the indicators listed in the rubric. The interview guide therefore touches upon topics such as participant engagement, reflection, decision-making, local relevance, stakeholder interaction and communication beyond the ULL. These results are presented in chapter 5

A semi-structured interview format was chosen to make it possible to combine consistency and flexibility. The semi-structured format leaves room for a laddering interviewing technique (Appendix C that could help in understanding why certain experiences led to certain outcomes (Rowe & Cooke, 1995). The same themes and indicators are addressed in each case to make it possible to compare different ULLs. At the same time, the flexibility in the interview makes it possible for organisers to explain the specific characteristics of their living lab in their own words. A more rigid questionnaire format would risk not capturing all information needed to

assign valid rubric scores, and could leave important topics that are not covered in the rubric unexplored.

Approval of the TU Delft Human Research Ethics Committee was sought and granted for this step of the thesis.

4.2.2 Supporting documentation

The case reconstructions and rubric assessments are based primarily on the organiser interviews. Publicly available project documentation was used only as a supplementary source. This included grey literature and project documentation such as project websites, grant proposals, public project descriptions, consortium pages and, where available, project reports or pilot-result documents.

These sources were used to verify and supplement factual information from the interviews. This included information such as project start dates, project duration, participating organisations, consortium composition, locations, stated project aims, intervention types and publicly described activities.

The availability and usefulness of supporting documentation differed between cases. In some cases, project websites and public descriptions provided useful factual context, while in others the organiser interview remained the main source of information. Where interview data and supporting documentation differed or where documentation was incomplete, the interview data was treated as the primary source for reconstructing how the living lab functioned in practice.

4.2.3 Case reconstructions

The collected data consisted of semi-structured organiser interviews and supporting documentation where available. The interviews were recorded and transcribed. The transcripts were used to reconstruct each case in a structured way before rubric scores were assigned.

The case reconstruction focused on the following elements:

1. the goal of the ULL
2. the mobility issue addressed
3. the local context
4. the involved stakeholders
5. the role of the organiser
6. the role of participants
7. the activities that took place
8. the degree of co-creation
9. reflection moments or learning activities
10. communication beyond the ULL
11. available documentation

Supporting documentation, such as project websites, public descriptions, and available project materials, was used to clarify factual details and supplement the interview-based reconstruction where possible

4.3 Case study 1: GEMINI

4.3.1 Case introduction

This case is the Amsterdam branch of the European GEMINI project, in which new mobility services are tested in real-life urban settings. In Amsterdam, the project focused on cooperative car sharing at a neighbourhood level. The living lab revolved around small local cooperatives in which residents collectively organise, manage and use shared electric car groups.

Table 2 – Case study 1 (GEMINI) characteristics

Problem	High car ownership and parking pressure in Amsterdam
Goal	Test cooperative car-sharing as scalable mobility solution
Initiators	GEMINI consortium, Municipality of Amsterdam, Toogethr
Stakeholders	Municipality, researchers, mobility provider, neighbourhood communities
Participants	Residents of participating neighbourhoods
Recruitment	Residents were either actively approached by Townmaking in selected neighbourhoods or volunteered themselves after learning about the initiative. Recruitment strategies differed between neighbourhoods.
Activities	Cooperative ownership, shared vehicle use, governance participation
Local context	Four neighbourhoods with different socio-economic characteristics
Duration	Four-year Horizon Europe project, with neighbourhood initiatives operating for varying periods during the project
Available data	Interview (*Interview with 'CENEX' Representative*, 2026) Project website (GEMINI, n.d.).

4.3.2 Available data

Unless otherwise indicated, the information in the reconstruction of this case is based on a semi-structured interview conducted with a representative of CENEX Nederland conducted on 14-04-2026. CENEX is a project partner responsible for evaluation activities within GEMINI.

Publicly available information about the project partners and project itself on the project website was used to factcheck dates, project partners and timeline (GEMINI, n.d.).

4.3.3 Case description

According to the interviewee, GEMINI is a four-year European research project focused on testing new mobility services and business models. In Amsterdam, CENEX Nederland was involved as evaluation partner alongside the Municipality of Amsterdam and Townmaking, the organisation that actually set up and supported the neighbourhood initiatives.

The Amsterdam living lab consisted of four neighbourhood-based sub-labs. Participants entered the living lab in different ways. In some neighbourhoods, residents actively volunteered after learning about the initiative, while in others, such as the Spaarndammerbuurt, residents were actively approached by Townmaking. According to the interviewee, participation only proceeded when sufficient local interest existed to make the cooperative viable. A minimum number of committed participants was required before a cooperative could be established.

The four neighbourhoods were deliberately different from one another. This variation was important to see to what extent the carsharing initiatives researched in this project would function under different local conditions. One neighbourhood was described as an older working-class area with relatively lower incomes, another as a newly developing district still under construction, another as a wealthier area with strong parking pressure, and the last as an average/regular residential neighbourhood.

The lab focused on cooperative car sharing. The shared cars were not simply offered to residents as a ready-made service. Instead, neighbourhood groups were supported in setting up their own local cooperative structures around the vehicles. Residents could help determine practical arrangements such as the pricing structure, the number and type of vehicles, and some of the rules around use. This meant that participants were not just users of the mobility service but actual contributors to its design and governance. Decisions about vehicle selection, ownership structures, cost allocation, and practical operation were discussed within the cooperative itself.

In one neighbourhood, an existing privately owned car of one of the participants was brought into the cooperative and shared by the group, in the other cases, vehicles were leased.

The process usually started with an exploration of the neighbourhood. According to the interviewee, Townmaking spoke with residents, gathered local stories and tried to understand what was needed in a specific area before helping groups get started. This process was called ‘narrative record making’. Participants were then supported with the organisational and legal aspects of cooperative car sharing, such as leasing, insurance, governance and cost sharing. The municipality facilitated charging infrastructure, provided dedicated parking arrangements during the project period, and helped address regulatory barriers that stood in the way during implementation.

The interviewee also noted that not every group turned out to be as stable as others. Some initiatives stopped, some struggled when key individuals left, and the original ambition of building a wider local service ecosystem around the shared cars that included local garages and service providers appears to be left for a later stage of the project.

The duration and intensity of participation varied between individuals and neighbourhoods. Some participants primarily engaged as users of the shared vehicles, while others took more active roles in organising and maintaining the cooperative. The interviewee emphasised that the success of the initiatives depended strongly on local engagement and on the presence of motivated individuals willing to take ownership of organisational tasks.

The case aligns closely with the definition of an urban living lab used in this thesis. It was embedded in real neighbourhoods, involved collaboration between multiple stakeholder groups, allowed participants to influence the implementation of the intervention, and evolved over time in response to local circumstances.

4.4 Case study 2: ALTHEA

4.4.1 Case introduction

This case concerns the Rotterdam/Antwerp branch of the ALTHEA project, a broad Horizon Europe project that encompasses multiple 'transition super living labs' (ALTHEA Project, n.d.). According to the interviewee, these living labs are intended to support green transition in both urban and peri-urban contexts by connecting mobility, energy, and governance. Within the Rotterdam/Antwerp case, one of the concrete mobility-oriented interventions mentioned in the interview is a shared van service for workers travelling between the city and the port.

Table 3 - Case study 2 (ALTHEA) characteristics

Problem	Mobility and energy transition challenges in urban and peri-urban areas
Goal	Develop and test transition super living labs
Initiators	Horizon Europe consortium consisting of municipalities, research organisations, consultancies and "transition-oriented stakeholders"
Stakeholders	Cities, researchers, freight actors, mobility providers, public authorities
Participants	Citizens, commuters, workers, freight stakeholders, public authorities and other locally relevant stakeholder groups, depending on the specific intervention
Recruitment	Differs between living labs and interventions and are organised locally by project partners and participating authorities
Activities	Shared mobility pilots, worker transport initiatives, public transport redesign activities, co-creation sessions, data-driven mobility tools and governance experimentation
Local context	Rotterdam-Antwerp, Lisbon, Milan, Alicante, Ioannina

Duration	Horizon Europe project launched in December 2025, with living lab activities continuing throughout the project period
Available data	Interview (*Interview with 'ALTHEA' Representative*, 2026) Project website (ALTHEA Project, n.d.)

4.4.2 Available data

Unless otherwise indicated, the information in the reconstruction of this case is based on a semi-structured interview conducted on 16-04-2026 with a research consultant from Panteia, who acts as the technical coordinator at the project level for ALTHEA. As the project was still in an early stage at the time of the interview, information is mostly about the intended design and setup of the living labs rather than completed outcomes.

Publicly available project documentation, including the project website and consortium pages, was used to verify factual details such as project locations, intended interventions, and stakeholder composition(ALTHEA Project, n.d.).

4.4.3 Case description

The central aim of ALTHEA is to test and support sustainable mobility innovations in areas where conventional mobility systems do not fully meet local needs. These include peri-urban areas, connections between port and city areas, industrial zones, tourism-heavy areas, and places where access to public transport is limited or inefficient. The project includes five living labs in different European contexts, each encompassing multiple local initiatives. These areas were selected because they face concrete mobility and transition challenges that require locally tailored solutions. According to the interviewee, participating municipalities joined the consortium in order to gain access to funding, expertise, and implementation support that would help them address challenges that would otherwise be difficult to tackle independently.

The five living labs are located in Rotterdam/Antwerp, Ioannina, Alicante, Lisbon and Milan. While all focus on sustainable mobility transitions, each addresses a different local challenge, ranging from city-port accessibility and industrial mobility to tourism-related mobility pressures and urban logistics. In the Rotterdam/Antwerp location, the central challenge is the interaction between the city and the port, especially in relation to accessibility, worker transport, and the broader transition of transport and energy systems.

A key part of ALTHEA is that the living labs and the initiatives within them are each adapted to their local contexts, rather than implementing one fixed solution across all sites. As a result, participant groups differ between interventions. Depending on the local challenge, participants may include commuters, workers, citizens, freight operators, public authorities, mobility providers, energy stakeholders, or combinations thereof. Recruitment and engagement activities are organised locally by the responsible project partners and municipalities.

The interview mentions several possible or ongoing interventions, including shared mobility services, shared vans, public transport improvements, apps, data tools, energy-mobility connections, and planning support for cities. This process of tailoring to the local context is especially important because the project focusses on peri-urban mobility and connecting this

to existing urban mobility solutions. These existing solutions is different everywhere. In the Rotterdam/Antwerp location, this is visible in the focus on worker access to the port, where ordinary public transport does not reach all terminals.

At the time of the interview, most interventions were still being developed or had only recently started. As a result, the case primarily provides insight into the intended design of a transition-oriented living lab rather than into completed implementation trajectories.

Participant involvement is present, but not in the same way across all initiatives. In the Rotterdam/Antwerp worker-transport example, the intervention is described mostly as a practical service offer. Workers are informed about the service, can choose to use it, and may provide feedback based on their experience. At the same time, the interview does indicate that co-creation is part of many ALTHEA innovations. In the van-pooling example, the service can be fine-tuned together with users. In other ALTHEA cases, citizens are explicitly consulted on how public transport solutions should be redesigned, for instance by discussing smaller buses, more frequent services, or different stopping points. Interventions within ALTHEA do not only test technical solutions, but also investigate whether proposed mobility options are meaningful and usable in everyday life.

Reflection and evaluation are built into the project structure. The interviewee refers to evaluation cycles at both living lab level and project level, where partners review solutions, consider improvements, and later assess what has been achieved over the project period. However, the interview also makes clear that the case with van pooling, and the ALTHEA project in general, was still in an early phase. The interviewee cannot yet see visible effects on behaviour, local environments, or participants' underlying views on mobility.

A final point touched upon in the interview is continuity. The interviewee says that in her experience, living labs often depend heavily on temporary project funding, which creates a risk that promising initiatives stop once funding ends. In their view, lasting requires continuity beyond the formal project, for example through a committed owner such as a municipality, a port authority, or another actor able to keep the initiative alive. This is relevant to the present thesis because it suggests that the influence of a living lab may depend not only on its design during the funded project period, but also on whether the context can sustain it afterwards. This speaks in favor of implementing mechanisms such as network nurturing into living labs if lasting effects are desired.

4.5 Case study 3: sCOOL2walk

4.5.1 Case introduction

sCOOL2walk focuses on personal mobility in the everyday journey to school by helping parents, children, schools, and public actors organise walking groups and related active school-travel arrangements. Rather than centering on a new vehicle or transport service, the intervention is built around collective walking, cycling, and the reduction of car-based school trips.

Table 4 - Case study 3 (sCOOL2walk) characteristics

Problem	Unsafe and unsustainable school travel patterns

Goal	Encourage active and safer school travel
Initiators	Future Mobility Network (now Movares) and European project partners
Stakeholders	Schools, municipalities, police, researchers, platform developers
Participants	Parents and children
Recruitment	Schools, parents and children were recruited through participating schools and local project partners
Activities	App use, workshops, route discussions, school-based interventions
Local context	School environments and local mobility barriers
Duration	Multi-year European development and pilot phase, followed by continued implementation in selected locations
Available data	Interview ("Interview with 'The Future Mobility Network' Representative," 2026) Project website (Scool2walk, n.d.) EIT grant application (Caicedo Mafla, 2022)

4.5.2 Available data

Unless indicated otherwise, the information in the reconstruction of this case is based on a semi-structured interview conducted on 20-04-2026 with one of the founders of sCOOL2walk and the Future Mobility Network. The EIT Urban Mobility project proposal, alongside a publicly available project history, were used to verify factual details, project phases, and stakeholder involvement (Caicedo Mafla, 2022; Scool2walk, n.d.).

4.5.3 Case description

According to the interviewee, sCOOL2walk originated in a European project in which a digital platform was developed and tested in several cities, including Barcelona in Spain, Siġġiewi in Malta, and Riga in Latvia (Caicedo Mafla, 2022). The project was initiated by Future Mobility Network together with European project partners and local authorities. The underlying concept of walking groups itself was not new. The objective in the project was to test and develop a more structured and reusable digital platform that could support the organisation of these walking groups, route planning, data handling, and long-term continuity beyond an informal WhatsApp group or paper-based arrangement.

The interview suggests that the intervention was developed through co-creation with the groups that would later use it. Children, parents, schools, and local police were involved in the early design process. Participants were asked about obstacles, fears, motivations, and practical preferences related to how they make their way to school. These groups later also became the participants of the living lab. Schools acted as local hubs, parents organised and

supervised walking groups, and the children participated in the walking groups. This participatory approach was also visible through workshops with children, conversations with schools and parents, and local activities that helped to tailor the intervention to the specific context.

The intervention is organised around fixed routes, pick-up points, local school contexts, and the specific barriers experienced by children and parents in a given area (for example, a specific park not feeling safe early in the morning). Workshops are used to make those local experiences visible. Children are asked where they live, how they travel, what they find exciting or worrying, and how they experience the route to school.

The interview also indicates that the living lab evolved during implementation. One concrete example is that the platform was initially aimed mainly at primary-school children, but later also adapted for older children and teenagers. According to the interviewee, this led to the addition of a separate teen account, because older participants were interested in joining but did not want the same guided format as younger children. This suggests that participant feedback was not only collected, but also led to changes in the design of the intervention.

On outcomes, the evidence in this interview is mostly about behaviour of the participants. The interviewee explains that the project measured travel behaviour, for example through baseline measurements and intermediate tracking of whether children walked or cycled to school more often. She also mentioned that the intervention aims to make parents more aware that the school trip can be organised differently, instead of defaulting to the car. The clearest longer-term result mentioned is that in Malta the initiative continued after implementation, with schools still using the concept.

A final lesson the interviewee shared is that the most relevant narrative change may not sit only with the actual users, in this case, the children. They are not always the decision-maker when it comes to personal mobility. In this case the parents are the ones who decide how the school journey is organized, and changing their internal narrative would therefore be even more impactful.

5 Analysis and interpretation

Chapter 4 presented the three selected case studies and reconstructed their main characteristics. This chapter analyses those cases in relation to the mechanisms associated with narrative-shift potential that were identified in chapter 2.5 and operationalised in the ULL characterisation rubric that was introduced in chapter 3.4. This analytical step answers the third research sub-question: **"How are these mechanisms expressed in selected mobility-focused ULL cases?"**

The first section of this chapter analyses each case individually. This within-case analysis discusses how the mechanisms appear in GEMINI, ALTHEA and sCOOL2walk, and what this tells us about the narrative-shift potential of each living lab. In the second part, the cases are compared across mechanisms. This cross-case analysis identifies recurring strengths, weaknesses and differences between the cases.

5.1 Methodology for data analysis

This chapter discusses how the data presented in chapter 4 will be analysed and translated into findings. Figure 4 shows an outline of the data analysis plan.

The case reconstructions form the basis for the analysis in this chapter. Whereas chapter 4 describes the three cases, this chapter interprets them using the ULL characterisation rubric introduced in chapter 3 .

The analysis was conducted in two steps. This is recommended in qualitative case study methodologies (Miles & Huberman, 1994; Yin, 2013). First, within-case analysis examines each ULL individually within its own context and complexities, then a cross-case analysis identifies patterns or contrasts across the different ULLs. In the case of this study, within-case analysis helps understand the specific strengths and weaknesses of mechanism profiles, while the cross-case analysis allows us to to identify recurring patterns, differences and trade-offs across different types of mobility-focused ULLs.

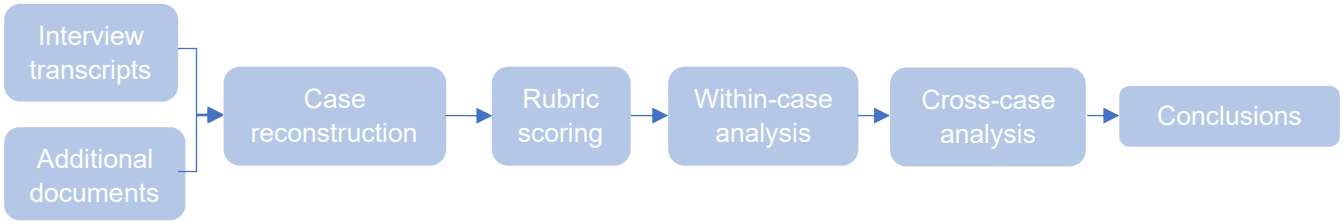


Figure 4 - Data analysis plan

5.1.1 Within-case assessment using the rubric

Based on the case reconstructions presented in chapter 4 , the ULL characterisation rubric is used to assess the presence of the ten indicators. This scoring done by the researcher and based on the interview transcripts and case reconstructions. For each indicator, a score from 1 to 5 was assigned based on the available evidence.

The organisers will not fill in the rubric themselves, and the rubric scores will not be checked with them afterwards. Instead, the interviews were used as input for the researcher's own reconstruction and assessment. This was done to keep the scoring process consistent across cases. The organiser interview guide is included in Appendix D

Each score is accompanied by a short justification. These justifications explain which parts of the interview supported the assigned score and can be found in Appendix F Where evidence was limited or ambiguous, the supporting documentation was used, and the score were assigned conservatively.

The within-case assessment made it possible to identify the specific strengths and weaknesses of each case and is presented in chapter 5.2.

5.1.2 Cross-case analysis per mechanism

The cross-case analysis is organised around the six mechanisms: deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion. For each mechanism, the analysis compares the three cases in terms of score and expression. The same mechanism can be present in different ways, comparing only the scores would therefore risk overlooking important differences in how mechanisms are actually expressed in ULLs.

The analysis then identifies which mechanisms were strongly present across cases, which mechanisms appear weaker or less deliberately designed, and which trade-offs emerge between mechanisms and practical ULL constraints.

The cross-case analysis therefore serves two purposes. Analytically, it makes it possible to identify patterns and contrasts across the three selected ULLs. Design-wise, it generates the basis for the ULL optimisation tool developed in chapter 7

The cross-case analysis is presented in chapter 5.3.

5.2 Within-case analysis

This section presents the within-case analysis of the three selected living labs. Each case is discussed separately, using the rubric scores as a starting point. The detailed score justifications are included in Appendix F

The within-case analysis focuses on how the mechanisms are expressed in practice. This includes how participants are involved, how activities are embedded in local contexts, how reflection takes place, how stakeholders interact, and whether the living lab creates opportunities for diffusion beyond the direct participant group. Figure 5 provides an overview of the rubric scores for all three cases.

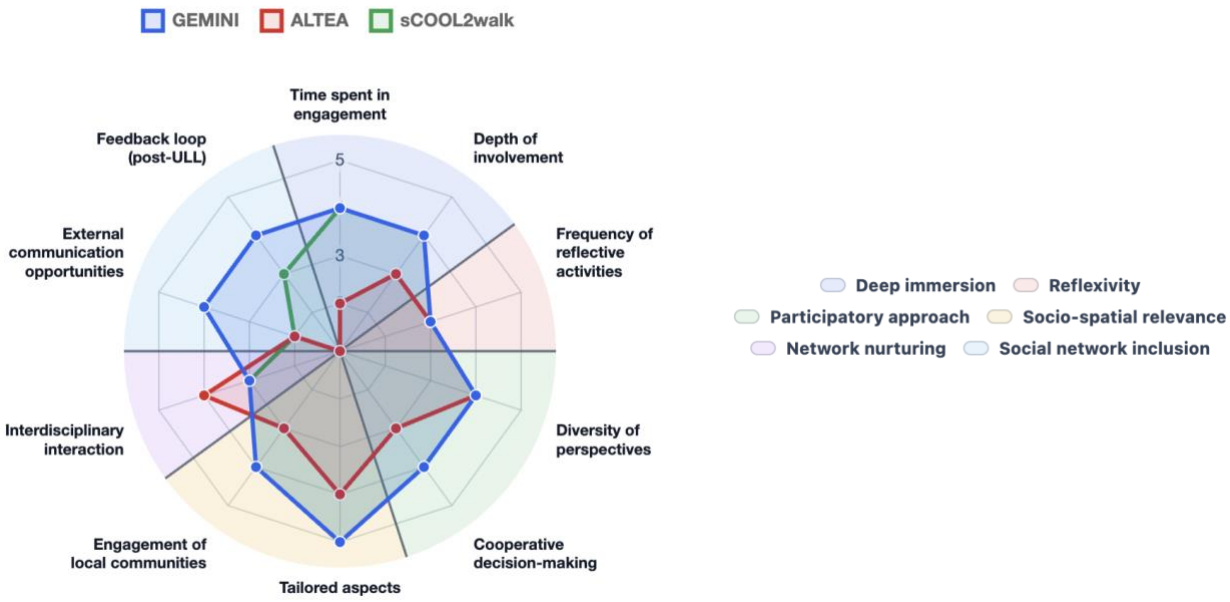


Figure 5 - ULL characterisation overview of all three case studies, based on assigned scores in Appendix F

5.2.1 Case study 1: GEMINI

Figure 6 shows the ULL rubric results for the GEMINI cooperative car-sharing living lab. The assessment was conducted using the ULL characterisation rubric presented in Appendix A Detailed evidence and justification for each assigned score can be found in Appendix F This section focuses on how the assessed mechanisms were realised in practice and what this reveals about the narrative-shift potential of the living lab.

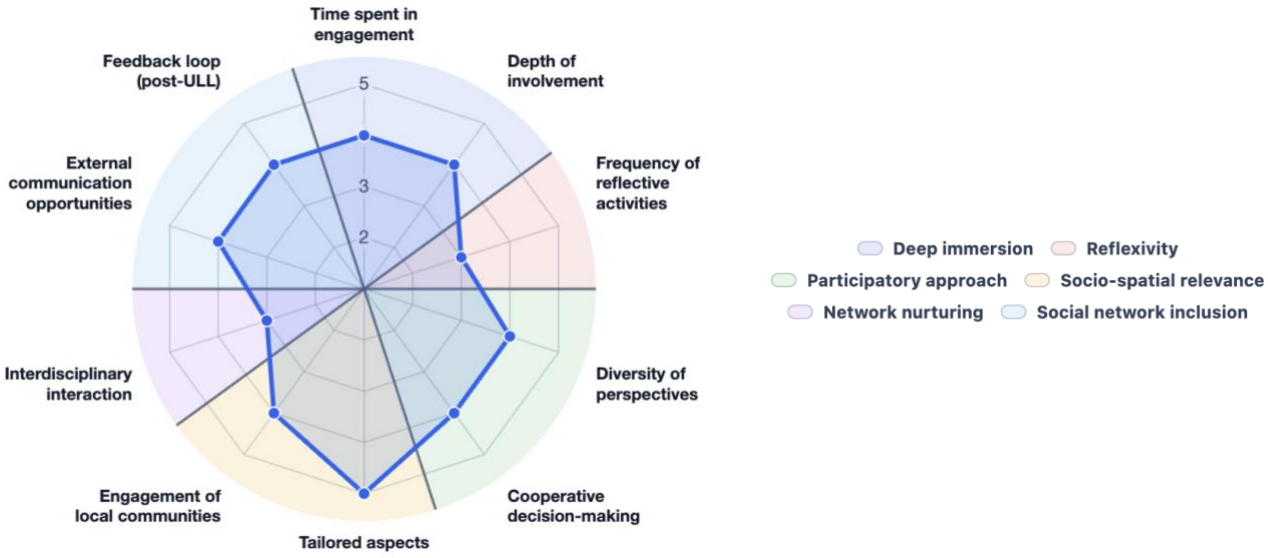


Figure 6 - ULL characterisation overview of GEMINI, based on assigned scores in Appendix F

GEMINI has a relatively strong mechanism profile, especially for deep immersion, participatory approach, socio-spatial relevance and social network inclusion. The narrative-shift potential comes mainly from the fact that residents are not only users of a shared mobility service, but also co-organisers of a cooperative structure. The alternative narrative that car access does not require private ownership is therefore not only communicated, but also very much alive in the living lab itself.

Deep immersion scores high because participation is long-term and tied to concrete mobility practices. Participants do not only test a service once. They become part of a cooperative car-sharing initiative that requires ongoing decisions about use, costs, rules, recruitment and organisation. Residents experience the alternative narrative by helping to organise it.

The participatory approach is also strong. Residents can influence the number and type of vehicles, pricing structures, discounts, internal roles, cleaning, recruitment and other practical arrangements. The basic concept and support structure are provided by Townmaking and the project partners, but the local implementation is shaped by the residents themselves.

Socio-spatial relevance is another strength. The living lab consists of four neighbourhood-based sub-labs in Amsterdam, each with different socio-economic and spatial characteristics. The intervention is adapted to local conditions such as parking pressure, affordability, trust amongst neighbours and existing mobility habits. This makes the alternative narrative more concrete and relevant to participants' own surroundings.

Social network inclusion is relatively strong because participants help recruit others and make the initiative visible in their neighbourhoods. The cooperative model depends on a sufficient number of committed members, which gives participants a practical reason to discuss the initiative with neighbours and social contacts. This is different from external communication organised only by project partners. In GEMINI, participants themselves become part of the diffusion process. However, this mainly applies to active core members and board members. More passive users are less likely to play this role.

Reflexivity is present, but less deliberately aimed at narrative change. Surveys, interviews, resident evenings, narrative records and ongoing conversations with Townmaking provide moments for reflection. However, the interview suggests that these reflections focus mainly on practical and organisational questions: what the cooperative needs, how it should function and how residents can cooperate effectively. There is no explicit reflection on a narrative level: whether car access requires ownership, or how their ideas about that have changed over time.

Network nurturing is also more mixed. GEMINI contains strong local resident networks and useful links with Townmaking, the municipality, CENEX and European project partners. However, the local ecosystem, for instance local service providers, garages or other neighbourhood actors, is not involved.

This is also part of what makes the implementation and with that the alternative narrative vulnerable in this case. Some initiatives struggled or stopped when key people left or when there were too few active members. This is the strength of a community-led group, without the resilience that embedding the narrative into a broader local network can bring.

Overall, GEMINI's narrative-shift potential comes from community ownership, collective decision-making, social embedding and long-term participation. The main opportunity for improvement is to implement more explicit narrative reflection, and in strengthening the wider support network around the cooperatives.

5.2.2 Case study 2: ALTHEA

Figure 7 lists the assessment results for the ALTHEA Transition Super Living Lab. The scores were generated using the ULL characterisation rubric that can be found in Appendix A and Appendix F contains the detailed evidence and justification underlying each assessment. This subchapter focuses on how the identified mechanisms are implemented within the living lab and what this reveals about its narrative-shift potential.

ALTHEA is a broad programme that connects mobility, energy and governance across several living labs. The highest scoring mechanisms are socio-spatial relevance and network nurturing. Looking closer at these mechanisms however, shows that they are expressed mainly at institutional and programme level rather than at the level of everyday participants.

Socio-spatial relevance scores strong because the project is organised around different local and regional transition challenges. The Rotterdam-Antwerp case focuses on city-port interaction and worker transport, other living labs address issues such as peri-urban accessibility, tourism pressure, industrial areas, logistics and energy communities. ALTHEA does not apply one standard solution everywhere. Interventions are adapted to local challenges and existing systems. For example, the shared van service in the Rotterdam-

Antwerp region is a response to a specific local accessibility issue: workers need to reach port areas that are not (well) served by public transport.

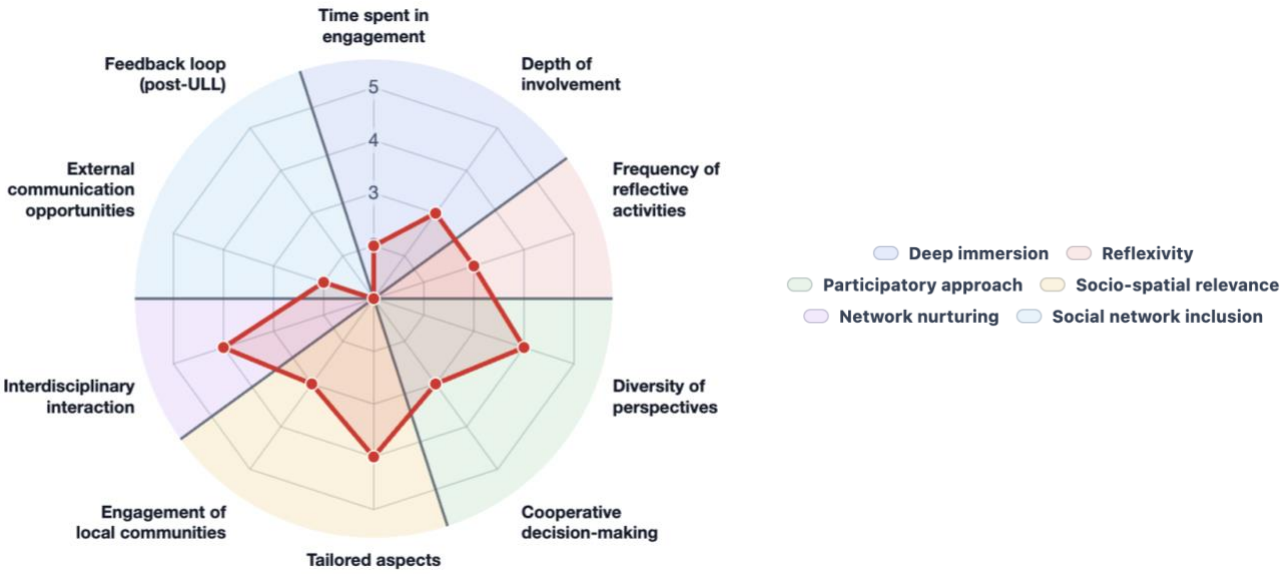


Figure 7 - ULL characterisation overview of ALTHEA, based on assigned scores in Appendix F

Network nurturing is also strong. ALTHEA brings together municipalities, research organisations, technical partners, mobility actors, energy stakeholders, port-related actors and European project partners. ALTHEA's narrative-shift potential therefore lies partly in helping institutional actors see integrated mobility, energy and governance solutions as feasible and actionable.

Participant-level immersion is quite weak. For many everyday users, participation is simply using or responding to a specific service or pilot. In the worker transport example, participants are introduced to a mobility service and may provide feedback based on their experience. This can still create exposure to an alternative mobility option, but there is little contrast to set this apart from other, non ULL related options or experiences.

The participatory approach is also limited. The interviewee indicated that users may help fine-tune services, and citizens may be asked how public transport solutions could be redesigned. However, the broader project agenda, and actual innovations are decided upon and led by the consortium. Participants are consulted, but they do not co-govern.

Reflexivity is also mainly visible at the organiser and stakeholder level. Evaluation cycles are built into the project and living lab structure, allowing partners to review solutions and discuss improvements, but there is no evidence that everyday participants are encouraged to reflect explicitly on their own mobility assumptions. Reflexivity is therefore present, but not strongly directed at participants, and not pointed at participant-level narrative change.

Social network inclusion is weak in the current stage of the project. ALTHEA includes external communication, such as project dissemination, conferences, LinkedIn or local press, but this is mainly organised by project partners. Participants themselves are not supported in sharing their experiences or becoming ambassadors of an alternative mobility narrative.

At the time of the interview, ALTHEA had only recently started, and the interviewee indicated that it was too early to identify any effects. Low scores for feedback loops and social network inclusion are partly due to this early stage of the project.

Overall, ALTHEA's narrative-shift potential is strongest at the institutional level. It shows how a living lab can bring together actors across sectors to solve transition challenges. The main limitation within the focus of this thesis is that everyday participants appear to have less continuous involvement and less influence over the broader living lab structure.

5.2.3 Case study 3: sCOOL2walk

The assessment results for the sCOOL2walk living lab are shown in Figure 8. This assessment was conducted using the ULL characterisation rubric presented in Appendix A Appendix F contains the detailed evidence and justification underlying each assigned score. This section interprets the results and examines how the identified mechanisms are implemented within the living lab.

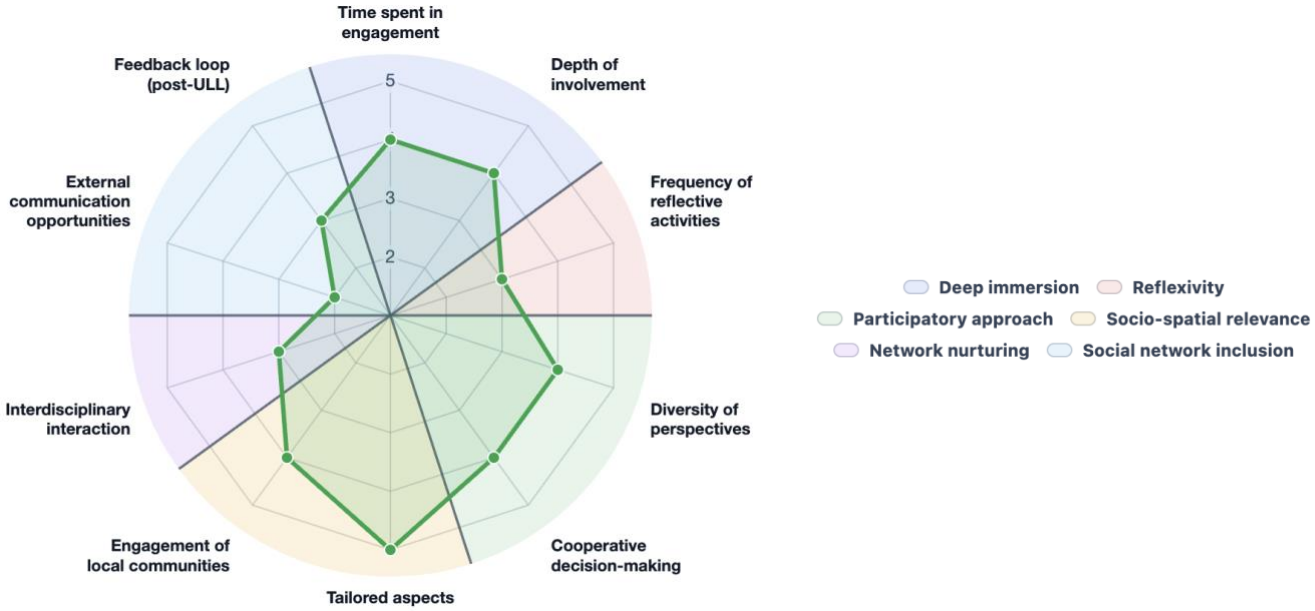


Figure 8 - ULL characterisation overview of sCOOL2walk, based on assigned scores in Appendix F

sCOOL2walk scores strongly on deep immersion, participatory approach and socio-spatial relevance. The case focuses on a concrete everyday mobility challenge: travelling to school. The alternative narrative is that the school journey does not need to be organised primarily through individual car-based drop-off, but can be organised collectively and by foot.

Deep immersion is strong because the intervention is embedded in daily routines. During the pilot period, the walking groups and platform were potentially relevant on every school day. The alternative mobility practice is not experienced as a one-off experiment, but as something that can become, or even is, part of ordinary school travel.

The participatory approach is relatively strong. The platform was developed in co-creation with parents, children, schools, local police, researchers, cities and project partners. This participation influenced concrete design decisions. For example, concerns about live tracking

shaped how children are registered in the system, and concerns about group safety influenced limits on walking group size.

Socio-spatial relevance is one of the strongest mechanisms in this case. School travel is highly context-dependent. sCOOL2walk assesses and integrates local conditions directly through workshops and route.

Reflexivity is present, but not strong. Children and parents were asked about current travel behaviour, safety, social cohesion and route experiences. These are reflective moments, but they focus mainly on practical barriers and the improvement of the intervention, the app, in this case. There is no explicit reflection on broader mobility assumptions, such as why driving children to school is seen as normal, safe or responsible, also not after the pilot ended.

Network nurturing is also moderate. The case involves schools, parents, municipalities, local police, researchers and platform developers. These actors are necessary for implementation. However, the available evidence suggests that interaction between stakeholder groups was mediated mostly through the project team or platform, rather than through direct relationship-building between all actors.

Social network inclusion exists, but is not a central mechanism. Schools and parents can help spread the concept, and walking groups are visible in the local school environment. There is also evidence of continuation after the original European project, including further platform development and later implementation in new contexts. However, this continuation does not seem participant-led. They were not supported to become ambassadors for the alternative narrative.

Overall, sCOOL2walk's narrative-shift potential comes from repeated exposure, local relevance and co-created design. The main opportunity for improvement is connecting this repeated practice to more explicit reflection, especially among parents, on assumptions about safety, responsibility and car-based school travel.

5.3 Cross-case analysis

The within-case analysis showed how narrative-shift mechanisms appear within each individual living lab. This section compares the cases across mechanisms. Instead of asking what characterises each case, the cross-case analysis asks how each mechanism appears across different ULL configurations.

The cross-case analysis is organised in four steps. First, the six mechanisms are compared one by one. Second, mechanisms that are strongly present across the cases are discussed. Third, mechanisms that are weak or underdeveloped are identified. Finally, the main trade-offs between mechanisms are discussed.

5.3.1 Per mechanism

This section compares how each mechanism appears across the three cases. The same mechanism can be expressed in different ways depending on the structure, scale and context of the ULL.

1. **Deep immersion**

   Deep immersion is present in all three cases, but its form differs. In GEMINI, deep immersion is strongest because residents are involved over a longer period and participate in the actual organisation of cooperative car sharing. They do not only use a mobility service, but help shape and maintain it. This makes the alternative narrative, that car access can be organised collectively rather than through private ownership, part of participants' practical and organisational experience.

   In sCOOL2walk, immersion is also strong, but it is tied less to governance and more to repeated everyday practice. Children and parents encounter the alternative mobility practice through the school journey, which can be repeated daily during the pilot. The walking groups make the alternative narrative concrete through routine use: the school trip can be organised collectively and actively rather than through individual car drop-off.

   In ALTHEA, immersion is weaker at the level of everyday participants. Users may engage with specific services, such as a shared van service, but the available evidence suggests that this involvement is often closer to service use or feedback than to prolonged participation in shaping the intervention. ALTHEA may still create immersion for institutional actors involved in the programme, but participant-level immersion is less developed than in GEMINI and sCOOL2walk.

   Connecting these findings back to the concepts of absorption and transportation introduced in chapter 2.3, immersion appears to be strongest when participation becomes a natural part of everyday life. Repeated exposure seems to hold more weight than short-term engagement.

2. **Reflexivity**

   Reflexivity is moderately present across all cases, but it is not strongly directed at narrative change. In GEMINI, reflection occurs through surveys, interviews, resident evenings, narrative records and conversations with Townmaking. However, these moments mainly focus on the practical functioning of the cooperative. Participants reflect on what the group needs, how the service should be organised and how the cooperative can work, but not necessarily on how their assumptions about car ownership or car access may have changed.

   In ALTHEA, reflexivity is built into the project through evaluation cycles at living lab and project level. These evaluation moments help project partners assess and improve interventions. However, this form of reflexivity appears mainly organiser-driven. There is less evidence that everyday participants are invited to reflect on their own mobility assumptions, routines or beliefs.

   In sCOOL2walk, reflexivity appears through questionnaires, workshops and discussions about route safety, travel behaviour and barriers to active school travel. These moments ask parents and children to think about how they travel and what makes the school journey safe or unsafe. However, as in GEMINI, reflection mostly supports improvement of the intervention being testedrather than explicit reflection on the underlying mobility narrative.

   Drawing from the reflection phase of narrative persuasion discussed in chapter 2.3.2, optimizing for narrative-shift potential requires reflecting on personal beliefs. Currently, reflexivity is often an indirect outcome rather than a deliberate design element, rendering it underdeveloped relative to its theoretical importance. Therefore, future

urban living labs should deliberately incorporate moments for participants to reflect on their internal narratives and on what they consider to be normal or possible.

3. **Participatory approach**

   The participatory approach is expressed most strongly in GEMINI and sCOOL2walk. In GEMINI, residents influence the cooperative structure, pricing, vehicle choices, rules and practical organisation. Their role goes further than just consultation, they are co-organisers of the intervention. This gives participants a high degree of influence over how the alternative mobility practice is implemented locally.

   In sCOOL2walk, participation is visible in the co-creation of the platform and intervention design. Parents, children, schools, police, municipalities and project partners contributed to the development of the walking group system. Participant input shaped concrete design choices, such as tracking, group size and the later adaptation for older children. The project remained led by the organisers, but user and stakeholder input clearly affected the design.

   In ALTHEA, participation is more mixed. The programme includes co-creation and consultation, and citizens or users may help refine mobility solutions. However, the broader project structure and intervention agenda are defined by the consortium. This means that participation exists, but everyday users have less influence over the direction of the living lab than in GEMINI or sCOOL2walk.

   The comparison shows that participation can range from consultation and service refinement to cooperative ownership and co-governance. For narrative-shift potential, the stronger forms of participation appear more promising because they allow participants to experience themselves as actors in the alternative narrative rather than only as users of a solution

4. **Socio-spatial relevance**

   Socio-spatial relevance is the strongest mechanism across the cases. All three living labs are built around concrete local mobility challenges. In GEMINI, the intervention is adapted to Amsterdam neighbourhoods with different socio-economic profiles, parking pressures, levels of trust and mobility habits. The narrative of cooperative car sharing is therefore linked to recognisable neighbourhood problems.

   In ALTHEA, the living labs address specific transition challenges in different European contexts, such as port accessibility, peri-urban mobility, tourism pressure and public transport gaps. The Rotterdam-Antwerp case focuses on the connection between city and port, especially the accessibility of work locations that are not well served by public transport.

   In sCOOL2walk, socio-spatial relevance is very concrete. The intervention is built around school environments, specific routes, perceived safety, local barriers and everyday routines of parents and children. The local context is not the setting of the intervention and, with help of the participants and other stakeholders, also an input into its design.

   The comparison suggests that socio-spatial relevance is closely connected to the basic makeup of mobility-focused ULLs. Mobility problems are experienced through specific places, infrastructures and routines. ULLs can therefore make alternative mobility narratives more meaningful by connecting them to local circumstances that participants already recognise.

5. **Network nurturing**

   Network nurturing is present in all cases, but at different scales. In GEMINI, networks are strongest at the neighbourhood level. Residents, Townmaking, the municipality, CENEX and European project partners are connected around the cooperative car-sharing model. However, this network is for a large part built around the living lab and its targets, rather than the intervention or alternative narrative. The broader local ecosystem around the cooperatives, such as local garages, housing associations or other local service actors, appears less developed. This creates a vulnerability: continuation depends strongly on active residents and project support.

   In ALTHEA, network nurturing is one of the strongest mechanisms. The project connects municipalities, research organisations, technical partners, mobility actors, energy stakeholders, port-related actors and European project partners. Its network nurturing is less participant-centred, but more developed at the level of organisations and (local) governments.

   In sCOOL2walk, network nurturing is moderate. The project involves schools, parents, municipalities, police, researchers and platform developers, which creates an implementation network around active school travel. However, the interaction between these actors appears to mostly go through the project team and the platform. There is stakeholder involvement, but less evidence of direct, sustained relationship-building between all relevant actors.

   The comparison shows that network nurturing can support narrative-shift potential in different ways. Local networks can support ownership and continuity, while institutional networks can potentially support scaling and integration into policy and promote continuity in that way. It's therefore important to not only assess if a network exists, but whether it includes the actors needed to carry the alternative narrative beyond the project period.

6. **Social network inclusion**

   Social network inclusion varies strongly between the cases and is generally less deliberately designed than the other mechanisms. GEMINI scores strongest because residents help recruit others and the cooperative model depends on neighbourhood-level trust and communication. Participants can become visible examples of cooperative car sharing, and the initiative has generated attention from residents, municipalities and media. However, this diffusion is still mostly tied to recruitment and project visibility rather than to a deliberate strategy for spreading the alternative narrative.

   In ALTHEA, social network inclusion is weak at the participant level. The project includes external communication through channels such as conferences, project dissemination, LinkedIn and local press, but this communication is mainly organised by project partners. Participants are not clearly supported to share their experiences with their own social networks or act as carriers of the alternative mobility narrative.

   In sCOOL2walk, social network inclusion is also limited. Parents and schools can spread the concept locally, and walking groups are visible in the school environment. However, the interview suggests that external sharing mainly occurred during recruitment, rather than as an ongoing participant-led part of the ULL. The continuation of the concept in Malta suggests some ripple effect, but this does not appear to have been deliberately designed around participant storytelling or narrative diffusion.

Across the cases, social network inclusion is often present as communication about the project, but less often as communication by participants. Connecting these observations to the concept of ripple effects introduced in chapter 2.4.3, which logically occur at the participant level, suggests that while project dissemination can increase visibility, participant-led sharing may be more effective in making alternative mobility narratives credible and relatable within everyday social networks.

5.3.2 Mechanisms strongly present across cases

Although the three living labs vary substantially, several mechanisms are consistently present across all cases. This consistent presence does not necessarily mean that these mechanisms are more important than the others, but it does suggest that they are closely connected to the basic characteristics of mobility-focused ULLs.

One of the mechanisms that scores consistently high is socio-spatial relevance. All three cases are embedded in concrete local mobility contexts. GEMINI addresses neighbourhood-level car ownership and parking pressure, ALTHEA adapts mobility interventions to regional accessibility challenges, and sCOOL2walk focuses on specific school environments and local challenges along the route. This local embedding is central to how ULLs operate. It makes the alternative mobility narrative more tangible because participants encounter it in relation to places, routines and problems they already know.

Another mechanism that is strongly present across cases is deep immersion. Each case creates some form of repeated or deep engagement, although the source of immersion differs. In GEMINI, immersion comes from long-term participation in a cooperative car-sharing structure. In ALTHEA, it comes from participation in pilots and local transition activities, although this involvement is less continuous. In sCOOL2walk, immersion comes from the repeated everyday practice of travelling to school differently. Across the cases, participation is not limited to a single event, but becomes connected to daily life or ongoing responsibility.

Another recurring mechanism is network nurturing. All cases depend on relationships between multiple actors. In GEMINI, this includes residents, Townmaking, the municipality and project partners. In ALTHEA, network nurturing is especially visible at the institutional level, where municipalities, research organisations, mobility actors and energy stakeholders are connected. Participants are less involved here. In sCOOL2walk, networks form around schools, parents, local authorities, police and platform developers. These networks support implementation, learning and potential continuity beyond the initial intervention.

Together, these three mechanisms appear to be recurring strengths of mobility-focused ULLs. They also show that ULLs often already contain conditions associated with narrative-shift potential, even when narrative change is not an explicit design objective.

5.3.3 Mechanisms weak across cases

Several theoretically important mechanisms have lower scores across the cases. They are not necessarily absent altogether, but they are often present indirectly or as by-products, not as deliberate design elements focussed on narrative change.

The clearest example is reflexivity. Chapter 2.3.2 showed that reflection is an important part of narrative persuasion, because participants need to interpret their experiences and connect

them to their own assumptions, values and beliefs. In the cases, reflection does take place, but it is usually focused on improving the intervention itself. Participants reflect on whether a car-sharing cooperative works, whether a mobility service is useful, or whether a school-travel app needs to be adjusted. They are less often asked to reflect explicitly on what the experience means for their internal mobility narratives: what they consider normal, desirable, realistic or necessary. It is present in practical evaluation, but not always in narrative interpretation. This could be a design opportunity. Future ULLs could strengthen narrative-shift potential by adding explicit reflection questions to existing feedback moments, rather than creating entirely new activities.

The second weaker mechanism is social network inclusion. Some diffusion beyond the immediate participant group occurs in the cases, but it is rarely deliberately designed as participant-driven diffusion, and could be more focussed on the alternative narrative. In GEMINI, residents help recruit others and the initiative receives external attention. In sCOOL2walk, parents and schools may spread the concept through their local networks. In ALTHEA, external communication is mainly organised by project partners. Across the cases, participants are not strongly supported in becoming 'carriers' or ambassadors of the alternative narrative.

This matters because narrative shifts are not only individual processes. For alternative mobility narratives to spread, they need to move through social networks. ULLs could therefore do more to help participants share their experiences with others in credible and relatable ways.

Reflexivity and social network inclusion therefore appear to offer the greatest opportunities for improvement. They are both closely connected to narrative-shift theory, but less consistently and less deliberately embedded in ULL practice.

5.3.4 Trade-offs

The cases suggest that improving one mechanism may sometimes constrain another mechanism, or create tensions with practical ULL objectives. Below, some examples are listed.

One trade-off is participation and scalability. A high degree of participation can strengthen immersion, ownership and reflexivity, but it also requires time and effort from participants. GEMINI shows the value of cooperative ownership, but also the dependence on motivated residents willing to take on organisational tasks. This kind of participation may be powerful, but difficult to scale to larger or less committed participant groups.

A second trade-off concerns local adaptation and standardisation. Socio-spatial relevance is strongest when interventions are tailored to specific local circumstances. sCOOL2walk and GEMINI both show the value of adapting interventions to specific neighbourhoods, schools or routes. However, extensive tailoring can make replication of an ULL, or even of an alternative narrative more difficult. A solution that works well in one context may not transfer directly to another.

A third trade-off concerns reflexivity and participant burden. More explicit reflection could strengthen narrative-shift potential, but it may also make participation feel demanding. This is especially relevant when participants join a ULL for practical reasons, such as accessing a shared car or organising school travel.

A fourth trade-off is between network nurturing and organisational complexity. Larger networks can support implementation and continuity by embedding the alternative narrative into its structures, but they also increase coordination demands. ALTHEA shows the value of broad institutional collaboration, but also illustrates that large programmes can become complex and organiser-driven. Network nurturing needs to be purposeful: not every possible stakeholder relationship is equally useful.

6 Research conclusion

This chapter concludes Part I of the thesis. The aim of Part I was to answer the main research question:

How can the narrative-shift potential of mobility-focused urban living labs be assessed?

To answer this question, the theoretical framework first identified six mechanisms that literature associates with narrative-shift potential in mobility-focused ULLs: deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion. These mechanisms were then translated into a ULL characterisation rubric and applied to three case studies: GEMINI, ALTHEA and sCOOL2walk. The analysis compared how the mechanisms were expressed within and across these cases.

6.1 Answer to the research question

The narrative-shift potential of mobility-focused urban living labs can be assessed by translating theoretically grounded mechanisms into observable indicators and using these indicators to compare real-world ULLs.

The assessment approach developed in Part I consists of four steps.

First, literature on narratives, narrative persuasion and ULLs was used to identify mechanisms associated with narrative-shift potential. These mechanisms are deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion. Together, they describe different ways in which participants may encounter, interpret and potentially share alternative mobility narratives within a living lab setting.

Second, these mechanisms were operationalised into a ULL characterisation rubric (Appendix A The rubric translates the mechanisms into ten indicators that can be assessed across cases. These indicators make it possible to assess the extent to which a ULL contains conditions associated with narrative-shift potential.

Third, real-world ULLs are reconstructed through organiser interviews and supporting documentation. This step is necessary because ULLs are context-dependent and cannot be understood through scores alone. The reconstruction clarifies the goals, activities, stakeholders, participant roles, local context and practical implementation of each case.

Fourth, the rubric is applied to the reconstructed cases. The resulting score profiles make it possible to compare the cases within and across mechanisms. The scores are structured qualitative assessments, not objective measurements. They are based on the available evidence and should be interpreted in relation to the case descriptions and score justifications.

The rubric and interview guide allow for narrative-shift potential to be assessed in a way that is structured but still context-sensitive. The rubric provides comparability, while the case reconstructions preserve the practical and local specificities of each ULL. The approach is useful for identifying where narrative-shift potential is already present, where it is weaker, and which aspects of ULL design could be improved.

6.2 Main research findings

The case analysis led to four main research findings.

First, mobility-focused ULLs can contain conditions associated with narrative-shift potential, even when narrative change is not an explicit design objective. Across the three cases, socio-spatial relevance, deep immersion and network nurturing were relatively strong. This suggests that several basic characteristics of ULLs, such as local embedding, repeated engagement and stakeholder collaboration, are relevant for narrative-shift potential.

Second, these mechanisms are expressed differently depending on the type of ULL. In GEMINI, narrative-shift potential is mainly connected to local cooperative ownership and long-term resident involvement. In ALTHEA, it is strongest at the institutional level, through stakeholder coordination and locally tailored transition planning. In sCOOL2walk, it is mainly connected to repeated everyday practice and the local school context.

Third, reflexivity and social network inclusion appear to be underdeveloped across the cases. Reflection is present, but usually focuses on practical improvement of the intervention rather than on participants' assumptions about mobility. Social network inclusion is also present in some cases, but rarely as a deliberate strategy for participant-led diffusion of the alternative mobility narrative. These mechanisms therefore offer important design opportunities.

Fourth, strengthening narrative-shift potential involves trade-offs. More participation can strengthen ownership and immersion, but also increases participant burden. Strong local adaptation can improve socio-spatial relevance, but may reduce replicability. Broader networks can support continuity, but also create organisational complexity.

Together, these findings show that mobility-focused ULLs often contain implicit narrative-shift potential, but that this potential is not always deliberately recognised or used. The main opportunity is therefore to make these mechanisms more explicit and to help organisers decide which mechanisms are most relevant to strengthen in their specific context.

6.3 Transition to design phase

The analysis presented in this chapter shows that while mobility-focused ULLs do show clear signs of narrative-shift potential, the (sometimes inherently) present mechanisms are rarely aligned intentionally towards narrative shifts amongst participants. Mechanisms such as socio-spatial relevance and deep immersion are strongly present, but geared towards solving practical, operational issues, while mechanisms like reflexivity and social network inclusion remain underdeveloped.

Furthermore, the presence of distinct systemic trade-offs confirms that a single, standardized living lab blueprint is structurally unviable.

The structural gaps, mechanism profiles, and trade-offs identified here are direct inputs for the design of the ULL Optimisation Tool presented in chapter 7.

PART II - DESIGN
DEVELOPING A ULL OPTIMISATION TOOL

7 Design methodology and requirements

The previous chapters developed and applied a method for assessing the narrative-shift potential of mobility-focused urban living labs. Part I showed that ULLs can contain conditions associated with narrative-shift potential, especially through local relevance, repeated engagement and stakeholder networks. However, the case analysis also showed that these conditions are not always recognised or deliberately designed with narrative change in mind. Reflexivity and social network inclusion, in particular, appeared less deliberately developed across the selected cases.

This chapter explains how the findings from Part I were translated into the design of the ULL optimisation tool. The purpose of the tool is to help organisers of mobility-focused ULLs make narrative-shift potential explicit, assess the mechanism profile of their ULL, and identify context-specific opportunities to strengthen this potential. The chapter therefore connects the research conclusion to the design output.

The chapter follows the four stages of the Double Diamond model. First, it explains the role of the design phase within the thesis. It then introduces the Double Diamond approach (Design Council, n.d.) as the structuring logic for the design process. The 'discover' section summarises the research inputs from Part I. The 'define' section translates these inputs into a design challenge, target users and design requirements. The 'develop' section explains how these requirements informed the tool concept. Finally, the 'deliver' section introduces the pre-validation tool concept. This concept is validated in chapters 8 and revised into the final ULL Optimisation Tool presented in chapter 9

7.1 Purpose of the design phase

The design phase translates the assessment approach developed in Part I into practical support for ULL organisers. Part I answered the main research question, how narrative-shift potential can be assessed: by identifying mechanisms associated with narrative-shift potential, operationalising these mechanisms into a rubric, reconstructing real-world ULL cases and comparing mechanism expression across cases.

However, assessment alone does not tell organisers what to do with the results. A mechanism profile can show where a ULL appears strong or weak, but it does not automatically indicate which mechanisms should be prioritised, which ones can realistically be strengthened, or what trade-offs may follow. A low score on one mechanism does not necessarily mean that this mechanism should be improved, and a high score does not necessarily mean that the ULL is well designed. The relevance of each mechanism depends on the alternative narrative, the participant group, the local context, the stage of implementation and the practical constraints of the ULL.

The purpose of the design phase is therefore to move from assessment to design support. The ULL optimisation tool is intended to help organisers interpret the mechanism profile of their ULL and translate this interpretation into context-specific design choices. In doing so, the design phase addresses the main design question of this thesis:

“How can the assessment of narrative-shift potential be translated into a practical design-support tool for organisers of mobility-focused urban living labs?”

7.2 Double Diamond method

The Double Diamond model (Design Council, n.d.) distinguishes between two broad phases of design activity: understanding and defining the problem, and developing and delivering a solution. Each diamond contains a divergent and a convergent movement. In the first diamond, the problem space is explored before a more precise problem definition is formulated. In the second diamond, possible solutions are explored before one final design direction is developed and delivered. Figure 1 in chapter 1.6 shows an outline of this process.

In this thesis, the Double Diamond is used as a structuring framework rather than as full-fledged design process that includes multiple rounds of prototyping with large groups of end users. This fits the scope of the thesis, where the main contribution is not a fully implemented commercial tool, but a research-informed design-support tool that translates theoretical and empirical insights into a practical format for ULL organisers. Table 5 shows an overview of how the different phases of the Double Diamond model map to this thesis.

The first diamond corresponds mainly to Part I of the thesis. The literature review explored the conceptual problem by connecting narratives, narrative persuasion and urban living labs. This led to the identification of six mechanisms associated with narrative-shift potential in mobility-focused ULLs: deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion. These mechanisms were then operationalised into the ULL characterisation rubric and applied to three real-world cases. Through within-case and cross-case analysis, the research phase defined the main design-relevant problem: ULLs often contain narrative-shift potential implicitly, but organisers lack a structured way to recognise, discuss and deliberately strengthen this potential.

The second diamond corresponds to Part II. In this chapter, the design-relevant findings from Part I are translated into a design challenge, target users, requirements and tool concept. Chapter 8 discusses the validation steps used to assess and refine the initial tool concept. Chapter 9 then presents the final ULL Optimisation Tool.

Table 5 - Overview of double diamond phases in this thesis

Double Diamond phase	In this thesis	Output
Discover	Literature review, rubric development, case study analysis	Six mechanisms, rubric, case findings

Define	Translation of findings into design challenge and requirements	Design challenge, target users, five requirements
Develop	Exploration of tool formats and components	Canvas + rubric + prompt cards + optimisation canvas.
Deliver	Validation and refinement of the initial concept	Final ULL Optimisation Tool

7.3 Discover: research input

The discover phase was covered mainly by Part I of this thesis. The aim of this phase was to understand how narrative-shift potential in mobility-focused ULLs could be conceptualised, assessed and compared. The literature review (chapter 2), rubric development (chapter 3.4) and case study analysis (chapter 5) together formed the research input for the design phase.

The most important design-relevant inputs are summarised in Table 6.

Table 6 - Research input for the design phase

Research input	Design relevance
Alternative narratives need to be feasible, acceptable and central	The tool should help organisers clarify the dominant narrative being challenged and the alternative narrative being supported.
Six mechanisms associated with narrative-shift potential were identified	The tool should be structured around deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion.
The ULL characterisation rubric made mechanism expression assessable	The tool can use the rubric as an assessment component, but must also help organisers interpret the resulting mechanism profile.
Socio-spatial relevance, deep immersion and network nurturing were relatively strong across cases	The tool should help organisers recognise existing strengths, not only weaknesses
Reflexivity and social network inclusion were underdeveloped	The tool should include prompts that help organisers strengthen these mechanisms
Trade-offs emerged between participation, scalability, local adaptation, burden and complexity	The tool should support prioritisation rather than maximise all scores

ULLs differ strongly in scale, governance and participant role	The tool must be adaptable to different ULL types

These inputs define the problem space for the design phase. The next section converges from these inputs towards a design challenge, target users and design requirements.

7.4 Define: design challenge, users and requirements

7.4.1 From research findings to design challenge

Part I developed and applied a mechanism-based assessment of narrative-shift potential in mobility-focused ULLs. The analysis showed that ULLs often contain conditions associated with narrative-shift potential, especially through local embedding, repeated engagement and stakeholder collaboration. However, these conditions are not always recognised or deliberately shaped as part of the living lab design.

This creates a gap between assessment and practice. The ULL characterisation rubric makes it possible to identify how mechanisms such as deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion are expressed in a living lab. However, assessment alone does not tell organisers what to do with those insights. A low or moderate score on a mechanism does not automatically mean that the mechanism should be strengthened, and a high score does not automatically mean that the ULL is well designed. The relevance of each mechanism depends on the narrative goal, participant group, local context, organisational capacity and trade-offs within the ULL.

The design challenge is therefore to translate the assessment of narrative-shift potential into practical support for organiser decision-making. The tool developed in Part II should help organisers move from a mechanism profile to context-specific design choices: which mechanisms matter most, which ones can realistically be strengthened, and how this can be done without assuming a fixed blueprint for all ULLs.

The design goal is to develop a practical tool that helps organisers of mobility-focused ULLs make narrative-shift potential explicit, assess the mechanism profile of their ULL, and identify context-specific opportunities to strengthen this potential.The tool should integrate the six ULL mechanisms identified in chapter 2.5, the empirical lessons learned from real-world ULL implementations in chapter 5 , and the design challenge formulated above.

These elements should help organisers move from a general ambition, such as “stimulating sustainable mobility”, to specific, actionable design interventions by answering questions such as: which existing mobility narrative is this ULL challenging, which alternative narrative should be promoted, which ULL mechanisms can support that shift, and how can the ULL be adapted to strengthen these mechanisms without undermining its practical objective?

This design goal follows from the main design question: **“How can the assessment of narrative-shift potential be translated into a practical design-support tool for organisers of mobility-focused urban living labs?”**

7.4.2 Target users and use context

The ULL optimisation tool is designed for organisers of mobility-focused urban living labs. In this thesis, organisers are understood as the actors involved in designing, coordinating or implementing a living lab. Depending on the case, this may include project coordinators, researchers, municipal partners, mobility providers, consultants, community organisations, school representatives or other stakeholders involved in shaping the living lab process.

The tool is intended to be used in a structured design or reflection session by people who understand the goals, activities, participants and constraints of the living lab. It can be used by a single organising team or individual, but could also be relevant when multiple stakeholders are involved and a shared language is needed.

The tool can be used before, during or after ULL implementation. Before implementation, it can support design choices. During implementation, it can support reflection and adjustment. After implementation, it can support evaluation and learning for future living labs.

7.4.3 Design requirements

The design of the tool is shaped by five requirements derived from the research input. This chapter will list these requirements, addressing the first sub design question: **"What design requirements follow from the assessment of narrative-shift potential in selected mobility-focused ULLs?"**

Requirement 1: The tool must help organisers define and assess the alternative mobility narrative their ULL aims to support.

The narrative-shift potential is shaped for a large portion by the way the alternative narrative is offered to and integrated into the participants' environment. In the case ULLs, this is the degree to which the six mechanisms are expressed.

However, it is ultimately constrained by the alternative narrative that is put forward. As established in chapter 2.2.3, not all alternative narratives have a chance at spreading and establishing themselves. Therefore, before designing the lab's operational mechanics, organisers should evaluate the alternative narrative their living lab proposes against Holden et al.'s (2020) requirements:

1. **Feasibility:** is the technical, financial, and spatial alternative viable within local realities?
2. **Acceptability:** does the vision resonate with the core values, aspirations, and approval of the target public?
3. **Centrality:** does the alternative narrative deliver on the long-term goal (in this case, systemic sustainability)

Requirement 2: The tool must be adaptable to different ULL types and contexts, rather than prescribe one fixed blueprint for how narrative-shift potential should be strengthened.

ULLs exist on a wide spectrum, varying across size, topic, governance models and other contextual factors (Nesterova et al., 2021). Within the case studies, this is for instance visible in the contrast between the local community ownership of GEMINI (chapter 4.3) and the large-scale institutional network of ALTHEA (chapter 4.4), a "one-size-fits-all" blueprint for ULLs does not exist. A rigid, standardized checklist of interventions or activities would not be able to accommodate the wide variety of ULLs.

Requirement 3: The tool must support prioritisation and trade-off discussion, rather than encourage organisers to maximise all mechanism scores equally.

Chapter 5.3.4 highlighted that mechanisms that promote narrative-shift potential can create trade-offs. ULL optimisation therefore does not simply mean maximising every mechanism score. It requires balancing narrative-shift potential against feasibility, participant burden, organisational capacity and the specific goals of the living lab.

The tool must therefore help organisers balance competing priorities. A low score on one mechanism does not always mean that this mechanism should be strengthened. The decision depends on the goal of the ULL, the alternative narrative, the participant group, the available resources and the practical constraints.

Requirement 4: The tool must make implicit narrative-shift potential explicit by helping organisers recognise how existing ULL activities, interactions and structures may already support or limit narrative-shift mechanisms.

The analysis of the case studies in chapter 5 revealed a gap between theory and practice: while real-world ULLs inherently contain elements that seem support narrative shifts (such as deep immersion and socio-spatial relevance), these mechanisms are only present and shaped for functional, practical reasons rather than for deliberate narrative persuasion.

This is perhaps most visible in the reflexivity scores and associated activities. All case studies contain activities where reflection on lab design, development of the intervention and the collaboration are the main topics. Chapter 2.3.2 identified reflection as a critical stage in narrative persuasion, showing that long-term paradigm change requires participants to actively interpret, evaluate, and externalize their experiences. If part of the existing reflection activities would touch upon the alternative narrative level rather than only on the intervention level, the narrative-shift potential of the living lab could increase at a very low cost. No extra activities, and little extra time to ask of participants.

Requirement 5: The tool must be usable before, during and after ULL implementation, so that it can support initial design, ongoing adjustment and retrospective learning.

The case studies showed that ULLs are not fixed interventions with one clear design moment. Some living labs are designed before implementation, some evolve during implementation, and others are evaluated only after activities have taken place. The tool should therefore be useful at different moments in the ULL process.

Before implementation, the tool can help organisers clarify the intended narrative shift and make deliberate design choices. During implementation, it can help organisers reflect on whether the living lab is still supporting the intended narrative-shift mechanisms. After implementation, it can help organisers evaluate which mechanisms were present and what could be improved in future living labs.

7.5 Develop: From requirements to tool concept

This section details the transition from the established design requirements to the concrete formulation of the ULL optimisation tool concept. It discusses the various tool formats that were explored, evaluates their alignment with ULLs, and explains the rationale behind selecting a workshop-based design-support format. Finally, it describes how specific tool components were chosen to directly address the five formulated design requirements.

This chapter addresses the second sub design question: **"What tool format can support organisers in assessing and improving narrative-shift potential in practice?"**

7.5.1 Considered tool formats

Several possible tool formats were considered before arriving at the final concept. Each format offered certain advantages, but also had limitations in relation to the requirements formulated in section 7.4.3.

A first possibility, the most basic form of an ‘improvement tool’ would be a fixed checklist of recommended interventions. This would make the tool concrete and easy to use, because organisers could directly select actions to improve mechanisms such as reflexivity or social network inclusion. However, this format would not fit the diversity of ULL contexts. The case analysis showed that an intervention suitable for a neighbourhood cooperative may not be suitable for a large institutional transition programme. A checklist would also risk suggesting that every mechanism should be maximised in the same way, while the cross-case analysis showed that strengthening one mechanism can introduce trade-offs elsewhere.

A second possibility was to use the ULL characterisation rubric itself as the final tool. This would have created a direct link between the research assessment and the design output. The descriptions for higher scores could be considered ‘goals’ for each indicator. This could work for different ULL contexts, but it would not help organisers decide whether that mechanism is relevant to strengthen, whether doing so is feasible, or what design intervention would be appropriate. The rubric should be a component of the final tool, but not the complete design output.

A third possibility was a written guidebook or manual. This format would allow for explanation of the six mechanisms, examples from the case studies, and possible design suggestions. However, a guidebook would be passive, and text-heavy. It would explain the assessment logic, but would not support a collaborative process or decision-making among ULL organisers and stakeholders. Since ULLs are often multi-actor processes, the design output needed to support discussion rather than only provide information.

For these reasons, a workshop-based design-support tool was selected as the most suitable format. This format can combine structured components with flexible parts where possible and

beneficial. It can use the rubric as an assessment component, while also creating space for discussion, interpretation and context-specific design decisions.

7.5.2 Selection of a workshop-based design-support tool

The workshop format was selected because it fits both the subject of the thesis and the intended users of the tool. ULLs are collaborative and context-dependent environments. Their design often involves multiple actors, such as municipalities, researchers, mobility providers, community organisations, schools or resident groups. These actors may have different assumptions about what the ULL is trying to achieve and what kind of change it should support. A workshop-based format creates a shared space in which these assumptions can be made explicit and discussed.

The workshop format also fits the interpretive nature of narrative-shift potential. The tool supports organisers in assessing and strengthening conditions that literature associates with narrative-shift potential. This means that the value of the tool lies not only in the final scores or outputs, but also in the discussion that takes place while interpreting those scores. For example, a low score on reflexivity may be interpreted differently depending on the stage of the ULL, the participant group, and the practical burden of adding reflection moments. A workshop setting allows these contextual factors to be considered.

In addition, the workshop format can support the transition from assessment to actively designing. The process can first help organisers define the intended narrative shift, then assess the mechanism profile of the ULL, then discuss which mechanisms are relevant and feasible to strengthen, and finally formulate concrete interventions.

7.5.3 Translation of requirements into tool components

The ULL tool concept consists of four components: a narrative canvas, the ULL characterisation rubric, mechanism prompt cards and an optimisation canvas. These components were selected because each addresses a specific requirement from section 7.4.

The narrative canvas was included because the tool needs to start from the alternative mobility narrative itself. The case analysis showed that mechanism scores only become meaningful when they are interpreted in relation to a specific narrative direction and target group. For example, in sCOOL2walk, the direct users of the walking groups are children, but the relevant decision-makers for the intended narrative shift may be parents. This shows that organisers first need to clarify which narrative is being challenged, which alternative narrative is being supported, and who the intended target group is.

The ULL characterisation rubric was included as a structured assessment component. The rubric (Appendix A developed in chapter 3.4 translates the six mechanisms into observable indicators. In the tool, the rubric is used to create a mechanism profile of the ULL. This profile helps organisers see where narrative-shift potential is currently concentrated and where it may be underdeveloped.

Because the assessment needs to lead to design thinking, prompt cards are included. The case analysis showed that some mechanisms, especially reflexivity and social network inclusion, are often present only indirectly. Prompt cards help organisers think about how existing ULL activities could be adjusted to strengthen these mechanisms. They do not

prescribe fixed solutions, but ask targeted questions that help organisers translate abstract mechanisms into possible interventions.

Finally, to converge these insights into actionable steps, to support prioritisation and trade-off discussion, another canvas focussed on optimisation is included. The cross-case analysis showed that improving narrative-shift potential is not a matter of maximising all mechanism scores. This optimisation canvas therefore helps organisers decide which mechanisms to prioritise, which interventions to develop, and which trade-offs to monitor.

Besides the reasons outlined above, the usefulness of these materials in a workshop like this can also be understood through the concept of boundary objects. Boundary objects are shared artefacts that are flexible enough to be meaningful to different stakeholder groups, while stable enough to support coordination between them (Star & Griesemer, 1989). This is relevant for the ULL optimisation tool because the different actor groups may not share the same vocabulary, priorities or assumptions about mobility, participation or narrative change. The canvas, rubric, prompt cards and optimisation canvas act as common ground. They are shared reference points for discussion without requiring all workshop participants to interpret them in exactly the same way. In this sense, the materials do not only structure the workshop process, but also help to translate abstract concepts such as narrative-shift potential into familiar concepts to each actor.

7.6 Deliver: initial ULL Optimisation Tool concept

Based on the design requirements and the selected workshop format, an initial version of the ULL Optimisation Tool was developed. This version was used as a pre-validation prototype, to test whether the proposed structure could indeed help organisers move from narrative-shift assessment towards concrete design opportunities.

This initial tool consisted of four components. The first component was a narrative canvas, used to define the dominant mobility narrative being challenged, the alternative narrative being supported, and the intended target group for the narrative shift. The second component was the ULL characterisation rubric developed in chapter 3.4, used to assess the presence of the ten indicators connected to the six narrative-shift mechanisms. The third component was a set of mechanism prompt cards, used to help organisers develop weaker or underdeveloped mechanisms into possible design interventions. The fourth component was an optimisation canvas, used to prioritise opportunities, discuss trade-offs and formulate concrete design interventions.

The initial workshop used these components in four steps. First, organisers characterised the relevant mobility narratives. Second, they assessed the mechanism profile of the ULL using the rubric. Third, they identified which mechanisms were relevant and realistic to strengthen. Fourth, they translated these priorities into possible design interventions. This structure was intended to prevent the tool from functioning only as a scoring exercise. Instead, the assessment was used as input for interpretation, prioritisation and redesign.

At this stage, the tool was not yet considered final. It functioned as a pre-validation prototype used to test whether the proposed workshop structure was understandable, coherent and practically useful for ULL organisers. The full pre-validation version of the tool as well as an extensive overview of the intended workflow is included in Appendix G

Validation is addressed in chapter 8 The revisions resulting from this validation are discussed in section 8.4 and incorporated into the final version of the tool presented in chapter 9 All final workshop materials are included in Appendix H

8 Validation of initial tool

This chapter details the validation phase of the design process, aiming to evaluate the usability, internal logic, and practical value of the ULL optimisation tool. This validation was performed with the initial version of the tool, which can be found in Appendix G This chapter closes with a list of revisions. These revisions are incorporated into the final ULL Optimisation Tool presented in chapter 9

8.1 Validation approach

The validation approach consists of two steps. First, a retrospective application of the tool to one of the researched case studies (GEMINI) is conducted to test the tool's internal logic and step-by-step process flow. Second, an expert feedback session is held with an experienced ULL organiser to assess the tool's clarity, terminology, and practical applicability in a real-world setting.

8.2 Retrospective application to GEMINI

As a first form of validation, the ULL optimisation tool was applied retrospectively to one of the case studies analysed in this thesis. The purpose of this step was to examine whether the proposed workshop process works well and can generate meaningful insights.

GEMINI was selected as the most suitable case for this retrospective application, mostly because of the simple governance structure, clear intentions and relatively small scope. In this ‘simulated run’, this could make it easier to estimate what types of decisions the actual organisers would make. The actual organisers were not present to discuss priorities, trade-offs or feasibility. The exercise therefore does not show whether the tool works in a real workshop setting, but whether there are gaps in the logic.

The retrospective application below follows the four steps of the workshop process introduced in chapter 7.6 and documented in Appendix G

8.2.1 Part A: Narrative characterisation

The first part of the tool asks organisers to define the narrative that the ULL challenges, the alternative narrative it promotes, the target group for the intended narrative shift, and whether the alternative narrative is feasible, acceptable and central to the sustainability goal.

In the GEMINI case, the dominant narrative being challenged can be formulated as follows: access to a car requires private car ownership. This narrative connects car access to individual ownership, flexibility and independence. It makes private car ownership appear as the normal or necessary way to secure access to a car when needed.

The alternative narrative proposed by GEMINI is that access to a car can be organised collectively. Instead of each household owning a private vehicle, residents can share electric cars through a local cooperative while maintaining flexibility and independence.

The target group for the narrative shift is primarily neighbourhood residents. More specifically, it targets residents who either own a car, are considering car ownership, or are open to alternative forms of access but may not yet see cooperative car sharing as realistic or convenient. A secondary target group consists of local authorities and mobility organisations, because the living lab also explores whether cooperative car sharing can become part of a broader urban mobility system.

The next step is to assess feasibility, acceptability and centrality of the alternative narrative. Feasibility is relatively strong, because the GEMINI setup includes practical support for leasing, insurance, parking, charging infrastructure etc. Acceptability is supported by the neighbourhood-based setup. Residents are asked to join a concrete local initiative with people from their own area. Centrality is also present, because cooperative car sharing can contribute to lower car ownership and reduced parking pressure, two of the main goals in this case.

This first phase shows that GEMINI has a clear and usable alternative narrative. The narrative is not only theoretically desirable, but also translated into a concrete practice that participants can experience.

8.2.2 Part B: Narrative-shift mechanism assessment

The second step of the workshop uses the ULL characterisation rubric to assess the presence of the mechanisms associated with narrative-shift potential. In this case, this was already done earlier. The results were presented in chapter 5.2.1, more detailed justifications of the narrative scores can be found in F.1.

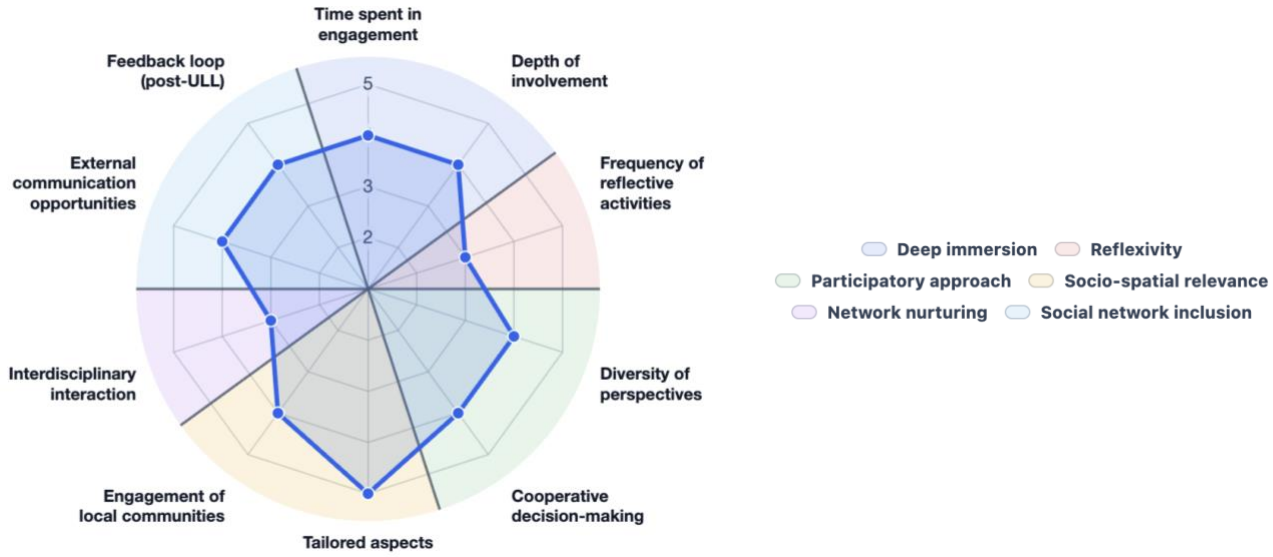


Figure 9 - ULL characterisation overview of GEMINI, based on assigned scores in Appendix F

8.2.3 Part C: Opportunity and trade-off analysis

The third step of the workshop translates the mechanism profile into design opportunities. In this step, we zoom in on mechanisms with lower or moderate scores and ask (1) whether strengthening them would support the alternative narrative, (2) whether it is practically possible, and (3) what trade-offs would be introduced.

A low scoring mechanism that stands out most is reflexivity. Strengthening reflexivity would support the alternative narrative. Participants already experience car sharing in practice, but structured reflection could help them interpret that experience in relation to their own assumptions about car ownership. Without such reflection, participants may treat the cooperative just as a practical service. With reflection, they may become more aware that the intervention challenges an assumption they might had: that access to a car requires individual ownership.

This opportunity appears practically feasible. GEMINI already includes contact moments with residents, such as surveys, interviews, narrative record making and residents' evenings. Strengthening reflexivity would therefore not require a completely new activity. Existing moments could be expanded with questions such as: "Has participating changed how you think about owning a car?", "What made shared access feel realistic or unrealistic?", "What did you assume about car sharing before joining?", or "What do you now see differently about mobility in your neighbourhood?". The main trade-off is participant burden. Residents already invest time in the project, and additional reflection should not make participation feel like a research obligation. Making sure to integrate these reflections into the existing contact moments is therefore important.

The lowest scoring mechanism is network nurturing. The project already connects important institutional and local actors, but the broader local ecosystem around the cooperatives appears is not really developed. Strengthening this mechanism could help with long-term continuity by embedding the alternative narrative into local interactions, for example by connecting the cooperatives to local garages, or new housing developments where residents could be offered to join a cooperative.

This is practically possible, but more demanding than strengthening reflexivity. It depends on the willingness to cooperate of parties outside the ULL and requires coordination by the organisers. The trade-off is organisational complexity. A broader network may strengthen continuity, but it can also make decision-making slower and increase the administrative burden. Organisers should identify which local relationships are most important for continuity and focus on those.

The third opportunity is social network inclusion. GEMINI already contains a strong social element because residents help recruit others in their neighbourhood and the cooperative model depends on trust between neighbours. However, this could be developed more deliberately. Participants could be supported in becoming ambassadors for cooperative car sharing, not only by recruiting new members, but also by sharing why this experience changed how they think about car access, ownership and neighbourhood mobility.

This opportunity is feasible because external communication already exists. Participants already contribute to recruitment, and the project has also been communicated through channels owned by the municipality and in general media coverage. However, the current communication appears to focus mostly on explaining the initiative and attracting members. It

could be expanded to include participant stories that make the alternative narrative more visible. A potential trade-off is that participants may not want to become public representatives of the project. Some may simply want to use the shared car without taking on an ambassador role. To avoid having a negative effect on the number of participants willing to join the ULL, social network inclusion should remain voluntary and should focus on supporting motivated participants rather than expecting all members to communicate externally.

The opportunity analysis therefore identifies three possible priorities: making reflection more narrative-focused, strengthening local ecosystem connections, and supporting participant-led diffusion. These priorities are not equally urgent or equally easy to implement. Reflexivity appears to offer the highest potential relative to the required effort, because it can be added to existing moments. Network nurturing may be more important for long-term continuity, but requires more coordination. Social network inclusion could increase diffusion beyond direct participants, but depends strongly on participants' willingness to take on a more visible role.

8.2.4 Part D: Design intervention development

The final step of the workshop translates the selected opportunities into concrete design interventions. In the workshop, this step is supported by the mechanism prompt cards described in Appendix G.1. For this retrospective application, the relevant prompt cards are those for reflexivity, network nurturing and social network inclusion, because these were identified as the main opportunity areas in step C.

Reflexivity

The reflexivity prompt card asks where participants already discuss or evaluate their experiences, whether these moments could include questions about what participants consider normal, desirable or possible in mobility, and whether participants could compare their previous assumptions with their experiences in the living lab.

This first prompt points to several existing moments where reflection already takes place. Participants are involved in surveys, interviews, narrative record making, residents' evenings and ongoing conversations with Townmaking. These moments are currently mostly used to understand practical needs, evaluate the functioning of the cooperative, and support the development of the local group.

The second prompt asks if these moments could include questions about what participants consider normal, desirable or possible in mobility. This could be done by expanding the questions that are already discussed in during these activities with reflection on the assumptions behind mobility choices. For example, participants could be asked whether participating has changed how they think about owning a car, whether shared access feels more realistic than expected, or whether the cooperative changed what they consider normal in relation to mobility.

The third prompt asks whether participants can compare previous assumptions with their actual experience in the living lab. This is possible in GEMINI. Participants can compare the assumption that private ownership is necessary for car access with the experience of using a cooperatively shared car.

This results in the following possible intervention: add narrative reflection questions to existing resident contact moments. These prompts could be included in surveys, interviews, resident evenings or onboarding conversations. The intervention strengthens reflexivity without adding a separate workshop or activity. It also keeps the burden on participants relatively low, because it uses moments that already exist within the ULL process.

Network nurturing

The network nurturing prompt card asks which actors are needed to keep the alternative narrative alive after the formal project ends, whether relationships between participants, institutions and implementation partners are being actively developed, and whether there is a clear owner or continuation pathway beyond the funded project period.

The first prompt highlights that the cooperative cannot rely only on motivated residents. Resident commitment is crucial, but the continuity of cooperative car sharing also depends on actors that can support parking, charging, maintenance, insurance, legal organisation, recruitment and scaling. In practice, besides the resident cooperatives themselves, these are the municipality and Townmaking. Whereas Townmaking plays a role mostly in the setup phase, the support of the municipality is important to for instance enable parking and charging of a shared vehicle.

The second prompt: the resident cooperatives are mostly in touch with Townmaking, who in turn are in touch with the municipality to take care of the aforementioned enablers (parking and charging). A more direct connection between the residents and the municipality could be beneficial for the continuity of the project, and make these cooperations more resilient to Townmaking potentially withdrawing after the funding ends. This relationship is currently not actively developed. Other local relationships such as with local garages or new housing developments are also not actively pursued at the moment.

The third prompt focuses on continuation after the project period. In GEMINI, the intention is that cooperatives continue independently after the project. At the same time, the interview shows that some groups are vulnerable to falling apart when key residents move away or when the group is too small. This suggests that continuity should not depend only on the internal motivation of residents, but also on a clear support structure around the cooperative. This could be a different group for each of the cooperatives.

This results in the following possible intervention: create a local continuity overview for each cooperative. This overview would identify which actors are essential for continuation, which relationships already exist, which are missing, and who is responsible for maintaining them. Depending on the neighbourhood, this could include the municipality, Townmaking, local garages, housing associations, community centres, energy cooperatives, charging providers or other nearby resident groups that could support.

Social network inclusion

The social network inclusion prompt card asks whether participants are supported in sharing their experiences with others, whether there are moments, materials or roles that help

participants become ambassadors, and whether the ULL can create visible examples that make the alternative narrative easier for others to understand.

Applied to GEMINI, the first prompt shows that social network inclusion is already partly present. Participants help recruit others in their neighbourhood, for example through flyers and local communication. Because the cooperative model depends on a minimum number of users, participants have a practical reason to share the initiative with others. External communication also takes place through municipal channels and media coverage. However, this communication seems mostly aimed at explaining the service or attracting members, rather than deliberately supporting participants in communicating the alternative narrative behind it.

The second prompt asks whether participants could be supported more explicitly as ambassadors. They definitely could be. With suitable formats or materials, enthusiastic participants can be helped to share their experiences in the living lab more actively.

The third prompt asks whether visible examples can make the alternative narrative easier for others to understand. Stories from neighbours could make the alternative narrative more tangible. Instead of presenting cooperative car sharing only as a mobility service, communication could show how residents organise car access together, what changed in their own mobility behaviour, and what they learned about sharing responsibility with neighbours.

This results in the following possible intervention: create ‘cooperation stories’. Residents who are willing to do so could share short stories about why they joined, what changed in their mobility behaviour, what they found difficult, and whether participation changed how they think about car ownership. These stories could be used in neighbourhood recruitment, onboarding material, municipal communication or project dissemination. The purpose would not only be to attract new members, but also to make the alternative narrative more visible beyond the direct participant group.

8.2.5 Conclusion of the retrospective application

Applying the ULL optimisation tool retrospectively to GEMINI shows the added value of the tool. The process resulted in three possible interventions: narrative reflection prompts, a local continuity overview, and a ‘cooperation story’ format. The actual organisers were not involved in weighing the feasibility or desirability of these interventions, so this should not be considered definitive advice, but it does show the reasoning process this tool aims to put in motion, and the way the tool generates highly context-specific interventions to increase the narrative shift-potential of an ULL.

8.3 Expert feedback session

The second validation step consisted of an expert feedback session with a smart mobility innovation expert from the Municipality of Helmond. The aim of this session was to assess whether the initial version of the ULL optimisation tool was understandable, whether the workshop structure was usable in the context of a real mobility challenge, and whether the tool could help identify meaningful design opportunities for organisers.

The expert applied the workshop structure to an active municipal project in Helmond focused on improving the last-mile accessibility of a local business park. While the park was already connected to a regional bus line, the physical distance between the bus stop and individual workplaces was up to three kilometres, making it too far for employees to walk comfortably. The municipality was therefore piloting a last-mile mobility solution consisting of shared bicycles, with future plans to introduce an autonomous shuttle service.

The session was conducted online and lasted one hour. The workshop materials described in chapter 7.6 were prepared in a Miro environment before the session. These materials included the narrative canvas, the ULL characterisation rubric, the mechanism prompt cards and the optimisation canvas. An export of the Miro board used during this session is included in Appendix G The session followed the four steps of the workshop process introduced in chapter 7.6 and documented in Appendix G

Because the Helmond project was still in an early development phase, some parts of the workshop could not be completed in the same way as they would be in a fully implemented ULL. This itself became an important validation finding, because it showed that the usefulness of different parts of the tool depends partly on the stage of the living lab.

The insights resulting from this session are categorized below according to the tool's components.

8.3.1 Narrative canvas

The first phase of the session focused on formulating the dominant and alternative narratives on the narrative canvas. The expert recognised the underlying concept of narrative shifts, and dominant mobility narratives. In the Helmond case, the dominant mobility narrative was formulated as: "*The business park is only realistically accessible by car*". This reflected the situation of employees who had commuted to the area for a longer period and who continued to see the private car as the default option, even after the introduction of the regular bus connection.

The alternative narrative was formulated as follows: "*The business park is accessible through a combination of public transport and shared last-mile mobility solutions*". This narrative was clear and relevant to the case (the centrality requirement), but the discussion of feasibility and acceptability did bring to light some conditions that influence whether the narrative can become credible.

The interviewee pointed out that a shared bicycle does not represent a suitable alternative for all employees, especially during bad weather or for employees with physical limitations. The alternative narrative therefore requires a more complete mobility offer, including the planned autonomous shuttle, before it can be considered realistic for the entire target group.

Furthermore: the credibility of the alternative narrative is bottlenecked by a 'secondary audience': the employers. Employers influence the travel policy of their organisation, which could for instance include parking allocations, travel reimbursement structures or, on the other hand, incentives for carless commuting. If these policies continue to assume or favour private car use, the alternative narrative is less likely to become acceptable among employees.

This was a limitation in the target audience definition that was not spotted during the session at that point in time. The target audience for the narrative shift was formulated as the employees working at the business park. However, as explained above, employers also play an important role in embedding this alternative narrative. It would be good to not only include the end users of an alternative narrative as target audience, but also the actors within the ULL who influence its adoption in practice.

8.3.2 Application of the ULL characterisation rubric

Applying the ULL characterisation rubric to the Helmond case helped facilitating a structured discussion of the project across the six mechanisms. The project scored strongly on socio-spatial relevance, because it was clearly connected to a specific location and infrastructural bottleneck. Cooperative decision-making was also present in the early stages, as local businesses had been brought together to help identify the business park's parking and accessibility constraints.

A practical point of feedback in this phase was that the mechanisms and indicators were not properly explained in the ULL rubric. A description of each would help smoothen the process. In this case, it was resolved by explaining them one by one as the indicators were scored.

The scoring process also revealed some ambiguity in the indicator definitions. The indicator "time spent in engagement" was difficult to apply. It was unclear whether this should, in this case, refer to the duration of an employee's daily commute using the shared bicycle, or to the time spent participating in the co-creative and evaluative parts of the living lab. A participant might use the shared bicycle every day without ever actively contributing to the living lab as a reflective or co-creative process.

Other indicators where the workshop hit resistance were "engagement of local communicates" and "interdisciplinary interaction". From the point of view of the interviewee, there was only 1 group of participants in this living lab: the visitors/employees of the business park. At the same time, there was a complete lack of access to participants for the ULL organisers. In this municipal setup, the organisers do not have direct communication lines with individual employees. Contact is established through employer communication channels of the local businesses.

This affects the feasibility of several mechanisms and potential interventions. Direct reflection sessions, participant feedback loops or participant-led communication are harder to organise when access to participants runs through employers. This also raises the question if the chosen target audience can be considered participants of the living lab in this case, something that was missed in the narrative canvas phase of the workshop.

At this point, it became clear that, while several insights from this session would be useful, the proposed case did not meet the definition of a living lab that is used in this thesis. While the tool does contain a 'screening step' for the narrative, it does not contain one for the ULL itself.

8.3.3 Opportunity selection, prioritisation and intervention

The fact that this living lab was more pilot-like than ULL-like, also had an impact on the rest of the session. For example, the interviewee argued promoting deep immersion, or reflexivity at this stage would be premature. Asking employees to critically evaluate their car-centred

commuting assumptions is less useful if the alternative mobility offer is still incomplete. In the Helmond case, the shared bicycles were already available, but the autonomous shuttle or another bad-weather alternative and the employer policy changes were not yet in place. Expressed in narratives: the alternative narrative was not yet available to the participants to experience, at least not enough to allow for meaningful reflection. Participants first need to experience the alternative as a realistic option before reflection can help them reinterpret their assumptions. Practically speaking: the organisers were not interested in promoting a narrative shift at this stage. They were still building up. So much so, that it was not clear yet how the remaining mobility solution would be organised, if this would indeed be an autonomous shuttle, and if it would be free, paid, on demand or running on a fixed schedule, etc. This made all mechanisms of which the expression could be improved halt in the 'possibility' and 'trade off' steps of the optimisation canvas.

There were two useful insights that still did pop up in this phase.

First, regarding network nurturing, in this case the important network is not necessarily a local service ecosystem around the bicycles, but the network between the municipality, the business park association and employers. These actors are needed to support the mobility offer and to sustain it beyond the initial pilot.

Second, social network inclusion had already proved itself as valuable. The expert described an early user who used the shared bicycles every day during the first week. This person was approached as an informal ambassador, and according to the expert this helped increase visibility and use among others. However, this ambassador approach was not continued systematically because of the aforementioned aversion of scaling up at this stage. The fact that this did pop up does, however, suggests that the tool could help organisers identify useful interventions that have a real effect.

8.3.4 Synthesis of expert feedback

The expert feedback session showed that the tool can help structure a relevant discussion about the conditions present in an ULL under which an alternative mobility narrative may become credible. The narrative canvas helped formulate the dominant narrative, and an alternative narrative around access through public transport and shared last-mile mobility. This suggests that the 'narrative framing' is understandable for the target audience, provided that it is introduced with concrete examples.

At the same time, the session also showed that the tool assumes a clearer living lab structure than was present in the Helmond case. The project was still in a pioneer or pilot phase. The shared bicycles were already available, but the wider mobility offer, including a bad-weather alternative and a possible shuttle service, was not yet in place. As a result, some mechanisms, especially reflexivity and social network inclusion, were not yet actionable. Asking employees to reflect on their car-based commuting assumptions would be premature if the alternative mobility offer is not yet sufficiently complete or credible. It remains to be seen if this case will take on a more ULL-like structure in later phases of the project.

The session also revealed that the target group for the narrative shift is not always the same as the group that enables the shift in practice. Employees were the intended users of the last-mile mobility solution, but employers influenced whether the alternative could become realistic through parking policy, travel reimbursement and other mobility incentives. This suggests that

the tool should distinguish between the intended narrative-shift target group and enabling actors.

A further finding concerns participant access. In the Helmond case, the municipality had no direct communication line with individual employees. Communication ran through employers and the business park organisation. This limited the feasibility of interventions such as participant reflection, feedback loops or participant-led communication. The tool should therefore include an explicit check of whether organisers have direct or indirect access to the intended target group before selecting interventions. Often, this would be the case for anything that would pass as ULL.

Finally, the session exposed ambiguity in several rubric indicators. In particular, “time spent in engagement” and “depth of involvement” were difficult to interpret because using the mobility service, giving feedback and participating in the living lab process are different forms of engagement. The rubric should therefore distinguish more clearly between use of the intervention and participation in co-creation, evaluation or reflection, and include descriptions of the mechanisms and indicators that are used.

8.4 Revisions based on validation

The validation activities described in sections 8.2 and 8.3 led to several revisions of the ULL optimisation tool. The retrospective application to GEMINI mainly confirmed the internal logic of the tool. The four-phase structure going from narrative definition, to mechanism assessment, to opportunity selection, and finally to concrete interventions made sense: each phase provided input for the next. The expert feedback session added a different type of insight. It showed that the tool can structure a relevant conversation around a real mobility challenge with the target group, unfamiliar with the concept of narratives used in this thesis prior to the session, but also that several assumptions in the tool needed to be made more explicit.

The most important revisions concern the starting conditions of the tool, the distinction between different actor groups, the interpretation of participant engagement, and the practical usability of the rubric. These revisions are discussed below.

8.4.1 Adding a living lab screening step

The expert feedback session showed that the tool assumes a relatively clear living lab structure. In the Helmond case, the project contained elements of a living lab, such as a real-world mobility pilot, municipal coordination and interaction with employers. However, it did not yet fully match the definition of a ULL used in this thesis. The project was still in a pilot or pioneer phase, and the alternative mobility offer was not yet complete enough to support meaningful participant reflection on the intended narrative shift. Actual users were not part of the feedback loop in the lab, and rather than a collaborative approach, the municipality was responsible for taking all decisions around shaping the solution that was being tested.

The tool is designed for ULLs, not for every mobility pilot. If a project does not (yet) include active participant involvement, co-creation, reflection, or even lacks direct access to the intended users, several mechanisms become difficult or impossible to assess and improve upon. In the Helmond session, this became visible when indicators such as “time spent in

engagement", "engagement of local communities" and "external communication opportunities" were difficult to interpret. Employees used the mobility service, but were not really participants in a living lab process. Employers were involved more in the decision making process, but did not interact with the intervention.

For this reason, a short screening step is added before the narrative canvas. This step helps organisers determine whether the tool can be applied directly, or whether the project first needs to be developed further as a living lab. The screening step asks:

1. Does the project take place in a real-life setting?
2. Are the intended users or affected groups actively involved beyond only using a service?
3. Are multiple relevant stakeholder groups involved in shaping or supporting the project?
4. Is the alternative mobility practice sufficiently developed for participants to experience it as a realistic option?

If most of these questions cannot be answered positively, the case that's being assessed does not meet the definition of a living lab used in this tool. In that case, the tool could still be used as an early design reflection or to get a feel for where potential issues might pop up, but the first design task would not yet be optimising narrative-shift potential, but strengthening the living lab structure itself.

This check would've also flagged the lack of fit with the ULL rubric that existed in the tunnelvisionair project (chapter 3.4.3).

8.4.2 Separating target groups, participants and enabling actors

The narrative canvas originally asked organisers to define the 'target audience' for the intended narrative shift. The expert feedback session showed that this is too simple. In the Helmond case, employees were the intended users of the shared bicycles and possible shuttle service. They were therefore the most obvious target group for the narrative shift: from "the business park is only realistically accessible by car" to "the business park is accessible through public transport and shared last-mile mobility".

However, the session also showed that employers strongly influence whether this alternative narrative can become credible, and convincing them is a requirement for convincing their employees. Employer policies around parking, travel reimbursement and communication shape whether employees experience the alternative as realistic or desirable. Employers are not necessarily the direct target of the narrative shift in the same way as employees, but they are enabling actors. Without them, the alternative narrative is likely to remain practically weak.

A similar distinction appeared earlier in the sCOOL2walk case (chapter 4.5). Children are the direct users of walking groups, but parents often decide how the school journey is organised. This means that the group experiencing the intervention is not always the group whose internal narrative matters most for adoption.

The narrative canvas was therefore revised to distinguish three actor categories:

1. **Intended narrative-shift target group**

The group whose assumptions, beliefs or mobility routines the ULL aims to influence.

2. **Direct participants or users**
   The group that directly takes part in the intervention, activity or service. Could be the same as the intended narrative-shift target group.

3. **Enabling actors**
   The actors who influence whether the alternative narrative can become feasible, acceptable or embedded in practice.

This addition makes visible where the credibility of an alternative narrative depends on actors who are not direct users, and if the logic behind the living lab setup allows is contributing or hindering its objectives.

8.4.3 Adding an access check

The expert feedback session also showed that organisers may not always have direct access to the intended target group. In the Helmond case, the municipality did not communicate directly with individual employees. Communication ran through employers and the business park organisation. This limited the feasibility of several interventions, especially participant reflection, feedback loops and participant-led communication.

This is important because several mechanisms in the tool assume some form of interaction with participants. Reflexivity requires moments where participants can discuss or evaluate their experiences. Social network inclusion requires participants to share or demonstrate their experiences beyond the ULL. Participatory approach requires that affected groups can influence some part of the process. If organisers have no direct or indirect access to these groups, those mechanisms cannot be strengthened in the same way.

This ‘access check’ can be integrated into the actor mapping step described above. If either of the three identified actor groups are not part of the ULL or otherwise not accessible, this should be addressed before participant-facing interventions are selected. Until then, it’s difficult realistically develop interventions that could contribute to improving the narrative-shift potential of a living lab. It prevents the tool from suggesting participant-facing interventions when organisers cannot actually reach participants.

8.4.4 Refining ULL rubric descriptions and clarity

A practical point from the expert feedback session was that the rubric could not be used smoothly without additional explanation. The six mechanisms and ten indicators were understandable once explained, but their meaning was not always immediately clear from the rubric itself. This slows down the workshop and makes self-facilitated use less attractive.

The tool materials are therefore revised to include short descriptions of each mechanism directly in the workshop materials. These descriptions are shortened versions of the explanations in chapter 2.5, they should give participants enough information to apply the rubric without needing the full thesis text.

8.4.5 Final alterations to the ULL optimisation tool

Based on the validation, the ULL optimisation tool is revised in the following ways (Table 7):

Table 7 - Revisions to the ULL optimisation tool based on validation

Validation insight	Tool alteration
Some mobility projects may still be in an early pilot phase or may not (yet) function as a living lab. While these projects may self-identify as ULLs, they do not meet the criteria this thesis assumes.	Add a living lab screening step.
Some indicators are difficult to assess or improve when participants only use a service but are not actively involved in the living lab process.	Use the screening step to check whether intended users/affected groups are involved beyond just passive use of the technology or intervention central in the ULL.
The original narrative canvas treated the target audience too broadly. In practice, the intended narrative-shift target group, direct users and enabling actors may be different groups.	Revise the narrative canvas to distinguish between three actor categories: intended narrative-shift target group, direct participants or users, and enabling actors.
The credibility of an alternative mobility narrative may depend on actors who do not directly use the intervention, such as employers, parents or local institutions.	Include enabling actors explicitly in the actor mapping step, so their role in feasibility, acceptability and embedding becomes visible.
Organisers may not have direct access to the intended narrative-shift target group, which limits the feasibility of participant-facing interventions.	Add an access check into the actor mapping step. This check determines whether organisers can directly or indirectly reach the relevant target groups, users and enabling actors.
The rubric was understandable after explanation, but not always clear enough for smooth or self-facilitated use.	Add short mechanism descriptions directly to the workshop materials, based on the explanations in chapter 2.5.

These revisions do not require adding a separate tool component. Instead, the first canvas is revised into a ULL framing canvas. This canvas combines the living lab screening step, narrative definition, actor mapping, access check and narrative viability assessment. The other components remain the ULL characterisation rubric, mechanism prompt cards and optimisation canvas.

With these revisions, the tool becomes more robust for use across different mobility-focused ULL contexts, helping organisers make narrative-shift potential explicit and translate it into context-specific design choices.

9 ULL Optimisation Tool

This chapter presents the final ULL Optimisation Tool. The tool is a workshop-based design-support process that helps organisers of mobility-focused urban living labs assess, discuss and strengthen narrative-shift potential in a context-specific way.

The version presented in this chapter is the revised version of the pre-validation tool described in chapter 7.6 and Appendix G The revisions are based on the retrospective application to GEMINI and the expert feedback session discussed in chapter 8 Compared with the pre-validation version, the final tool adds a living lab fit step, expands the original narrative canvas into a ULL framing canvas, distinguishes between intended narrative-shift target groups, direct participants or users and enabling actors, and includes an explicit access check before mechanism-based interventions are selected

The final tool consists of four components: a ULL framing canvas, the ULL characterisation rubric, mechanism prompt cards and an optimisation canvas. Together, these components help organisers move from a general mobility-transition ambition to a more specific understanding of which narrative is being challenged, which alternative narrative is being supported, which actors matter, which narrative-shift mechanisms are present, and which design interventions could realistically strengthen the living lab. A general overview of the workshop outline can be found in Table 8.

This chapter answers the main design question: **How can the assessment of narrative-shift potential be translated into a practical design-support tool for organisers of mobility-focused urban living labs?**

Table 8 - Overview of ULL Optimisation Tool

Workshop part	Tool resource	Main question	Output
A. Living lab fit	ULL framing canvas	Is this project sufficiently ULL-like?	Go/adapt/use as early reflection
B. Narrative and actor framing	ULL framing canvas	What narrative is challenged, who matters, and can they be reached?	Narrative statement, actor map, access check
C. Mechanism assessment	ULL characterisation rubric	Which mechanisms are currently present?	Mechanism profile
D. Opportunity and trade-off analysis	Optimisation canvas	Which mechanisms are relevant and feasible to strengthen?	Priority mechanisms

E. Intervention development	Prompt cards + optimisation canvas	What design changes should be made?	Concrete interventions, trade-offs and next steps

9.1 Tool materials

The ULL optimisation tool takes the form of a workshop-based design-support tool. It consists of a set of printable or digital materials that guide organisers through a structured session, discussing and improving the narrative-shift potential of their mobility-focused ULL.

This format was chosen for the reasons laid out in chapter 7.5. An additional benefit of a workshop format is that it makes it possible to bring the perspectives of various stakeholders together and create a shared understanding of the narrative goals of the ULL.

There are four main resources that are used in this workshop:

1. **ULL framing canvas**

   The ULL framing canvas is the starting point of the workshop. First, it helps organisers determine whether the project can meaningfully be approached as a living lab. It then helps them define the dominant mobility narrative being challenged, the alternative narrative being supported, and the relevant actor groups. Finally, it checks whether organisers can reach those actors and whether the alternative narrative is feasible, acceptable and central.

2. **ULL characterisation rubric**

   The ULL characterisation rubric helps organisers assess the current or planned living lab on the ten indicators connected to the six mechanisms associated with narrative-shift potential: deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion. Short descriptions of each mechanism are included in the workshop materials.

3. **Mechanism prompt cards**

   A set of cards, one for each mechanism, containing design prompts/questions that help organisers think about how a mechanism could be strengthened in their specific living lab context. And move towards concrete design interventions. For example, the reflexivity card asks where participants already evaluate their experiences and how these moments could be expanded to include reflection on assumptions about mobility.

4. **Optimisation canvas**

A one-page canvas used to organise the priority mechanisms, describe possible design interventions, identify trade-offs, assign responsibilities and define next steps.

These workshop materials, as well as information about where to find the full-resolution and interactive versions of these materials, are included in Appendix H Figure 10 below shows a preview of what these materials look like.



Figure 10 - Overview of available workshop materials. Included in full resolution in Appendix H

9.2 Workshop process

The workshop itself consists of five parts:

A. Living lab fit

B. Narrative characterisation and actor framing

C. Narrative shift mechanism assessment

D. Opportunity and trade-off analysis

E. Design intervention development

The first two parts are both completed on the ULL framing canvas. Together, they establish whether the project is sufficiently living-lab-like for the tool to be applied, which narrative direction the ULL is working towards, which actors matter, and whether the alternative narrative is viable. The following steps then assess the mechanism profile of the ULL, interpret the profile through opportunity and trade-off analysis, and translate the selected priorities into concrete design interventions.

Together, these parts move the organiser from a general ambition to a more specific understanding of how the living lab could support a narrative shift. The subchapters below will introduce each phase in more detail

9.2.1 Part A: Living lab fit

The first step uses the ULL framing canvas to determine whether the project meets the definition of a living lab. Not every mobility pilot that uses living lab language is sufficiently developed as a ULL for this tool to be applied directly.

The living lab fit step asks organisers to answer four questions:

1. Does the project take place in a real-life setting?
2. Are the intended users or affected groups actively involved beyond only using a service?

3. Are multiple relevant stakeholder groups involved in shaping or supporting the project?
4. Will the technology or practice that is tested in this project be sufficiently developed for participants to experience it at the time of running the living lab?

If most of these questions can be answered positively, the tool can be applied as intended. If several answers are negative, the project may still be too early or too pilot-like to assess narrative-shift potential in a meaningful way. In that case, the tool can still be used as an early reflection instrument, but the first design task is to strengthen the living lab structure itself rather than to optimise narrative-shift potential.

This step prevents the tool from suggesting participant-facing interventions when participants are not actually involved, when the alternative mobility practice is not yet credible, or when organisers lack access to the relevant actor groups.

9.2.2 Part B: Narrative characterisation and actor framing

The second step also uses the ULL framing canvas. In this step, organisers make explicit which mobility narrative their ULL challenges, which alternative narrative it aims to support, and which actor groups are relevant to that shift.

Narratives shape what people consider feasible, desirable and normal. In mobility, dominant narratives can make car-centred mobility appear natural, convenient or inevitable, while alternative forms of mobility may appear unrealistic, inconvenient or only suitable for specific groups. A mobility-focused ULL may challenge such assumptions, but only if the alternative narrative is made visible within the design of the lab.

This step asks organisers to answer the following questions:

1) What current mobility narrative does the ULL challenge?

For most ULLs and contexts, this is a straightforward question to answer. In more ambiguous situations, or when organisers want to include direct participant reflections, the narrative snapshot questionnaire in Appendix B can be used. This questionnaire can be used to get an impression of participants' ideas, assumptions and beliefs about personal mobility.

2) What alternative mobility narrative does the ULL propose?

A good understanding of which alternative narrative is offered means everyone involved in the workshop has a clear idea of the goals. This makes it easier to make good ULL design decisions to reach these goals later down the line.

3) Who is the intended narrative-shift target group?

This is the group whose assumptions, beliefs or mobility routines the ULL aims to influence.

4) Who are the direct participants or users?

Direct participants or users are the people who directly take part in the intervention, activity or service.

5) Who are the enabling actors?

Enabling actors are the actors who influence whether the alternative narrative can become feasible, acceptable or embedded in practice. For instance, in the sCOOL2walk case study

(chapter 4.5), children are the direct users of the walking groups, but parents are often the decision-makers who decide how the school journey is organised.

6) **Can organisers access the relevant actor groups?**

The access check asks whether organisers can directly or indirectly reach the intended narrative-shift target group, direct participants or users, and enabling actors. If one of the three actor groups is not part of the ULL, or cannot be reached directly or indirectly, this should be addressed before participant-facing interventions are selected.

7) **For the identified target group, does the proposed alternative narrative meet the requirements of feasibility, acceptability and centrality?**

Feasibility concerns whether the alternative narrative is practically possible in the local context. This includes questions about technology, funding, spatial conditions, organisational capacity and regulatory feasibility. An alternative narrative that asks participants to adopt behaviour that is not practically possible to them is unlikely to spread.

Acceptability concerns whether the alternative narrative resonates with the values, needs and aspirations of the people involved. A narrative may be technically possible but still fail if it does not match what participants consider desirable, fair, safe or convenient.

Centrality concerns whether the alternative narrative contributes to the long-term sustainability goal that motivates the living lab. A mobility narrative may be feasible and acceptable while still failing to support a meaningful sustainability transition. For example, a narrative that simply replaces one high-impact mobility habit with another more convenient but still unsustainable habit won't contribute towards the intended transition.

These three requirements were introduced in chapter 2.2.3. If the alternative narrative is unclear, not feasible, not acceptable or not central to the intended transition, improving the ULL mechanisms alone will not solve the problem. The living lab would then risk creating a strong process around a weak or poorly defined narrative.

9.2.3 Part C: Narrative shift mechanism assessment

The third part of the workshop uses the ULL characterisation rubric that can be found in Appendix A and which was used to analyse the case studies in chapter 5 Organisers assess the current or planned ULL on the ten indicators that correspond to the six mechanisms identified in chapter 2.5. These mechanisms are deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion

The purpose of this step is to create a mechanism profile of the living lab. This profile shows how strongly the six mechanisms associated with narrative-shift potential are present in the design of the ULL, showing where narrative-shift potential is currently concentrated and where it may be underdeveloped.

9.2.4 Part D: Opportunity and trade-off analysis

The fourth step translates the mechanism profile into design opportunities. The first part of the optimisation canvas is used.

As discussed in chapter 5.3.4, mechanisms can interact with each other and with the practical objectives of the ULL. Increasing one mechanism may create costs or constraints elsewhere. Therefore, the goal is not to simply maximise every score

In this step, three questions are asked to organisers for each mechanism that has a score below 4 in the mechanism profile:

1) Would strengthening this mechanism support the alternative narrative defined in step A?
2) Is it realistically possible within the available time, budget, governance structure and participant relationship to influence this mechanism?
3) What trade-offs would be introduced by strengthening this mechanism?

This step results in a shortlist of priority mechanisms that are both relevant to the narrative goal and realistically improvable within the ULL context, and perhaps already some ideas for interventions that help to increase the scores for these mechanisms.

9.2.5 Part E: Design intervention development

Part E helps organisers translate the priority mechanisms identified in part D into concrete design interventions. In this phase, the workshop moves from assessment to redesign.

This step uses the mechanism prompt cards and the second part of the optimisation canvas. The prompt cards help organisers think through each priority mechanism by asking targeted design questions. These questions are meant to open up discussion, not to prescribe fixed solutions. The same mechanism may require different interventions depending on the participant group, local context, available resources and stage of the living lab.

For deep immersion, prompts focus on the duration, intensity and everyday integration of participation:

- How can participants engage with the alternative mobility practice repeatedly rather than only once?
- Can the intervention become part of participants' everyday routines?
- Can participants take responsibility for some part of the intervention rather than only using it?

For reflexivity, prompts focus on making assumptions about mobility explicit:

- Where in the ULL do participants already discuss or evaluate their experiences?
- Can these moments include questions about what participants consider normal, desirable or possible in mobility?
- Can participants compare their previous mobility assumptions with their experiences in the living lab?

For participatory approach, prompts focus on the depth and type of participation:

- Are participants only consulted, or can they influence decisions?
- Which parts of the intervention can realistically be co-designed?
- Are the people affected by the intervention represented in the design process?

For socio-spatial relevance, prompts focus on the fit with the local context:

- Which local mobility problem does the ULL address from the participant's perspective?
- How does the intervention connect to the physical and social characteristics of the place?
- Are local concerns, routines and barriers reflected in the design?

For network nurturing, prompts focus on relationships that support implementation and continuity:

- Which actors are needed to keep the alternative narrative alive after the formal project ends?
- Are relationships between participants, institutions and implementation partners being actively developed?
- Is there a clear owner or continuation pathway beyond the funded project period?

For social network inclusion, prompts focus on diffusion beyond direct participants:

- Are participants supported in sharing their experiences with others?
- Are there moments, materials or roles that help participants become ambassadors?
- Can the ULL create visible examples that make the alternative narrative easier for others to understand?

The outcome of this step is a filled in optimisation canvas. This is an overview that shows which mechanisms the organiser wants to strengthen, why those mechanisms matter for the intended narrative shift, what design interventions will be introduced, and what trade-offs need to be monitored.

9.3 Practical use of the tool and expected output

The ULL optimisation tool can be used at different moments in the development of a living lab. Its function differs depending on whether the ULL is still being designed, already running, or has ended.

The tool can be facilitated by an external facilitator, but this is not required. It can also be used by the ULL organising team itself, as long as one person takes responsibility for guiding the process. An external facilitator may be useful when many stakeholder organisations are involved or when there are conflicting priorities between partners. A self-facilitated version may be sufficient when the tool is used by a smaller project team or even by a single organiser.

The recommended participants are people who understand the design and implementation of the ULL. Depending on the scope of the ULL, this may include project coordinators, researchers, municipal partners, mobility providers, community representatives, school representatives, or other stakeholders depending on the case. Participant representatives can be included if this fits the ULL.

The expected output of the workshop is a reasoned design direction for strengthening narrative-shift potential. At the end of the workshop, organisers should have: a defined dominant and alternative narrative, an actor overview, a mechanism profile, a shortlist of priority mechanisms, and one or more concrete interventions.

9.3.1 Use before implementation

Before implementation, the tool can be used as a design-support instrument. In this phase, organisers can use the tool to clarify the narrative direction of the ULL and make deliberate choices about its design.

This is the most useful moment for applying the tool, because design changes are still relatively easy to make. Organisers can still decide how participants will be recruited, how much influence they will have, which reflection moments will be included, which local stakeholders should be involved, and how communication beyond the ULL will be organised.

In this phase, the mechanism assessment is based on the intended design of the ULL, the scores therefore indicate expected mechanism presence. By scoring the intended ULL design, organisers can identify whether the living lab is likely to support the intended narrative shift, or whether important conditions are missing.

9.3.2 Use during implementation

During implementation, the tool can be used as a monitoring and adjustment instrument. Organisers can periodically reassess the mechanism profile of the ULL and compare it with the intended profile.

This use could be especially relevant if the ULL evolves over time. Activities may change, participant involvement may increase or decrease, stakeholder roles may shift, and local constraints may require adaptations. The case studies in chapter 4 showed that living labs do

not always follow a fixed plan. ALTHEA, for instance, was still developing many of its interventions during the research period.

Using the tool during implementation allows organisers to notice whether the ULL is drifting away from its narrative objective. For instance, a ULL may become increasingly focused on technical implementation and lose attention for participant reflection. These developments are not necessarily problematic, but they should be visible to organisers if narrative-shift potential is part of the objective.

In this phase, the tool can also support team discussions. Different stakeholders may have different assumptions about what the ULL is trying to achieve. Use of this tool can provide a platform for discussing these differences in relation to narrative-shift potential.

9.3.3 Use after implementation

After implementation, the tool can be used for evaluation and learning. In this phase, organisers can reconstruct what happened, assess which mechanisms were present, and identify lessons for future ULLs.

This retrospective use can be valuable for organisations that run multiple living labs over time. Lessons from one living lab can be design input for the next. By comparing mechanism profiles across projects, organisers can identify recurring strengths and weaknesses. For example, an organisation may discover that its living labs are consistently strong in socio-spatial relevance and stakeholder networks, but consistently weak in reflexivity and participant-driven diffusion. This could be a design opportunity for future projects.

9.4 Design conclusion

The final ULL Optimisation Tool translates the assessment framework developed in Part I into a structured workshop process. It helps organisers determine whether their project is sufficiently living-lab-like, define the intended narrative shift, identify relevant actors, assess the mechanism profile of the ULL and translate this profile into context-specific design interventions.

GENERAL DISCUSSION AND CONCLUSION

10 Overall discussion

This chapter reflects on the reliability of the data, the validity of the research approach and design output, the generalisability of the findings, and the contribution of the thesis. It also includes a personal reflection on the methodological pivot that occurred during the research process and closes with implications for future research.

10.1 Reliability of the data

10.1.1 Literature

The theoretical framework of this thesis was developed through a targeted, thematic literature review. The review was not conducted as a systematic literature review, and the search process is therefore not fully reproducible. Because the review started from selected publications and relied partly on snowballing, it may overrepresent literature connected to those starting points. The review also combines literature from different fields, including narrative persuasion, sustainability transitions and urban living labs. While this allows for interdisciplinary insights, it also means that core concepts such as narratives, reflection, co-creation and transition are not always used in exactly the same way across sources.

These limitations mean that the six mechanisms identified in this thesis are not a complete or definitive list of all possible mechanisms related to narrative-shift potential. The list should be understood as synthesis of the selected literature, a defensible conceptual framework that is suitable for the aim of this thesis: constructing an assessment framework for narrative-shift potential in mobility-focused ULLs.

10.1.2 Case studies

The empirical data was collected mainly through organiser interviews, supplemented with supporting documentation where needed. Organisers were suitable sources for reconstructing the design of ULLs. They had knowledge of the goals of the living lab, the activities that took place, the stakeholder structure, participant recruitment, implementation constraints and evaluation activities. This made organiser interviews appropriate for assessing the presence of design conditions associated with narrative-shift potential.

At the same time, organiser interviews also introduce limitations. Organisers cannot fully represent participant experiences. Their accounts may be shaped by their role in the project, by memory, or by a desire to present the project in a positive way. They may also describe the intended design of a living lab more clearly than how participants actually experienced it in practice.

Supporting documentation helped to verify factual information, such as project duration, locations, partner organisations and stated project aims. However, documentation was uneven across the cases. Some cases had useful project websites, grant materials or public descriptions, while others relied more heavily on the interview.

The use of the rubric made the scoring process more consistent because the same ten indicators were used across the three cases. However, the scoring still involved interpretation. The scores are therefore mostly structured qualitative judgements, not objective measurements.

Within the scope of this thesis, the data is sufficiently reliable for reconstructing and comparing the selected ULLs as design settings. It is not sufficient for making strong claims about actual participant-level narrative shifts. This fits the focus of the thesis, which is on narrative-shift potential rather than actual, demonstrated narrative change.

10.2 Validity of the research approach

The research approach is valid for assessing the presence of theoretically grounded design conditions associated with narrative-shift potential. It is not valid for measuring internal narrative change among participants.

The conceptual validity of the approach comes from the grounding of the six mechanisms in literature on narratives, narrative persuasion and urban living labs. The operational validity of the approach comes from the ULL characterisation rubric. The rubric translates the six mechanisms into ten observable indicators and makes it possible to compare the degree of mechanism expression across cases. The case analysis showed that the rubric can reveal meaningful differences between ULLs.

The approach supports the claim that ULLs can be assessed for the presence of theoretically grounded conditions associated with narrative-shift potential. It also supports the claim that the selected cases show different mechanism profiles, and that reflexivity and social network inclusion were less deliberately developed than mechanisms such as socio-spatial relevance, deep immersion and network nurturing.

The approach does not support claims that participants actually changed their mobility narratives, that higher rubric scores necessarily lead to stronger narrative shifts, or that the six mechanisms are the only relevant mechanisms.

This is also the main strength and limitation of the concept of narrative-shift potential. The concept is useful because organisers cannot directly design internal belief change, but they can design conditions that may support such change. At the same time, This thesis does not disprove that a ULL may score highly on narrative-shift potential without producing actual narrative change or that a ULL may trigger narrative change through mechanisms not captured in the rubric.

Overall, the research provides a sufficiently grounded basis for drawing conclusions about the assessment and improvement of narrative-shift potential in the selected mobility-focused ULLs. The data and method do not support claims about actual participant-level narrative change, but they do support conclusions about the presence of design conditions associated with narrative-shift potential and about how these conditions can be made more explicit in future ULL design.

10.3 Validity of the design output

The ULL optimisation tool is grounded in the theoretical framework, the rubric-based case study findings and the validation activities. The tool plays directly into the main design-relevant finding of the analysis: mobility-focused ULLs may already contain implicit narrative-shift potential, but this potential is not always recognised or deliberately designed for.

The retrospective application to GEMINI tested the internal logic of the tool, and showed that the tool can translate a mechanism profile into concrete design opportunities. However, the actual GEMINI organisers were not involved in the retrospective application. The exercise therefore does not prove that these interventions would be feasible or desirable in practice.

The expert feedback session tested the practical relevance of the tool with a municipal smart mobility expert. The session showed that the narrative framing could be understood and applied to a real mobility challenge. It also showed that the tool can help identify important assumptions that might otherwise remain implicit, such as the difference between direct users, narrative-shift target groups and enabling actors.

The validation also showed that the tool assumes a relatively clear living lab structure. The Helmond case contained elements of a living lab, but was still closer to an early pilot. The alternative mobility offer was not yet complete enough to support meaningful reflection on the intended narrative shift. This showed that the tool should not be applied too directly to every mobility pilot. For that reason, a living lab screening step was added before the main tool process.

Several other revisions followed from the validation. The narrative canvas was revised to distinguish between intended narrative-shift target groups, direct users and enabling actors. An access check was added to make explicit whether organisers can actually reach the groups involved. Short mechanism descriptions were added to the rubric materials to support smoother use, further strengthening the design output.

The validation is an initial validation. It supports the internal logic, usability and practical relevance of the tool, but it does not prove that using the tool leads to stronger participant-level narrative shifts. The tool has not yet been tested over time in an actual ULL design or implementation process.

10.4 Generalisability of the findings

The findings of this thesis are not statistically generalisable. Only three main cases were analysed, and these cases were selected partly because of practical access. They are therefore not representative of all mobility-focused ULLs.

However, the cases differ in useful ways. GEMINI is a neighbourhood-based cooperative car-sharing living lab. ALTHEA is a large-scale transition-oriented programme. sCOOL2walk is a school-based active travel intervention. This variation does allow for and support analytical comparison across different types of mobility-focused ULLs.

The findings therefore support analytical generalisation rather than statistical generalisation. The selected cases suggest that mobility-focused ULLs may contain implicit narrative-shift potential, especially where they involve local embedding, repeated engagement and stakeholder collaboration. The cases also suggest that reflexivity and social network inclusion may be common improvement areas.

The mechanism framework is generalisable to other mobility-focused ULLs because it is grounded in theory, not only in the three case studies. However, the specific scores and case patterns from this thesis should not be generalised directly. The tool may also be relevant for ULLs outside personal mobility, but this has not been tested. There is no obvious conceptual reason why narrative-shift potential would only matter in mobility-focused ULLs, or why the identified mechanisms would only apply to ULLs related to personal mobility, but the empirical basis of this thesis is limited to personal mobility.

10.5 Theoretical and practical contribution

This thesis offers contributions to both academic research and practical living lab design. It provides new ways to understand and operationalise narrative-shift potential. The added value of this thesis can be grouped in theoretical, methodological and practical contributions.

10.5.1 Theoretical contribution

The theoretical contribution of this thesis lies in connecting literature on mobility narratives, narrative persuasion and urban living labs. It explicitly frames ULLs as environments in which alternative mobility narratives may be experienced, reflected upon, embedded and potentially diffused.

This shifts the focus from narratives only as a high-level lens to look at transitions to a more practical, participant-facing design conditions that can be supported within ULLs. The six mechanisms associated with narrative-shift potential that the thesis identifies provide a conceptual framework for understanding how ULLs may support narrative-shift potential.This offers a structured way to think about how narrative-related conditions can be designed into ULLs.

10.5.2 Methodological contribution

The methodological contribution is the ULL characterisation rubric. The rubric translates the six mechanisms into ten assessable indicators and makes abstract narrative-shift concepts usable in empirical case analysis.

The rubric supports structured case reconstruction, comparison across ULLs and the identification of design opportunities. It is especially useful in situations where participant-level data is unavailable, or not yet available, but where organisers and documentation can be used to pre- or reconstruct the design and functioning of a ULL.

10.5.3 Practical CDI contribution

The practical contribution is the ULL optimisation tool. The tool translates the assessment framework into a workshop-based design-support process. The value of the tool is not only that it helps assess a ULL, it also helps organisers make implicit assumptions explicit. It can give stakeholders a shared language for discussing which narrative the ULL challenges, and how the design of the tool supports that goal.

This fits the field of Communication Design for Innovation because the tool supports sense-making, stakeholder dialogue and reflective design decision-making.

10.6 Personal reflection

The original ambition for this thesis was to investigate whether participation in ULLs could trigger narrative shifts about personal mobility among participants. This would have required direct access to participants before and after participation in a ULL.

As the research progressed, it became clear that directly measuring narrative shifts among participants in real-world ULLs would be difficult within the scope and practical constraints of this thesis. Access to participants was limited. Many living labs had already taken place, while others were still in an early stage or would not be completed for several years. In several cases, organisers no longer had active contact with participants, or participant data could not be shared. A participant-facing questionnaire was developed and shared as a lower-effort alternative, but no participant responses were received.

The absence of participant data was personally frustrating, and remains the biggest limitation of the thesis. It means that the analysis cannot compare organiser intentions with actual participant experiences. It also means that the thesis cannot assess whether the identified mechanisms were actually experienced as meaningful by participants.

Because of this lack of participant access, the methodological focus shifted from measuring actual narrative shifts to assessing narrative-shift potential. This pivot initially appeared to weaken the thesis, but it also clarified what the actual contribution was. Instead of trying to prove an effect that could not be measured properly, perhaps even with participant access, the thesis developed a way to assess and strengthen the design conditions that may support those effects.

This shift also improved the fit with Communication Design for Innovation. The final contribution is not only an empirical analysis, but also a practical design-support instrument in a usable format for ULL organisers. The thesis shows that design research can remain valuable when methodological constraints are translated into a more precise and usable contribution.

10.7 Implications for future research

Future research could further develop the insights of this thesis in several directions.

First, future research should connect the assessment of narrative-shift potential to participant-level data. The rubric could be combined with pre- and post-participation questionnaires or retrospective participant interviews. This would make it possible to compare the assessed mechanism profile of a ULL with participants' own descriptions of changes in beliefs, assumptions or mobility practices. This research would move from assessing potential towards studying actual effects.

Second, the ULL optimisation tool should be tested in full workshop settings with actual ULL teams and multiple stakeholders. This would show whether the tool supports real design decisions, rather than only reflection. It would also help assess whether tool use changes how organisers design participation, reflection, communication and stakeholder networks.

Finally, the framework could be applied to more ULLs with a more diverse focus, for example in energy, food, housing or climate adaptation living labs. This would show whether the six mechanisms are specific to mobility or more broadly relevant for sustainability-oriented ULLs.

11 Overall conclusion

This final chapter brings together the findings from both the analytical research phase and the practical design phase to provide answers to the thesis goals. It addresses the answers to both the main research and design questions.

11.1 Answer to the research question

How can the narrative-shift potential of mobility-focused urban living labs be assessed?

Mobility-focused ULLs can be assessed by translating theoretically grounded mechanisms associated with narrative persuasion and ULL functioning into a structured rubric. These mechanisms are deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion. Applying the rubric to three cases shows that ULLs often contain strong implicit narrative-shift potential, especially through socio-spatial relevance, deep immersion and network nurturing. However, mechanisms most directly connected to narrative interpretation and diffusion, especially reflexivity and social network inclusion, are often less deliberately designed. ULLs can be improved by making the intended narrative shift explicit, assessing the current mechanism profile, identifying underdeveloped but relevant mechanisms, and designing context-specific interventions while accounting for trade-offs.

11.2 Answer to the design question

How can the assessment of narrative-shift potential be translated into a practical design-support tool for organisers of mobility-focused urban living labs?

The assessment of narrative-shift potential can be translated into a practical design-support tool by structuring it as a collaborative workshop process. The developed ULL Optimisation Tool combines a ULL framing canvas, ULL characterisation rubric, mechanism prompt cards and an optimisation canvas. Together, these components help organisers move from assessing mechanism expression to identifying context-specific opportunities for strengthening narrative-shift potential.

The tool first helps organisers check whether their project sufficiently functions as a living lab. It then supports them in defining the dominant mobility narrative being challenged, the alternative narrative being supported, and the relevant actor groups: the intended narrative-shift target group, direct participants or users, and enabling actors. The rubric is then used to assess the current or planned mechanism profile of the ULL, after which the prompt cards and optimisation canvas help organisers prioritise interventions, discuss trade-offs and define next steps.

The tool helps organisers decide which mechanisms are relevant to strengthen in their specific context, which interventions are feasible, and which trade-offs need to be accepted or monitored, rather than prescribing one ideal living lab model or require all mechanism scores to be maximised. Chapter 9 provides an overview of this tool. The workshop materials are included in Appendix H

12 Bibliography

ALTHEA Project. (n.d.). *Antwerp-Rotterdam TSLL*. Retrieved 22 April 2026, from https://altheaproject.eu/antwerp-rotterdam/

Archibald, M. M., Wittmeier, K., Gale, M., Ricci, F., Russell, K., & Woodgate, R. L. (2021). Living labs for patient engagement and knowledge exchange: An exploratory sequential mixed methods study to develop a living lab in paediatric rehabilitation. *BMJ Open*, *11*(5). https://doi.org/10.1136/bmjopen-2020-041530

Braddock, K., & Dillard, J. P. (2016). Meta-analytic evidence for the persuasive effect of narratives on beliefs, attitudes, intentions, and behaviors. *Communication Monographs*, *83*(4), 446–467. https://doi.org/10.1080/03637751.2015.1128555

Brömmelstroet, M. te, Mladenović, M. N., Nikolaeva, A., Gaziulusoy, İ., Ferreira, A., Schmidt-Thomé, K., Ritvos, R., Sousa, S., & Bergsma, B. (2022). Identifying, nurturing and empowering alternative mobility narratives. *Journal of Urban Mobility*, *2*, 100031. https://doi.org/10.1016/J.URBMOB.2022.100031

Bulkeley, H., Coenen, L., Frantzeskaki, N., Hartmann, C., Kronsell, A., Mai, L., Marvin, S., McCormick, K., van Steenbergen, F., & Voytenko Palgan, Y. (2016). Urban living labs: governing urban sustainability transitions. In *Current Opinion in Environmental Sustainability* (Vol. 22, pp. 13–17). Elsevier B.V. https://doi.org/10.1016/j.cosust.2017.02.003

Bullock, O. M., Shulman, H. C., & Huskey, R. (2021). Narratives are persuasive because they are easier to understand: Examining processing fluency as a mechanism of narrative persuasion. *Frontiers in Communication*, *6*. https://doi.org/10.3389/fcomm.2021.719615

Byrne, R., Smith, A., Watson, J., & Ockwell, D. (2011). *Energy Pathways Energy Pathways in Low-Carbon Development: From Technology Transfer to Socio-Technical Transformation*. www.sussex.ac.uk/sussexenergygroup

Caicedo Mafla, A. (2022). Promoting walkability in children and youth while consolidating the school community. *EIT Grant Proposal (shared by author)*.

Chabay, I., Koch, L., Martinez, G., & Scholz, G. (2019). Influence of narratives of vision and identity on collective behavior change. *Sustainability (Switzerland)*, *11*(20). https://doi.org/10.3390/su11205680

Chen, M., Bell, R. A., & Taylor, L. D. (2016). Narrator Point of View and Persuasion in Health Narratives: The Role of Protagonist–Reader Similarity, Identification, and Self-Referencing. *Journal of Health Communication*, *21*(8), 908–918. https://doi.org/10.1080/10810730.2016.1177147

de Graaf, A., Hoeken, H., Sanders, J., & Beentjes, J. W. J. (2012). Identification as a Mechanism of Narrative Persuasion. *Communication Research*, *39*(6), 802–823. https://doi.org/10.1177/0093650211408594

Design Council. (n.d.). *Framework for innovation*. Design Council. Retrieved 14 June 2026, from https://www.designcouncil.org.uk/resources/framework-for-innovation/

Economides, S. B., Han, C. L., Orowitsch, S., Scoullos, I. M., & Nuttall, W. J. (2012). Paradigm Shift for Future Mobility: A Cross Country Analysis of Behavioural Policies. *Procedia - Social and Behavioral Sciences*, *48*, 2588–2596. https://doi.org/10.1016/j.sbspro.2012.06.1229

ENoLL. (n.d.). *What are Living Labs*. Https://Enoll.Org/about-Us/.

Frantzeskaki, N., Collier, M., Hölscher, K., Gaziulusoy, I., Ossola, A., Albulescu, P., Bonneau, M., Borgstrom, S., Connop, S., Dumitru, A., Geneletti, D., Gorissen, L., Levin-Keitel, M., MacIntyre, T., Mascinga, I., McQuaid, S., Tabory, S., von Wirth, T., Vandergert, P., … Wittmayer, J. (2025). Premises, practices and politics of co-creation for urban sustainability transitions. *Urban Transformations*, *7*(1). https://doi.org/10.1186/s42854-025-00075-9

Frantzeskaki, N., van Steenbergen, F., & Stedman, R. C. (2018). Sense of place and experimentation in urban sustainability transitions: the Resilience Lab in Carnisse, Rotterdam, The Netherlands. *Sustainability Science*, *13*(4), 1045–1059. https://doi.org/10.1007/s11625-018-0562-5

Gadinger, F., Jarzebski, S., & Yildiz, T. (2014). From discourse to narration. The promise of narrative analysis in political science. *Politische Vierteljahresschrift*, *55*(1), 67–93. https://doi.org/10.5771/0032-3470-2014-1-67

GEMINI. (n.d.). *GEMINI project website*. Retrieved 22 April 2026, from https://www.geminiproject.eu/

Green, M. C., & Brock, T. C. (2000). The role of transportation in the persuasiveness of public narratives. *Journal of Personality and Social Psychology*, *79*(5), 701–721. https://doi.org/10.1037/0022-3514.79.5.701

Guske, A. L., Jacob, K., Hirschnitz-Garbers, M., Peuckert, J., Schridde, S., Stinner, S., Wolff, F., Zahrnt, D., & Ziesemer, F. (2019). Stories that change our world? Narratives of the sustainable economy. *Sustainability (Switzerland)*, *11*(21). https://doi.org/10.3390/su11216163

Hamby, A., Brinberg, D., & Daniloski, K. (2016). Reflecting on the journey: Mechanisms in narrative persuasion. *Journal of Consumer Psychology*, *27*(1), 11–22. https://doi.org/10.1016/j.jcps.2016.06.005

Hamby, A., Brinberg, D., & Jaccard, J. (2018). A Conceptual Framework of Narrative Persuasion. *Journal of Media Psychology*, *30*(3), 113–124. https://doi.org/10.1027/1864-1105/a000187

Hansen, A. V., Fuglsang, L., Liefooghe, C., Rubalcaba, L., Gago, D., Mergel, I., Haug, N., Røhnebæk, M. T., & Mureddu, F. (2021). Living Labs for Public Sector Innovation: Insights from a European case study. *Technology Innovation Management Review*, *11*(9–10), 47–58. https://doi.org/10.22215/TIMREVIEW/1464

Hansen, M. B., Rasmussen, I. S., Marloth, T., Jarløv, J. O., Arpi, M., Mogensen, D., & Jensen, J. N. (2023). A pre-post intervention study: Knowledge among parents about child infections and antibiotic use facilitated by maternal and child health nurses. *Nursing Open*, *10*(2), 641–648. https://doi.org/10.1002/nop2.1330

Haug, N., & Mergel, I. (2021). Public value co-creation in living labs-results from three case studies. *Administrative Sciences*, *11*(3). https://doi.org/10.3390/admsci11030074

Hawxwell, T., Hendriks, A., & Späth, P. (2024). Transformative or incumbent futures? How the future of mobility is imagined in sustainability transitions research. *Futures*, *159*. https://doi.org/10.1016/j.futures.2024.103325

Henriksson, M., Berg, J., & Henriksson, G. (2024). Everyday mobility and citizenship: a living lab approach. *Urban, Planning and Transport Research*, *12*(1). https://doi.org/10.1080/21650020.2024.2355355

Hermwille, L. (2016). The role of narratives in socio-technical transitions - Fukushima and the energy regimes of Japan, Germany, and the United Kingdom. *Energy Research and Social Science*, *11*, 237–246. https://doi.org/10.1016/j.erss.2015.11.001

Holden, E., Banister, D., Gössling, S., Gilpin, G., & Linnerud, K. (2020). Grand Narratives for sustainable mobility: A conceptual review. *Energy Research & Social Science*, *65*, 101454. https://doi.org/10.1016/J.ERSS.2020.101454

Interview with 'ALTHEA' representative. (2026).

Interview with 'CENEX' representative. (2026).

Interview with 'The Future Mobility Network' representative. (2026).

Johansson, H., Sandvik, K. O., Zsidákovits, J., & Łutczyk, G. (2016). A Need for New Methods in the Paradigm Shift from Mobility to Sustainable Accessibility. *Transportation Research Procedia*, *14*, 412–421. https://doi.org/10.1016/j.trpro.2016.05.093

Kronsell, A., & Mukhtar-Landgren, D. (2018). Experimental governance: the role of municipalities in urban living labs. *European Planning Studies*, *26*(5), 988–1007. https://doi.org/10.1080/09654313.2018.1435631

Liebowitz, S. J., & Margolis, S. E. (1995). Path Dependence, Lock-In, and History. *Journal of Law, Economics, & Organization*, *11*(1), 205–226.

Loorbach, D. (2010). Transition Management for Sustainable Development: A Prescriptive, Complexity-Based Governance Framework. *Governance: An International Journal of Policy, Administration, and Institutions*, *23*(1), 161–183. www.senternovem.nl/energytransition

Loorbach, D., & Rotmans, J. (2006). Managing Transitions for Sustainable Development. In *Understanding Industrial Transformation* (pp. 187–206). Kluwer Academic Publishers. https://doi.org/10.1007/1-4020-4418-6_10

Mahmoud, I. H., Morello, E., Ludlow, D., & Salvia, G. (2021). Co-creation Pathways to Inform Shared Governance of Urban Living Labs in Practice: Lessons From Three European Projects. *Frontiers in Sustainable Cities*, *3*. https://doi.org/10.3389/frsc.2021.690458

McMillen, H., Campbell, L. K., Svendsen, E. S., & Reynolds, R. (2016). Recognizing stewardship practices as indicators of social resilience: In living memorials and in a community garden. *Sustainability (Switzerland)*, *8*(8). https://doi.org/10.3390/su8080775

McPhee, C., Bancerz, M., Mambrini-Doudet, M., Chrétien, F., Huyghe, C., & Gracia-Garza, J. (2021). The defining characteristics of agroecosystem living labs. *Sustainability (Switzerland)*, *13*(4), 1–25. https://doi.org/10.3390/su13041718

Miles, M. B., & Huberman, A. M. (1994). *Qualitative Data Analysis* (2nd ed.). SAGE Publications.

Murrar, S., & Brauer, M. (2019). Overcoming Resistance to Change: Using Narratives to Create More Positive Intergroup Attitudes. *Current Directions in Psychological Science*, *28*(2), 164–169. https://doi.org/10.1177/0963721418818552

Nesterova, N., Uzunova, E., & van Egmond, P. (2021). *EIT Urban Mobility Knowledge base of innovative solutions in urban mobility and living labs*.

Nesti, G. (2018). Co-production for innovation: The urban living lab experience*. *Policy and Society*, *37*(3), 310–325. https://doi.org/10.1080/14494035.2017.1374692

Nguyen, H. T., & Marques, P. (2022). The promise of living labs to the Quadruple Helix stakeholders: exploring the sources of (dis)satisfaction. *European Planning Studies*, *30*(6), 1124–1143. https://doi.org/10.1080/09654313.2021.1968798

Puerari, E., de Koning, J. I. J. C., von Wirth, T., Karré, P. M., Mulder, I. J., & Loorbach, D. A. (2018). Co-creation dynamics in Urban Living Labs. *Sustainability (Switzerland)*, *10*(6). https://doi.org/10.3390/su10061893

Rollin, P., Bamberg, S., Ketterl, C., & Weiland, S. (2021). Cracks in the wall of a car-oriented local mobility system – Results of an urban living lab. *Journal of Environmental Psychology*, *77*. https://doi.org/10.1016/j.jenvp.2021.101678

Rowe, A. L., & Cooke, N. J. (1995). Measuring Mental Models: Choosing the Right Tools for the Job. In *HUMAN RESOURCE DEVELOPMENT QUARTERLY* (Vol. 6, Number 3).

Saris, W. E., Revilla, M., Krosnick, J. A., & Shaeffer, E. M. (2010). Comparing Questions with Agree/Disagree Response Options to Questions with Item-Specific Response Options. In *Survey Research Methods* (Vol. 4, Number 1). http://www.surveymethods.org

Schütz, F., Heidingsfelder, M. L., & Schraudner, M. (2019). Co-shaping the Future in Quadruple Helix Innovation Systems: Uncovering Public Preferences toward Participatory Research and Innovation. *The Journal of Design, Economics, and Innovation*, *5*(2), 128–146. https://doi.org/10.1016/j.sheji.2019.04.002

Scool2walk. (n.d.). *Implementations and Pilots*. Retrieved 22 April 2026, from https://www.scool2walk.com/implementations-and-pilots

Sharp, D., & Salter, R. (2017). Direct impacts of an urban living lab from the participants' perspective: Livewell Yarra. *Sustainability (Switzerland)*, *9*(10). https://doi.org/10.3390/su9101699

Slater, M. D., & Rouner, D. (2002). Entertainment-Education and Elaboration Likelihood: Understanding the Processing of Narrative Persuasion. *Communication Theory*, *12*(2), 173–191.

Star, S. L., & Griesemer, J. R. (1989). Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907–39. *Social Studies of Science*, *19*(3), 387–420. https://doi.org/10.1177/030631289019003001

Steen, K., & Van Bueren, E. (2017). *Urban Living Labs: A Living Lab Way of Working*. https://www.researchgate.net/publication/318109901

Thombre, A., & Agarwal, A. (2021). A paradigm shift in urban mobility: Policy insights from travel before and after COVID-19 to seize the opportunity. *Transport Policy*, *110*, 335–353. https://doi.org/10.1016/j.tranpol.2021.06.010

Tillema, T. (2014). *Space for mobility: towards a paradigm shift in Dutch transport infrastructure planning?* https://www.researchgate.net/publication/229040584

Veland, S., Scoville-Simonds, M., Gram-Hanssen, I., Schorre, A. K., El Khoury, A., Nordbø, M. J., Lynch, A. H., Hochachka, G., & Bjørkan, M. (2018). Narrative matters for sustainability: the transformative role of storytelling in realizing 1.5°C futures. In *Current Opinion in Environmental Sustainability* (Vol. 31, pp. 41–47). Elsevier B.V. https://doi.org/10.1016/j.cosust.2017.12.005

von Wirth, T., Fuenfschilling, L., Frantzeskaki, N., & Coenen, L. (2019). Impacts of urban living labs on sustainability transitions: mechanisms and strategies for systemic change through experimentation. *European Planning Studies*, *27*(2), 229–257. https://doi.org/10.1080/09654313.2018.1504895

Voytenko, Y., McCormick, K., Evans, J., & Schliwa, G. (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

Wells, P., & Xenias, D. (2015). From 'freedom of the open road' to 'cocooning': Understanding resistance to change in personal private automobility. *Environmental Innovation and Societal Transitions*, *16*, 106–119. https://doi.org/10.1016/j.eist.2015.02.001

Yin, R. K. (2013). *Case Study Research: Design and Methods*. SAGE Publications. https://books.google.nl/books?id=OgyqBAAAQBAJ

Zipfel, N., Horreh, B., Hulshof, C. T. J., De Boer, A. G. E. M., & Van Der Burg-Vermeulen, S. J. (2022). The relationship between the living lab approach and successful

implementation of healthcare innovations: An integrative review. *BMJ Open*, *12*(6). https://doi.org/10.1136/bmjopen-2021-058630

Appendix A ULL rubric

Mechanism indicator	Score 1 (low)	Score 2	Score 3 (moderate)	Score 4	Score 5 (high)
DEEP IMMERSION Time spent in engagement	Little time spent in ULL activities.	Limited engagement in activities; participants contribute minimally.	Moderate involvement; participants actively contribute for a reasonable duration.	Active participation; participants spend a significant amount of time in co-creation and experimentation.	Extensive engagement; participants highly immersed in ULL activities, actively contributing throughout.
DEEP IMMERSION Depth of involvement	Minimal contribution; participants provide limited input.	Limited engagement; participants contribute ideas sporadically.	Active involvement; participants consistently contribute meaningful ideas and perspectives.	Substantial contribution; participants actively shape alternative narratives.	Deep engagement; participants significantly influence and shape alternative narratives.
REFLEXIVITY Frequency of reflective activities	No participation in reflective activities.	Occasional involvement in reflective activities.	Regular participation in reflective activities.	Frequent engagement in activities promoting reflection.	Consistent and frequent involvement in reflective activities.
PARTICIPATORY APPROACH Diversity of perspectives	Limited diversity in participant backgrounds.	Some diversity, but a predominant group dominates.	Reasonable diversity in participant backgrounds.	Diverse representation across various socio-cultural factors.	Highly diverse participant backgrounds and perspectives.
PARTICIPATORY APPROACH Cooperative decision-making	Rare instances of collaborative decision-making.	Limited involvement from different sectors in decision-making.	Moderate participation in cooperative decision-making.	Active involvement from various sectors in joint decision-making.	Consistent and effective cooperative decision-making across all sectors.

SOCIO-SPATIAL RELEVANCE Tailored aspects	Few ULL activities directly address local challenges/opportunities.	Limited tailoring to local context; some relevance in activities.	Moderate tailoring to local challenges; activities are relevant.	Activities highly tailored to local challenges; strong relevance.	All activities specifically address and effectively tackle local challenges and opportunities
SOCIO-SPATIAL RELEVANCE Engagement of local communities	Low representation of diverse local community members.	Limited representation; certain demographics are underrepresented.	Moderate representation; diverse local community members are present.	High representation; diverse local community members actively engaged.	Extensive representation; active and meaningful engagement from all segments of the local community.
NETWORK NURTURING Interdisciplinary interaction	Rare interdisciplinary events; limited collaboration.	Occasional interdisciplinary events; some collaboration.	Regular interdisciplinary events; moderate collaboration.	Frequent interdisciplinary events; substantial collaboration.	Consistent and frequent interdisciplinary events; extensive collaboration.
SOCIAL NETWORK INCLUSION External communication opportunities	Rare sharing of ULL experiences externally.	Occasional sharing; limited external communication.	Regular sharing; moderate frequency of external communication.	Frequent sharing; active external communication.	Consistent and extensive sharing; high frequency of external communication.
SOCIAL NETWORK INCLUSION Feedback loop (post-ull)	Rare external feedback, questions, or interest post-ULL.	Occasional external feedback; some interest post-ULL.	Regular external feedback; moderate post-ULL interest.	Frequent external feedback; active post-ULL interest.	Consistent and extensive external feedback; high post-ULL interest.

Appendix B Narrative snapshot questionnaire

This appendix describes the development of a questionnaire and interview guide to assess participants' internal narratives about personal mobility as a result of their participation in Urban Living Labs (ULLs). The key research objective addressed is to uncover and evaluate participants' beliefs, attitudes, or "internal narratives" regarding personal mobility.

B.1 Methods of measuring internal narratives

Rowe & Cooke, (1995) examined methods for assessing mental models. Their research found various methods that could be considered for measuring internal narratives:

1. **Think-aloud protocols**

   Participants are asked to think out loud while completing a task or interact with the topic. This method provides deep insights into cognitive processes but is time-intensive and therefore less practical for large samples or repeated measures.

2. **(Laddering) interviews**

   Structured or semi-structured interviews can provide detailed quantitative and qualitative data about participants' narratives. Using a laddering interviewing technique can offer deeper insights into underlying values that explain why interviewees feel a certain way about the topic or elements within the mental model. The downside of interviews is that they require significant time investment both in conducting and analysing the data, making them less feasible for large sample sizes or repeated measures.

3. **Diagramming tasks**

   Participants create diagrams to represent their understanding of a system or concept. While useful for visualizing mental models, this method can be complex to analyse and compare and it may not capture all aspects of an internal narrative.

4. **Relatedness ratings**

   Participants rate the functional relatedness of various components within a system. This method can effectively capture the structure of mental models but require a lot of time and effort from participants, especially when dealing with large sets of components.

The research found that laddering interviews and relatedness ratings were the most effective methods for understanding internal mental representations, with each capturing different but complementary aspects of mental models (Rowe & Cooke, 1995). However, when efficiency, scalability, and consistency are key considerations, questionnaires could serve as an effective

alternative to interviews, keeping the same basic question and answering format, but allowing parallel data collection for multiple participants.

The validity of using a questionnaire to assess internal narratives is supported by other research, where pre- and post-intervention surveys have successfully captured shifts in internal narratives. For instance, M. B. Hansen et al. (2023) successfully used a pre- and post-intervention questionnaire to measure changes in parental knowledge and beliefs about childhood infections and antibiotics. This study demonstrated that a well-designed questionnaire can capture shifts in internal narratives following an, in this case educational, intervention.

This appendix will move forward assuming a questionnaire is used. However, should time allow for it, a laddering interview could provide more in depth insights. Appendix C provides more information about this laddering technique.

B.2 Design considerations

The questionnaire design is guided by several considerations:

1. **Consistent response format**

   By using a consistent response format, participant responses are standardized. This uniformity streamlines data analysis and interpretation. Furthermore, participants know what to expect when answering the questions, minimizing the chances of potential confusion and mistakes in filling in the answers.

2. **Balanced positive and negative framing**

   Questions are consciously framed to display both positive and negative sentiment to filter out influences of ‘acquiescence bias’. This is the tendency of respondents to agree with statements regardless of their content. Furthermore, framing questions in different ways forces respondents to carefully consider each statement, discouraging a consistent response pattern (Saris et al., 2010).

3. **Minimizing data quantity**

   Only the influence of the degree of exposure to the identified mechanisms is measured. Influences of other (demographic) factors is not important, and can therefore be left out.

B.3 Implementation

Questions consist of a statement that participants are asked to respond to using the same 5-point-Likert scale for each question, with answers ranging from 1 (strongly disagree) to 5 (strongly agree).

Depending on the final research and ULL optimisation tool design, the same underlying questions and constructs can be adapted to alternative formats. The adaptation of the tool to fit the selected methodology and ULL tool, will be discussed in later chapters.

B.4 Narrative snapshot questionnaire

Section 1: Introduction

This survey aims to explore your beliefs, attitudes, and thoughts regarding personal mobility. Your participation is voluntary, and your responses will remain confidential. The information gathered will be used for research purposes only. Take your time to provide thoughtful and honest answers.

Section 2: current transportation habits

1. I frequently use a car for my daily commuting needs.
2. Cycling is a convenient mode of transportation for me.
3. Public transportation is my preferred method of commuting.
4. I often choose to walk for short-distance travel.
5. I regularly use ride-sharing services (e.g., Uber, Lyft) for transportation.
6. I prefer using a bicycle over other modes of transportation.
7. I feel confident driving a car in various traffic conditions.
8. I am comfortable using public transportation services in my city.
9. I often combine different modes of transportation in a single journey.
10. I actively seek out eco-friendly transportation options.

Section 3: attitudes towards current transportation

1. I am satisfied with the convenience of my current mode of transportation.
2. The environmental impact of my transportation choices concerns me.
3. My current transportation method aligns well with my lifestyle.
4. I experience stress due to my current transportation habits.
5. I believe my transportation habits positively contribute to my community.
6. I find the cost of my current transportation method to be reasonable.
7. The reliability of my current transportation method is satisfactory.
8. I enjoy the flexibility that my transportation choices provide.
9. I feel safe when using my current mode of transportation.
10. I am content with the time it takes me to commute daily.

Section 4: confidence and preferences

1. I am confident in my ability to navigate public transportation systems.
2. I feel comfortable using a bicycle as a primary mode of transportation.
3. I prefer the convenience of private car ownership over shared mobility.
4. I am open to trying new and innovative transportation methods.
5. I feel at ease using shared mobility services (e.g., car-sharing, bike-sharing).
6. I am confident in my ability to adapt to changes in transportation infrastructure.

7. I prefer transportation options that allow for multitasking during travel (e.g., reading, working).
8. I value independence in my transportation choices.
9. I am willing to walk longer distances if it benefits my health.
10. I prefer transportation methods that offer privacy.

Section 5: willingness to change

1. I am open to exploring alternative transportation methods to reduce my environmental impact.
2. I would consider changing my primary mode of transportation if presented with a better alternative.
3. I am willing to invest time and effort in learning a new transportation method.
4. I would consider giving up private car ownership in favor of shared mobility options.
5. I am willing to pay more for eco-friendly transportation alternatives.
6. I would change my transportation habits if it positively influenced the local community.
7. I am open to participating in community initiatives that promote sustainable transportation.
8. I would consider relocating to an area with better access to sustainable transportation options.
9. I am willing to adjust my schedule to accommodate alternative transportation methods.
10. I believe changing my transportation habits could improve my overall quality of life.

Section 6: alternative concepts

1. Living in a car-free city has potential benefits.
2. Shared mobility services are practical alternatives to private vehicle ownership.
3. I believe carpooling effectively reduces traffic congestion.
4. Bike-sharing programs are appealing to me.
5. Designated car-free zones would improve urban living.
6. Electric scooters are a viable mode of transportation for short distances.
7. Mobility-as-a-Service (MaaS) platforms offer convenient transportation solutions.
8. Autonomous vehicles will positively transform personal mobility.
9. Investing in public transportation infrastructure is essential for sustainable cities.
10. Pedestrian-friendly urban design enhances the quality of life in cities.

Section 7: environmental concerns

1. I am actively aware of the environmental impact of my transportation choices.
2. Reducing carbon emissions from transportation is important to me.
3. I am willing to prioritize eco-friendly transportation options to reduce my carbon footprint.

4. I consider the environmental credentials (e.g., electric, hybrid) of vehicles when making transportation choices.
5. The potential for air pollution influences my choice of transportation.
6. I believe that individual actions in transportation choices can positively impact the environment.
7. I am concerned about the depletion of natural resources due to current transportation practices.
8. Noise pollution from transportation affects my quality of life.
9. I support policies that encourage the use of sustainable transportation.
10. Environmental sustainability is a key factor in my transportation decisions.

Section 8: future preferences

1. I envision a future where sustainable transportation is the norm.
2. In the future, I see myself relying more on eco-friendly transportation options.
3. The concept of Mobility-as-a-Service (integrating various transportation modes) appeals to me.
4. I am excited about advancements in transportation technology (e.g., electric vehicles, autonomous cars).
5. I believe that reducing private car ownership will benefit society.
6. I foresee increased use of shared mobility services in my daily life.
7. I expect public transportation systems to become more efficient and user-friendly.
8. Sustainable transportation options will become more accessible and affordable.
9. I am optimistic about the impact of sustainable transportation on urban living.
10. I plan to adapt my lifestyle to support sustainable transportation initiatives.

Section 9: conclusion

Thank you for taking the time to participate in this survey.

Appendix C Laddering interview technique

Rowe & Cooke (1995) suggest mental models are best assessed using a 'laddering interview' technique. Laddering involves using iterative probing questions to reveal the links between concrete experiences and deeper values or beliefs. An example of a typical laddering question is "Why is that important to you?". By continually asking follow-ups about the reasoning or meaning behind an answer, laddering helps to uncover the underlying motivations, assumptions, and values that shape an individual's perspective.

In the context of this research, laddering allows us to explore how specific aspects of a ULL experience (e.g. a particular activity, interaction, or realization) are connected to changes in the participant's personal mobility narrative. It helps us to map the chain from a participant's description of what happened during the ULL, to how they felt or reacted, and then to why that mattered for their outlook on mobility. In other words, laddering helps reveal how participants translate ULL experiences into new beliefs or attitudes about mobility. By using directed but open-ended questions, we can guide participants to articulate deeper insights. An example of such an insight could be uncovering that a specific positive experience with an e-bike in the ULL made a participant realize the value of sustainable travel, which in turn connects to their personal value of environmental responsibility.

This approach will lead to richer qualitative data on why narrative shifts occur. It aligns with the need for deeper exploration identified when switching methodologies (3.4).

Appendix D Interview guide for case study methodology - organisers

This interview guide supports the characterisation of Urban Living Labs (ULLs) in the case study methodology. The main purpose of the interview is to reconstruct the setup, activities, stakeholder involvement, and functioning of the ULL, and to fill in the ULL characterisation rubric (Appendix A consistently across cases.

The interview starts with a broad reconstruction of the ULL and then moves into the organiser and interviewer going through the rubric together. For each indicator, the organiser is asked to reflect on the extent to which the mechanism was present in the ULL, drawing on concrete examples from the design and implementation of the lab. Example questions are included below.

All interviews are recorded, with consent, to allow for transcription. Transcripts will be anonymized where necessary.

D.1 Semi-structured interview guide

Section 1: Consent and confidentiality

Thank you for taking part in this interview. Before we begin, do you have any questions about the study, the use of the interview, or the consent form?

Section 2: Background of the ULL

1. Could you briefly introduce the living lab?
2. What was the main goal or ambition of this ULL?
3. Who initiated the ULL, and which organisations were involved in its setup and implementation?
4. Over what period did the ULL take place?
5. What kinds of activities, experiments, or interventions were part of the ULL?

The goal of this section is to establish a general understanding of the ULL before moving to the rubric itself. Follow-up questions should be used to clarify the timeline, the type of activities, the target group, and the organisational setup of the lab.

Section 3: Stakeholders, participants, and local context

6. Which stakeholder groups were involved in the ULL?
7. Who were the intended participants or users?
8. How were participants recruited or selected?
9. To what extent was the ULL connected to a specific neighbourhood, district, city, or local mobility challenge?
10. Were there local circumstances or place-specific issues that shaped the design of the ULL?

This section is intended to clarify the stakeholder constellation, participant profile, and socio-spatial embedding of the ULL. These elements are important for several indicators in the rubric.

Section 4: Reconstruction of activities and process

11. Could you walk me through what participation in the ULL typically looked like from beginning to end?
12. What kinds of interactions took place between participants and organisers?
13. Were there moments of co-creation, evaluation, discussion, or decision-making built into the process?
14. Did the setup of the ULL change over time? If so, how and why?

The aim here is to reconstruct how the ULL functioned in practice, rather than only how it was intended to function on paper.

Section 5: Guided rubric scoring

In this section, the rubric is used as the main instrument. The interviewer and organiser go through each indicator one by one. For each indicator, the interviewer asks the organiser to describe the extent to which the mechanism was present in the ULL and to provide concrete examples. Based on these descriptions, a score is assigned using the rubric by the interviewer.

Mechanism 1: Deep immersion

Indicator 1: Time spent in engagement

- How much time did participants typically spend in ULL activities?
- Was participation limited to one or two moments, or did it involve repeated or longer-term engagement?
- To what extent were participants actively engaged throughout that time?

Indicator 2: Depth of involvement

- To what extent did participants actively contribute ideas, choices, or feedback?
- Were they mainly observers or testers, or did they help shape what happened in the ULL?
- How intensive would you describe their involvement?

Mechanism 2: Reflexivity

Indicator 3: Frequency of reflective activities

- Were there explicit moments for reflection built into the ULL, such as debriefs, discussions, evaluations, or feedback sessions?
- How often did these reflective moments occur?
- Were participants encouraged to think critically about their experiences, assumptions, or mobility habits?

Mechanism 3: Participatory approach

Indicator 4: Diversity of perspectives

- What kinds of participants and stakeholders were involved in the ULL?
- To what extent did the ULL include people with different backgrounds, experiences, or perspectives?
- Were there participant groups that were absent or underrepresented?

Indicator 5: Cooperative decision-making

- To what extent were decisions made jointly across stakeholder groups?
- Were participants or external stakeholders involved in shaping activities, priorities, or choices within the ULL?
- Can you give examples of moments where decisions were made collaboratively?

Mechanism 4: Socio-spatial relevance

Indicator 6: Tailored aspects

- To what extent were the activities or interventions tailored to local mobility challenges or opportunities?
- Was the ULL designed around a specific local problem, need, or opportunity?
- Can you give examples of ways in which the ULL was adapted to its context?

Indicator 7: Engagement of local communities

- To what extent were local community members involved in the ULL?
- Did the ULL succeed in involving people from the area or groups directly affected by the mobility issue?
- How meaningful was that involvement?

Mechanism 5: Network nurturing

Indicator 8: Interdisciplinary interaction

- Were there activities specifically aimed at connecting actors from different sectors or backgrounds?
- How often did these interactions take place?
- Did the ULL lead to new collaborations, relationships, or stronger connections across the quadruple helix?

Mechanism 6: Social network inclusion

Indicator 9: External communication opportunities

- Were participants encouraged or enabled to share their experiences outside the ULL?
- Did the ULL include communication moments, public events, presentations, or other ways of reaching beyond the direct participant group?

Indicator 10: Feedback loop (post-ULL)

- Was there any follow-up from people outside the ULL after activities had taken place?
- Did external individuals show interest, ask questions, respond to results, or become involved afterwards?
- To what extent did the ULL generate a ripple effect beyond the immediate setting?

Section 7: Final reflection

15. Is there anything about the ULL's design, implementation, or context that you think is important for interpreting the rubric, but that we have not yet discussed?
16. Looking back, are there any aspects of the ULL that you think were especially influential in shaping participants' experiences?

This final section allows the organiser to add relevant context that may not fit neatly under one rubric indicator but could still matter for interpretation.

Instructions for the interviewer

The organiser interview is primarily about recalling and reconstruction the setup of the living lab. The interviewer should aim to understand what the ULL looked like in practice and use that understanding to assign rubric scores as consistently as possible.

Appendix E Methodology exploratory test

The first interview was focused on the the Tunnelvisionair project in Amsterdam and served as practical test of the research methodology. Based on this interview, several changes to the methodology were introduced, mostly focused on capturing more contextual information. Whereas initially, the focus was solely on gathering enough information to fill in the ULL characterisation rubric, this interview made clear that the 'living lab' category was broader than initially expected, and that it's important to understand the goals and broader context of a living lab to assess if it is relevant within the scope of this research, and if it is indeed what is defined in this research as living lab.

E.1 Case study summary

The central issue this living lab was built around was that unpleasant cycling tunnels strongly affect how safe and comfortable a cycling trip feels, and thereby affect how attractive cycling is compared to alternative transportation methods. According to the interviewee, one bad tunnel can shape the total experience of a route and may even discourage people from leaving home by bike. The project focused on whether 'sensory interventions' could improve the experience of these spaces.

In Amsterdam, the team organized a public call in which people could vote for the most unpleasant cycling tunnel. Four of the 'worst' tunnels were selected based on this feedback. Each tunnel received a different 'sensory intervention', targeting sight, smell, hearing or touch. Concretely, respectively a disco-style visual intervention, orange scent, bird sounds, or fans creating a tailwind effect.

The project can be characterized as a real-world experiment, applied research. For each tunnel, the team conducted a baseline measurement before installing the intervention, and a test measurement when it was installed. Cyclists were intercepted immediately after passing through the tunnel and asked to complete a questionnaire. At the same time, researchers also held short conversations and made qualitative notes about remarks that did not fit neatly into the survey.

Participants were not pre-selected. Anyone cycling through the tunnel could be approached. This increased realism, but it also meant participation was fairly brief. The team found, for example, that cyclists were harder to stop than pedestrians, and evening data collection had to be dropped altogether because people were unwilling to step of their bike near dark tunnels.

The main actors were Goudappel as research bureau, the Municipality of Amsterdam, especially the cycling department, and Vervoerregio Amsterdam. City staff also helped on site. The intended end users were everyday cyclists and tunnel users.

The interview suggests that the project generated follow-up beyond the original experiment. Results fed into a broader study of 110 tunnels in Amsterdam Zuidoost, and at least one tunnel was later renovated using a combination of light, scent and sound. The interviewee also stresses that visibly showing what happened with the results matters, because participants otherwise risk feeling that they contributed to a study that changed nothing.

E.2 Interview with organisers

An employee from one of the organizing stakeholders that was responsible for setting up and executing this living lab was interviewed on 10-04-2026. This interview resulted in the context description in E.1, and the ULL characterisation rubric in Table 9.

Table 9 – Scores and justifications per indicator for Tunnelvisionair (based on ULL rubric in Appendix A

INDICATOR	RUBRIC FIT	EVIDENCE AND JUSTIFICATION
DEEP IMMERSION - TIME SPENT IN ENGAGEMENT	1: Little time spent in ULL activities.	Participation was brief for the participants: one tunnel passage followed by a questionnaire and sometimes a short conversation. A few people visited multiple tunnels, but that was exceptional rather than typical. Spending any less time would be difficult to qualify as 'participating' at all.
DEEP IMMERSION - DEPTH OF INVOLVEMENT	2: Limited engagement; participants contribute ideas sporadically.	Participants mainly experienced the intervention and provided feedback. They were not co-designers of the intervention itself, although the wider public did help select tunnels through the initial public vote. The actual participants' role was limited to evaluating.
REFLEXIVITY - FREQUENCY OF REFLECTIVE ACTIVITIES	2: Occasional involvement in reflective activities.	The questionnaire and on-the-spot follow-up conversation did ask of participants to reflect on how they experienced the tunnel, but this reflection was limited to the measurement moment and was not part of a repeated or structured reflection process. There were no debriefs, workshops or collective reflection moments.
PARTICIPATORY APPROACH - DIVERSITY OF PERSPECTIVES	3: Reasonable diversity in participant backgrounds.	Recruitment was open and took place in public space, which created a reasonably mixed participant pool. The team also analysed differences between men and women, younger and older people, and users familiar or unfamiliar with the area. Still, diversity was not actively pursued, it was dependent on who happened to pass by and agree to participate.
PARTICIPATORY APPROACH - COOPERATIVE DECISION-MAKING	1: Rare instances of collaborative decision-making.	There is little evidence that participants, local residents, public authorities, and other stakeholders made decisions jointly. The project is researcher- and client-led, with participant influence concentrated in voting and feedback. There was no 'shared governance'.
SOCIO-SPATIAL RELEVANCE - TAILORED ASPECTS	4: Activities highly tailored to local challenges; strong relevance.	The project was explicitly built around local tunnels, local cycling experience, and a concrete urban issue: perceived unpleasantness and social safety in Amsterdam cycling infrastructure. However, the interviewee

		did mention that some participants came from further away to specifically experience these altered tunnels as ‘touristic attraction’.
SOCIO-SPATIAL RELEVANCE - ENGAGEMENT OF LOCAL COMMUNITIES	3: Moderate representation	Local users were directly involved because actual tunnel users were approached in situ. At the same time, involvement was mostly as respondents rather than as long-term local co-creators, and publicity also attracted some visitors from outside the immediate local user group.
NETWORK NURTURING - INTERDISCIPLINARY INTERACTION	3: Regular interdisciplinary events; moderate collaboration.	Several organisations were involved: Gemeente Amsterdam, Vervoerregio Amsterdam, and Goudappel as research bureau, working together in the scoping, organising and processing of results of this living lab. This cross-organisational collaboration does seem to rely on existing networks, there is limited evidence of new network building. Limited actual quadruple-helix collaboration involving citizens, academia, industry, and government together took place.
SOCIAL NETWORK INCLUSION - EXTERNAL COMMUNICATION OPPORTUNITIES	4: Frequent sharing; active external communication.	The project was publicly visible and widely communicated by the municipality. The interviewee mentioned that some people came specifically to Amsterdam to visit the tunnels as an outing, suggesting the project was communicated externally and attracted public attention.
SOCIAL NETWORK INCLUSION - FEEDBACK LOOP (POST-ULL)	4: Frequent external feedback; active post-ULL interest.	The project clearly led to follow-up. It became the starting point for a broader assessment of 110 tunnels in Amsterdam Zuidoost, and at least one tunnel was later upgraded using light, smell, and sound based on the results. This indicates post-ULL interest and continuation, although not necessarily a feedback loop that included the original participants.

Appendix F Collected case study data

This appendix contains an overview per case. The score justifications are presented per case in subchapters F.1, F.2 and F.3. A complete overview of all scores is included in Table 10 below.

Table 10 - Overview of case study ULL rubric scores (based on rubric in Appendix A

Mechanism	Indicator	GEMINI	ALTHEA	sCOOL2walk
Deep immersion	Time spent in engagement	4	2	4
Deep immersion	Depth of involvement	4	3	4
Reflexivity	Frequency of reflective activities	3	3	3
Participatory approach	Diversity of perspectives	4	4	4
Participatory approach	Cooperative decision-making	4	3	4
Socio-spatial relevance	Tailored aspects	5	4	5
Socio-spatial relevance	Engagement of local communities	4	3	4
Network nurturing	Interdisciplinary interaction	3	4	3
Social network inclusion	External communication opportunities	4	2	2
Social network inclusion	Feedback loop (post-ULL)	4	-	3

F.1 Case study 1: GEMINI cooperative car sharing living lab

An employee from CENEX Nederland who was involved in the Amsterdam case as evaluation partner was interviewed for this case description. This interview forms the basis for the contextual reconstruction and for the ULL characterisation rubric scores in chapter 5.2.1.

Table 11 – Scores and justifications per indicator for GEMINI (based on ULL rubric in Appendix A

INDICATOR	RUBRIC FIT	EVIDENCE AND JUSTIFICATION
DEEP IMMERSION - TIME SPENT IN ENGAGEMENT	4: Active participation; participants spend a significant amount of time in co-creation and experimentation.	The living lab runs over a long period, roughly four years as a project, with some communities active for that whole period, others started up later or stranded before the end of the project. Participants did not just complete a survey or test a service once, but were active members of a cooperative car-sharing setup that they steer over time. Involvement does seem to differ strongly between highly active board members and more passive users.
DEEP IMMERSION - DEPTH OF INVOLVEMENT	4: Substantial contribution; participants actively shape alternative narratives.	Participants actively shape how the carsharing cooperative is organised. They can decide on cars, number of vehicles, pricing structures, discounts, internal roles, cleaning, recruitment of new members, and practical arrangements. Their role goes far beyond simply testing. However, the basic concept and support structure are still predefined by Townmaking.
REFLEXIVITY - FREQUENCY OF REFLECTIVE ACTIVITIES	3: Regular participation in reflective activities.	Reflection is through surveys, interviews, narrative records, conversations with Townmaking, and residents' evenings. Especially during the setup phase, there are frequent discussion about what the group needs and how the system should function. The interviewee could not give a fixed frequency but indicated that contact becomes less frequent once groups become more independent, although regular check-ins are still part of the standard way of working
PARTICIPATORY APPROACH - DIVERSITY OF PERSPECTIVES	4: Diverse representation across various socio-cultural factors.	The project is deliberately set up across four different Amsterdam neighbourhoods with different socio-economic profiles. This gives strong diversity in local contexts and user groups. However, the participant base still self-selecting and depends on people willing to join a cooperative car-sharing model.
PARTICIPATORY APPROACH - COOPERATIVE DECISION-MAKING	4: Active involvement from various sectors in joint decision-making.	Cooperative decision-making is clearly present. Residents organise themselves in cooperatives, choose internal roles, make decisions on pricing and usage, and manage practical aspects collectively. The municipality, Townmaking and CENEX also play roles, but the strongest cooperative decision-making seems to happen within the resident cooperatives rather than across all quadruple-helix sectors.
SOCIO-SPATIAL RELEVANCE - TAILORED ASPECTS	5: All activities specifically address and effectively tackle local challenges and opportunities	The intervention was explicitly tailored to local neighbourhood conditions and challenges like parking pressure, neighbourhood trust, and affordability. Each sub-lab is situated in a specific neighbourhood context, and narrative records are used to understand what each neighbourhood needs. A core part of the project was to comparing how cooperative car sharing worked in very different urban contexts within Amsterdam.
SOCIO-SPATIAL RELEVANCE - ENGAGEMENT OF LOCAL COMMUNITIES	4: High representation; diverse local community	Local residents are not only consulted but become members, organisers, board members, recruiters and users of the system. A limiting factor here is that engagement is somewhat uneven: there is a core group that is closely

	members actively engaged.	involved and a wider group of occasional users, and some members barely participate.
NETWORK NURTURING - INTERDISCIPLINARY INTERACTION	3: Regular interdisciplinary events; moderate collaboration.	Several actors are involved, including Gemeente Amsterdam, Townmaking, CENEX, European project partners and local residents. There are residents' evenings and ongoing contact. However, the planned broader local ecosystem around maintenance, local businesses, bikes and other services did not really materialise.
SOCIAL NETWORK INCLUSION - EXTERNAL COMMUNICATION OPPORTUNITIES	4: Frequent sharing; active external communication.	Participants were expected to help recruit others and contributed to the functioning of the cooperative. Their involvement was visible in their social network. The case was also communicated externally through municipal channels and media coverage in Parool and NRC. This indicates that sharing beyond the immediate participant group was an active part of the case.
SOCIAL NETWORK INCLUSION - FEEDBACK LOOP (POST-ULL)	4: Frequent external feedback; active post-ULL interest.	There is evidence of a ripple effect. The interviewee mentions growing interest, new emails from people wanting to start similar groups, activity in other Dutch cities, and interest from municipalities. The model is also being explored in multiple European cities. Although this does not prove a broad societal effect, it does suggest a visible post-lab feedback loop.

F.2 Case study 2: ALTHEA transition super living lab

An employee of Panteia was interviewed for this case. The interviewee participates in ALTHEA as technical coordinator at project level and therefore has a broad overview of the different living labs and their functioning. This provides useful insight into the project logic, governance structure, and planned mechanisms.

Table 12 – Scores and justifications per indicator for ALTHEA (based on ULL rubric in Appendix A

INDICATOR	RUBRIC FIT	EVIDENCE AND JUSTIFICATION
DEEP IMMERSION - TIME SPENT IN ENGAGEMENT	2: Limited engagement in activities; participants contribute minimally.	The interview suggests that most participants encounter the intervention primarily as a service offer rather than as a prolonged, immersive process. Workers can use the shared van service and are not only answering a one-off questionnaire, but there is little evidence here of long, intensive engagement for most users.
DEEP IMMERSION - DEPTH OF INVOLVEMENT	3: Active involvement; participants consistently contribute meaningful ideas and perspectives.	There is evidence of active user input. For example, citizens are asked whether public transport solutions make sense for them and how they would redesign them, such as smaller buses, more frequent buses, or different stopping points. Still, the overall project structure and many innovations seem largely predefined by the project partners.

REFLEXIVITY - FREQUENCY OF REFLECTIVE ACTIVITIES	3: Regular participation in reflective activities.	The interview clearly points to evaluation cycles both within each living lab and at overall project level. Partners review solutions, discuss improvements, and assess project achievements. Reflection is therefore built in, although it appears more organiser-driven than participant-driven.
PARTICIPATORY APPROACH - DIVERSITY OF PERSPECTIVES	4: Diverse representation across various socio-cultural factors.	The project explicitly uses a “social science and humanities framework” to reach underrepresented groups, including migrants and people with disabilities. This is a serious effort toward inclusion, but the interviewee also states that it is still unclear what the eventual reach will be in practice.
PARTICIPATORY APPROACH - COOPERATIVE DECISION-MAKING	3: Active involvement from various sectors in joint decision-making.	Co-creation is described as part of many ALTHEA innovations. Users can help refine services, and in other cases citizens are consulted about redesign options for public transport. However, the overall decision making happens at a consortium organiser level, there is limited joint decision-making across all quadruple-helix sectors.
SOCIO-SPATIAL RELEVANCE - TAILORED ASPECTS	4: Activities highly tailored to local challenges; strong relevance.	Local adaptation is a key part of ALTHEA. According to the interviewee, Innovations are adjusted to each city rather than simply copied. The worker-access issue in the port area of Rotterdam is an example.
SOCIO-SPATIAL RELEVANCE - ENGAGEMENT OF LOCAL COMMUNITIES	3: Moderate representation; diverse local community members are present.	The case is clearly oriented toward real local user groups, such as port workers and peri-urban residents, and there are efforts to gather their views. At the same time, the interview gives only limited evidence of broad or deeply embedded community participation.
NETWORK NURTURING - INTERDISCIPLINARY INTERACTION	4: Frequent interdisciplinary events; substantial collaboration.	The project connects municipalities, cities, ports, industrial areas, research/technical partners, and European project partners. It also includes multiple living labs and replicator cities. There is clear multi-stakeholder interaction, but more is possible at the local participant level.
SOCIAL NETWORK INCLUSION - EXTERNAL COMMUNICATION OPPORTUNITIES	2: Occasional sharing; limited external communication	The interviewee explains that all Horizon Europe living labs are required to communicate externally through channels such as conferences, LinkedIn, and local press. However, this communication is mainly organised by the project and living lab teams rather than by participants themselves.
SOCIAL NETWORK INCLUSION - FEEDBACK LOOP (POST-ULL)	-	The interviewee explicitly states that it is still too early to identify effects on behaviour or the wider environment. There is therefore not yet enough evidence of a post-lab ripple effect or a clear feedback loop beyond the immediate intervention context.

F.3 Case study 3: sCOOL2walk living lab

One of the founders of sCOOL2walk and Future Mobility Network was interviewed for this case.

Table 13 – Scores and justifications per indicator for sCOOL2walk (based on ULL rubric in Appendix A

INDICATOR	RUBRIC FIT	EVIDENCE AND JUSTIFICATION
DEEP IMMERSION - TIME SPENT IN ENGAGEMENT	4: Active participation; participants spend a significant amount of time in co-creation and experimentation.	The pilot appears to have lasted around four months, with the intervention potentially relevant on every school day. Parents and children were not only briefly consulted, but repeatedly engaged through app use, walking groups, questionnaires, workshops, and contact moments during the pilot.
DEEP IMMERSION - DEPTH OF INVOLVEMENT	4: Substantial contribution; participants actively shape alternative narratives.	Parents, children, schools, local police, cities and other stakeholders influenced the design of the platform. Concrete features were shaped through their input, such as no continuous live tracking, maximum walking group size, the social safety questions, and the later teen account. This goes further than just evaluation, although the overall concept was still project-led.
REFLEXIVITY - FREQUENCY OF REFLECTIVE ACTIVITIES	3: Regular participation in reflective activities.	Reflection was built in through pre- and post-questionnaires, questions to children about what they found exciting, unsafe, fun or difficult, and parent discussions about why they would or would not use the system. However, the interview suggests that the reflection moments focused more on technical improvement than on about the participants' mobility habits.
PARTICIPATORY APPROACH - DIVERSITY OF PERSPECTIVES	4: Diverse representation across various socio-cultural factors.	The project included several stakeholder types: parents, children, schools, local police, TU Eindhoven, city councils, and project partners. It was tested in very different urban and spatial contexts, including Latvia, Malta and Spain, with different climates, infrastructure, distances and levels of urban density. Not 5 because the cities were partly selected through availability rather than a deliberate balancing strategy.
PARTICIPATORY APPROACH - COOPERATIVE DECISION-MAKING	4: Active involvement from various sectors in joint decision-making.	The platform functions were developed in co-creation with multiple stakeholder groups. Stakeholder concerns directly impacted design choices, such as tracking, group size, survey items, and teen participation. However, it was still always the project that translated input into decisions, rather than all sectors making decisions together.
SOCIO-SPATIAL RELEVANCE - TAILORED ASPECTS	5: All activities specifically address and effectively tackle local challenges and opportunities	The living lab directly addressed local school mobility problems, including unsafe school surroundings, car-based drop-off traffic, walking conditions, group safety, social safety and route-specific obstacles. Some tailoring happened locally, for example the teen account in Barcelona due to a specific route through a park or forest.

SOCIO-SPATIAL RELEVANCE - ENGAGEMENT OF LOCAL COMMUNITIES	4: High representation; diverse local community members actively engaged.	Local parents, children, schools and police were actively involved, and parents were the actual users of the app. Children were engaged through workshops and questions about their routes and barriers.
NETWORK NURTURING - INTERDISCIPLINARY INTERACTION	3: Regular interdisciplinary events; moderate collaboration.	The project clearly involved multiple disciplines and stakeholder types, including schools, public authorities, local police, researchers and platform developers. However, the interviewee explicitly indicated that the project did not actively create direct interaction between groups such as children and police or parents and municipalities, this interaction as only indirect, through the platform and project team.
SOCIAL NETWORK INCLUSION - EXTERNAL COMMUNICATION OPPORTUNITIES	2: Occasional sharing; limited external communication.	Participants were asked during at least one parent evening to share the programme with other parents in their network. However, this seems to have been mostly during the recruitment phase, and not an ongoing external communication strategy.
SOCIAL NETWORK INCLUSION - FEEDBACK LOOP (POST-ULL)	3: Regular external feedback; moderate post-ULL interest.	There is some evidence of continuation and ripple effect. Malta continued using sCOOL2walk after the original pilot and even developed a physical cart for transporting bags. However, the interviewee was unsure whether results of the living lab were also fed back to participants

Appendix G Pre-validation workshop

This appendix gives an extensive overview to the initial, pre-validation ULL optimisation tool. Both the tool and the chapter overlap strongly with the final tool presented in chapter 9 for elements that were did not change after the validation presented in chapter 8 This appendix functions as an overview of the state of the tool as it was used in this validation process.

G.1 Tool overview

The initial ULL optimisation tool takes the form of a workshop-based design-support tool. It consists of a set of printable or digital materials that guide organisers through a structured session, discussing and improving the narrative-shift potential of their mobility-focused ULL.

An overview of all pre-validation materials can be found in Figure 11 below. A PDF file can be accessed on OneDrive, the interactive board is accessible on Miro, using the password “LIVINGLAB”



Figure 11 - Pre-validation workshop materials

This format was chosen for the reasons laid out in chapter 7.5. An additional benefit of a workshop format is that it makes it possible to bring the perspectives of various stakeholders together and create a shared understanding of the narrative goals of the ULL.

There are four main resources that are used in this workshop:

1. **Narrative canvas**

   A one-page canvas used to define the dominant mobility narrative, the alternative narrative, the target group for the narrative shift, and the feasibility, acceptability and centrality of the proposed alternative narrative.

2. **ULL characterisation rubric**

   This rubric (Appendix A helps organisers assess the current or planned ULL on the ten indicators connected to the six narrative-shift mechanisms.

3. **Mechanism prompt cards**

A set of cards, one for each mechanism, containing design prompts. These cards help organisers move towards concrete design interventions. For example, the reflexivity card asks where participants already evaluate their experiences and how these moments could be expanded to include reflection on assumptions about mobility.

4. **Optimisation canvas**

A one-page canvas used to organise the priority mechanisms, describe possible design interventions, identify trade-offs, assign responsibilities and define next steps.

G.2 Workshop process

The workshop itself consists of four parts that correspond to the four resources of the tool:

A. Narrative characterisation

B. Narrative shift mechanism assessment

C. Opportunity and trade-off analysis

D. Design intervention development

Together, these four parts move the organiser from a general ambition to a more specific understanding of how the living lab could support a narrative shift. The subchapters below will introduce each phase in more detail

Part A: Narrative characterisation

The first step uses the narrative canvas. In this step, organisers make explicit which mobility narrative their ULL challenges and which alternative narrative it aims to support.

Narratives shape what people consider feasible, desirable and normal. In mobility, dominant narratives can make car-centred mobility appear natural, convenient or inevitable, while alternative forms of mobility may appear unrealistic, inconvenient or only suitable for specific groups. A mobility-focused ULL may challenge such assumptions, but only if the alternative narrative is made visible within the design of the lab.

The narrative characterisation step therefore asks organisers to answer four questions:

1. **What current mobility narrative does the ULL challenge?**

For most ULLs and contexts, this is a straightforward question to answer. In more ambiguous situations, or when organisers want to include direct participant reflections, the narrative snapshot questionnaire in Appendix B can be used. This questionnaire can be used to get an impression of participants' ideas, assumptions and beliefs about personal mobility.

2. **What alternative mobility narrative does the ULL propose?**

A good understanding of which alternative narrative is offered means everyone involved in the workshop has a clear idea of the goals. This makes it easier to make good ULL design decisions to reach these goals later down the line.

3. **Who do you want to convince of this alternative narrative?**

This question relates to a point brought forward in the sCOOL2walk case study (chapter 4.5), where children are the direct users of the walking groups, but parents are often the decision-makers who decide how the school journey is organised. Either group may participate in activities, and it's important to target the activities that the right group participates in.

4. **Does the alternative narrative meet the requirements of feasibility, acceptability and centrality?**

Feasibility concerns whether the alternative narrative is practically possible in the local context. This includes questions about technology, funding, spatial conditions, organisational capacity and regulatory feasibility. An alternative narrative that asks participants to adopt behaviour that is not practically possible to them is unlikely to spread.

Acceptability concerns whether the alternative narrative resonates with the values, needs and aspirations of the people involved. A narrative may be technically possible but still fail if it does not match what participants consider desirable, fair, safe or convenient.

Centrality concerns whether the alternative narrative contributes to the long-term sustainability goal that motivates the living lab. A mobility narrative may be feasible and acceptable while still failing to support a meaningful sustainability transition. For example, a narrative that simply replaces one high-impact mobility habit with another more convenient but still unsustainable habit won't contribute towards the intended transition.

These three requirements were introduced in chapter 2.5. If the alternative narrative is unclear, not feasible, not acceptable or not central to the intended transition, improving the ULL mechanisms alone will not solve the problem. The living lab would then risk creating a strong process around a weak or poorly defined narrative.

Part B: Narrative shift mechanism assessment

The second part of the workshop uses the ULL characterisation rubric that can be found in Appendix A and which was used to analyse the case studies in chapter 5 Organisers assess the current or planned ULL on the ten indicators that correspond to the six mechanisms identified in chapter 2.5. These mechanisms are deep immersion, reflexivity, participatory approach, socio-spatial relevance, network nurturing and social network inclusion

The purpose of this step is to create a mechanism profile of the living lab. This profile shows how strongly the six mechanisms associated with narrative-shift potential are present in the design of the ULL, showing where narrative-shift potential is currently concentrated and where it may be underdeveloped.

Part C: Opportunity and trade-off analysis

The third step translates the mechanism profile into design opportunities. The first part of the optimisation canvas is used.

As discussed in chapter 5.3.4, mechanisms can interact with each other and with the practical objectives of the ULL. Increasing one mechanism may create costs or constraints elsewhere. Therefore, the goal is not to simply maximise every score

In this step, three questions are asked to organisers for each mechanism that has a score below 4 in the mechanism profile:

4) Would strengthening this mechanism support the alternative narrative defined in step A?
5) Is it realistically possible within the available time, budget, governance structure and participant relationship to influence this mechanism?
6) What trade-offs would be introduced by strengthening this mechanism?

This step results in a shortlist of priority mechanisms that are both relevant to the narrative goal and realistically improvable within the ULL context, and perhaps already some ideas for interventions that help to increase the scores for these mechanisms.

Part D: Design intervention development

Part D helps organisers translate the priority mechanisms identified in part C into concrete design interventions. In this phase, the workshop moves from assessment to redesign.

This step uses the mechanism prompt cards and the second part of the optimisation canvas. The prompt cards help organisers think through each priority mechanism by asking targeted design questions. These questions are meant to open up discussion, not to prescribe fixed solutions. The same mechanism may require different interventions depending on the participant group, local context, available resources and stage of the living lab.

For deep immersion, prompts focus on the duration, intensity and everyday integration of participation:

- How can participants engage with the alternative mobility practice repeatedly rather than only once?
- Can the intervention become part of participants' everyday routines?
- Can participants take responsibility for some part of the intervention rather than only using it?

For reflexivity, prompts focus on making assumptions about mobility explicit:

- Where in the ULL do participants already discuss or evaluate their experiences?
- Can these moments include questions about what participants consider normal, desirable or possible in mobility?
- Can participants compare their previous mobility assumptions with their experiences in the living lab?

For participatory approach, prompts focus on the depth and type of participation:

- Are participants only consulted, or can they influence decisions?

- Which parts of the intervention can realistically be co-designed?
- Are the people affected by the intervention represented in the design process?

For socio-spatial relevance, prompts focus on the fit with the local context:

- Which local mobility problem does the ULL address from the participant's perspective?
- How does the intervention connect to the physical and social characteristics of the place?
- Are local concerns, routines and barriers reflected in the design?

For network nurturing, prompts focus on relationships that support implementation and continuity:

- Which actors are needed to keep the alternative narrative alive after the formal project ends?
- Are relationships between participants, institutions and implementation partners being actively developed?
- Is there a clear owner or continuation pathway beyond the funded project period?

For social network inclusion, prompts focus on diffusion beyond direct participants:

- Are participants supported in sharing their experiences with others?
- Are there moments, materials or roles that help participants become ambassadors?
- Can the ULL create visible examples that make the alternative narrative easier for others to understand?

The outcome of this step is a filled in optimisation canvas. This is an overview that shows which mechanisms the organiser wants to strengthen, why those mechanisms matter for the intended narrative shift, what design interventions will be introduced, and what trade-offs need to be monitored.

G.3 Practical use of the tool

The ULL optimisation tool can be used at different moments in the development of a living lab. Its function differs depending on whether the ULL is still being designed, already running, or has ended.

The tool can be facilitated by an external facilitator, but this is not required. It can also be used by the ULL organising team itself, as long as one person takes responsibility for guiding the process. An external facilitator may be useful when many stakeholder organisations are involved or when there are conflicting priorities between partners. A self-facilitated version may be sufficient when the tool is used by a smaller project team or even by a single organiser.

The recommended participants are people who understand the design and implementation of the ULL. Depending on the scope of the ULL, this may include project coordinators, researchers, municipal partners, mobility providers, community representatives, school representatives, or other stakeholders depending on the case. Participant representatives can be included if this fits the ULL.

Appendix H Final workshop materials

The final tool consists of four components:

1. **ULL framing canvas (Figure 13)**
2. **ULL characterisation rubric with mechanism descriptions (Figure 14)**
3. **Mechanism prompt cards (Figure 15)**
4. **Optimisation canvas (Figure 16)**

All final workshop materials can be found in the figures below. A PDF file can be accessed on OneDrive, the interactive board is accessible on Miro, using the password “LIVINGLAB”

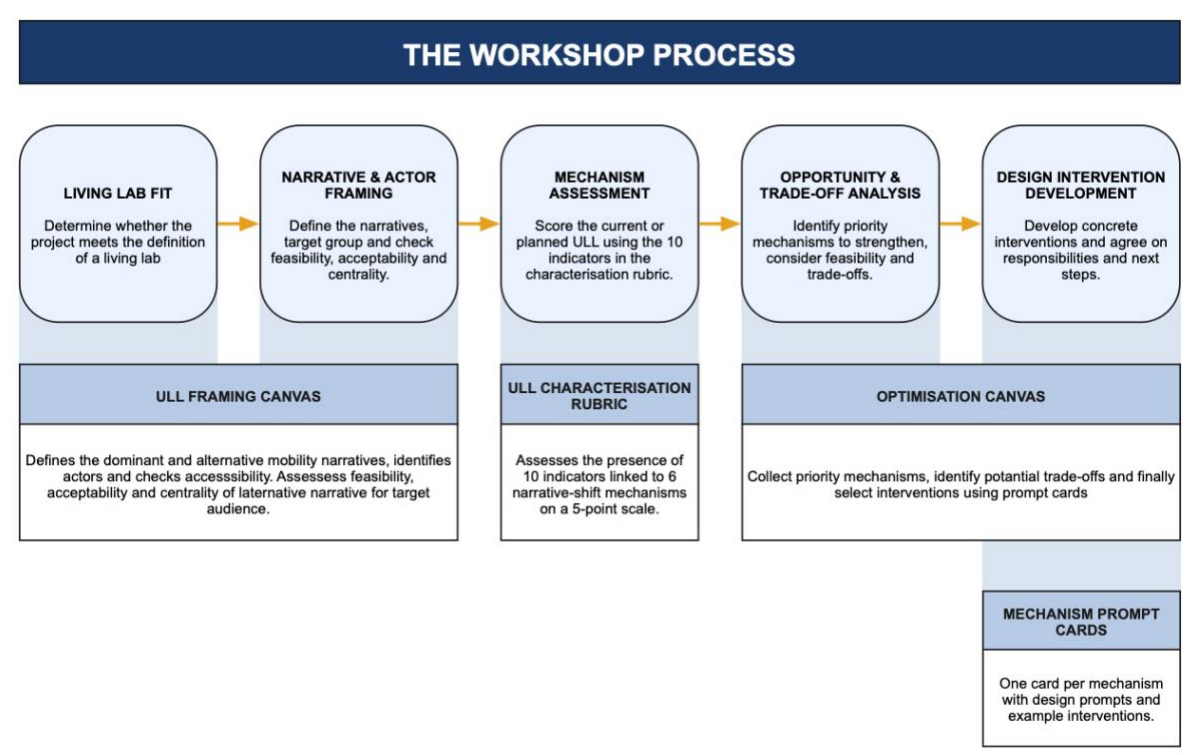


Figure 12- Final workshop materials: workshop process

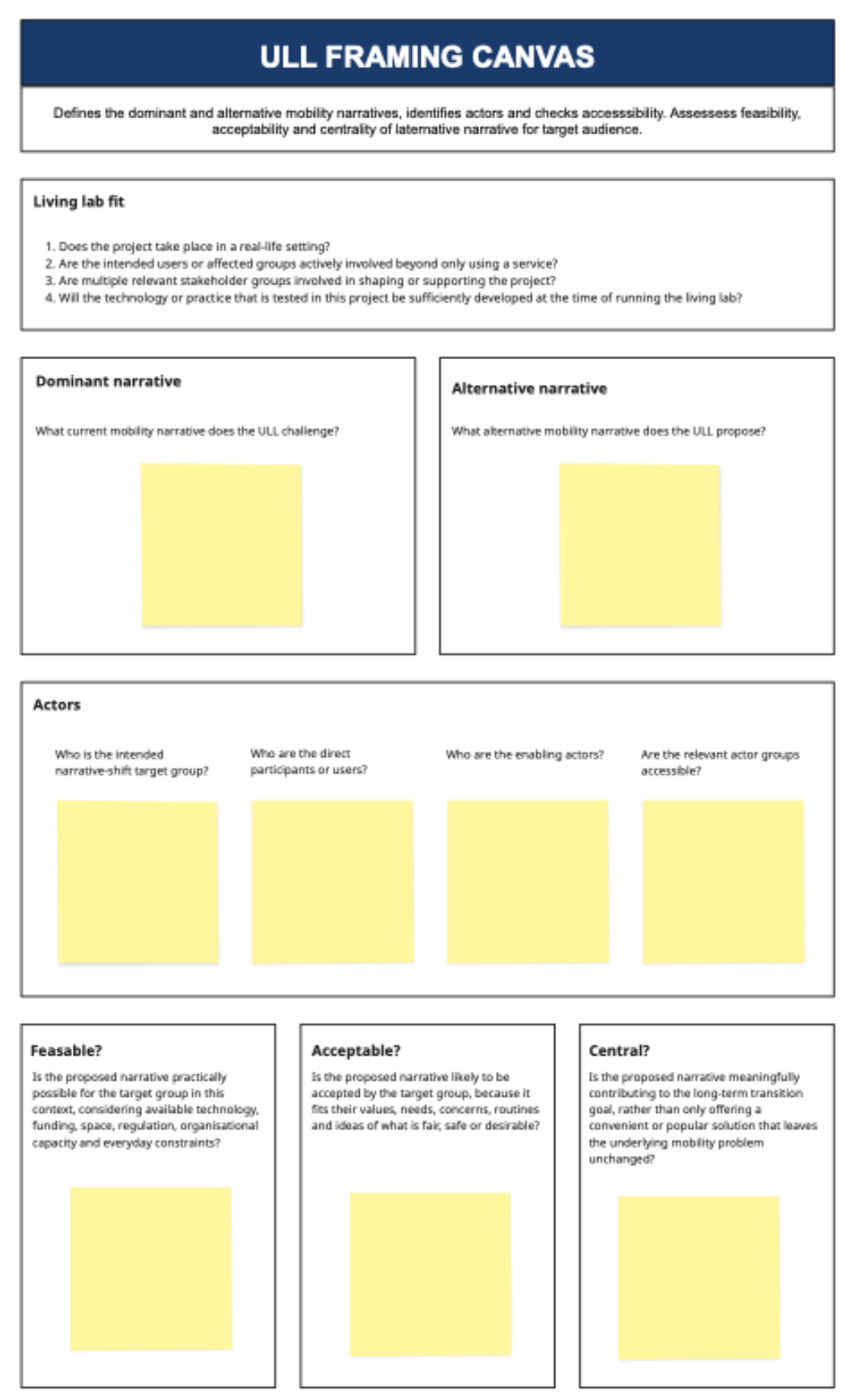


Figure 13 - Final workshop materials: ULL framing canvas

ULL CHARACTERISATION RUBRIC

Assesses the presence of 10 indicators linked to 6 narrative-shift mechanisms on a 5-point scale.

Mechanism	Indicator	Score 1 (low)	Score 2	Score 3 (moderate)	Score 4	Score 5 (high)
Deep immersion Repeated and meaningful exposure to the alternative mobility practice or narrative.	**Time spent in engagement**	Little time spent in ULL activities.	Limited engagement in activities; participants contribute minimally.	Moderate involvement; participants actively contribute for a reasonable duration.	Active participation; participants spend a significant amount of time in co-creation and experimentation.	Extensive engagement; participants highly immersed in ULL activities, actively contributing throughout.
	Depth of involvement	Minimal contribution; participants provide limited input.	Limited engagement; participants contribute ideas sporadically.	Active involvement; participants consistently contribute meaningful ideas and perspectives.	Substantial contribution; participants actively shape alternative narratives.	Deep engagement; participants significantly influence and shape alternative narratives.
Reflexivity Moments where participants interpret experiences and question assumptions about mobility.	**Frequency of reflective activities**	No participation in reflective activities.	Occasional involvement in reflective activities.	Regular participation in reflective activities.	Frequent engagement in activities promoting reflection.	Consistent and frequent involvement in reflective activities.
Participatory approach Meaningful influence by affected people and stakeholders, beyond consultation only.	**Diversity of perspectives**	Limited diversity in participant backgrounds.	Some diversity, but a predominant group dominates.	Reasonable diversity in participant backgrounds.	Diverse representation across various socio-cultural factors.	Highly diverse participant backgrounds and perspectives.
	Cooperative decision-making	Rare instances of collaborative decision-making.	Limited involvement from different sectors in decision-making.	Moderate participation in cooperative decision-making.	Active involvement from various sectors in joint decision-making.	Consistent and effective cooperative decision-making across all sectors.
Socio-spatial relevance Fit with local routines, barriers, infrastructures and community context.	**Tailored aspects**	Few ULL activities directly address local challenges/opportunities.	Limited tailoring to local context; some relevance in activities.	Moderate tailoring to local challenges; activities are relevant.	Activities highly tailored to local challenges; strong relevance.	All activities specifically address and effectively tackle local challenges and opportunities
	Engagement of local communities	Low representation of diverse local community members.	Limited representation; certain demographics are underrepresented.	Moderate representation; diverse local community members are present.	High representation; diverse local community members actively engaged.	Extensive representation; active and meaningful engagement from all segments of the local community.
Network nurturing Relationships that can support, continue or scale the alternative narrative.	**Interdisciplinary interaction**	Rare interdisciplinary events; limited collaboration.	Occasional interdisciplinary events; some collaboration.	Regular interdisciplinary events; moderate collaboration.	Frequent interdisciplinary events; substantial collaboration.	Consistent and frequent interdisciplinary events; extensive collaboration.
Social network inclusion Participant-led sharing, demonstration or discussion beyond the immediate ULL setting.	**External communication frequency**	Rare sharing of ULL experiences externally.	Occasional sharing; limited external communication.	Regular sharing; moderate frequency of external communication.	Frequent sharing; active external communication.	Consistent and extensive sharing; high frequency of external communication.
	Feedback loop (post-ull)	Rare external feedback, questions, or interest post-ULL.	Occasional external feedback; some interest post-ULL.	Regular external feedback; moderate post-ULL interest.	Frequent external feedback; active post-ULL interest.	Consistent and extensive external feedback; high post-ULL interest.

Figure 14 - Final workshop materials: ULL characterisation rubric

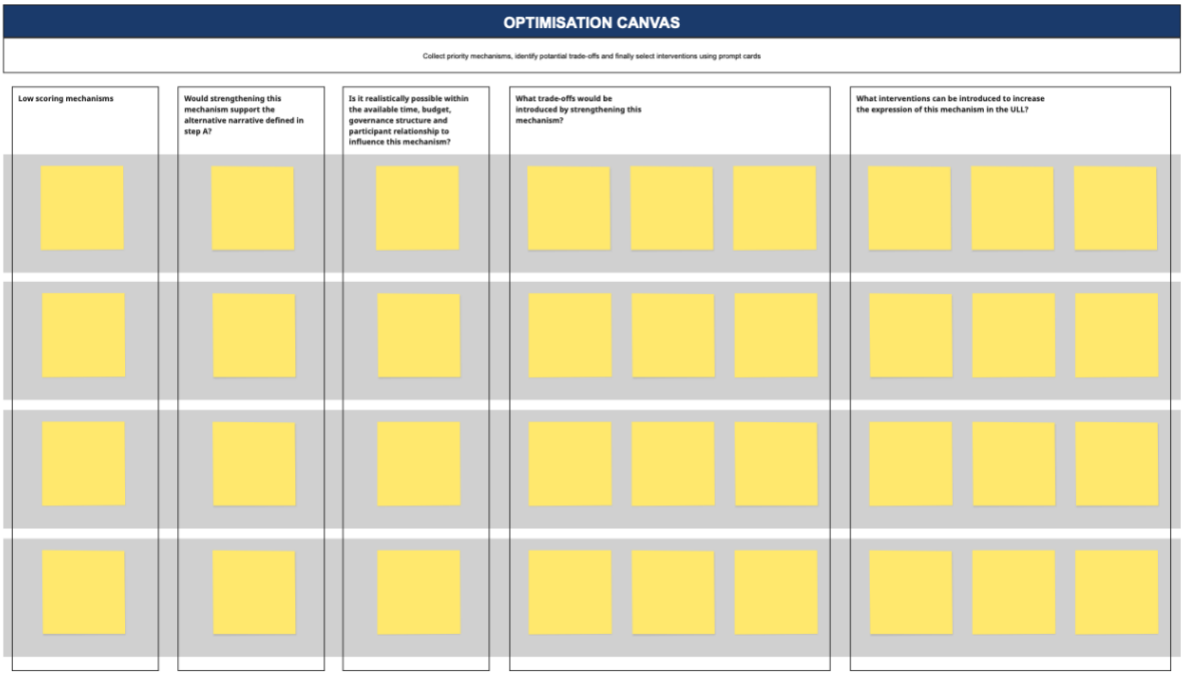


Figure 15 - Final workshop materials: Optimisation canvas



Figure 16 - Final workshop materials: Mechanism prompt cards