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TAILORING CO-CREATION FOR RESPONSIBLE INNOVATION: A DESIGN ETHNOGRAPHIC APPROACH

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TAILORING CO-CREATION FOR RESPONSIBLE INNOVATION: A DESIGN ETHNOGRAPHIC APPROACH

Research paper

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Abstract

It is hard to predict the impact of technology on society before it is developed enough. For example, the issue can be attributed to the need for more cross-sectoral collaboration in the design process. However, a solution for anticipating such outcomes has been proposed through the quadruple helix innovation model, which states that the involvement of government, academia, industry, and the public is essential in innovation systems. The question of how this collaboration can successfully be staged to foresee possible impacts is an empirical endeavour. This paper presents an iterative case study of how ethnographic material can be used to ongoingly tailor speculative co-creation to facilitate responsible innovation (RI) principles. The result is reflected through two lenses; the tools developed in the project to facilitate co-creation activities and the stakeholder reflections evoked through these tools.

Keywords: tailoring, co-creation, responsible innovation, design ethnography, speculative design.

1 Introduction

This paper demonstrates an approach to responsibly innovating future mobility services. Visions of future mobility present themselves in industrial and policy-making discourse as primarily service-based and artificial intelligence (AI)-driven technologies (for example, so-called Mobility as a Service (Maas)) (Quilty et al., 2022), and as such, become deeply embedded in socio-technical systems that involve not only technological components but also social, cultural, economic, and political aspects that must be considered for its development and implementation (Axsen and Sovacool, 2019). Subsequently, innovating within emerging Maas paradigms (Li and Voege, 2017) can lead to solutions that, instead of bringing value and being relevant for society, can create unnecessary burdens and failed outcomes. For example, micro-mobility solutions like e-scooters intended to reduce road congestion and improve the air quality in urban areas instead becoming an attraction to pedestrians and therefore reducing how much they are willing to walk (Hirst, 2021) and self-driving vehicles that should reduce road accidents failing to detect pedestrians with darker skin tones (Wilson et al., 2019). Indeed, defined as the Collingridge dilemma, foreseeing the harmful impact of innovation on society can be challenging, especially before it has been developed so far that it is too costly and slow to change (Genus and Stirling, 2018).

In support of solving the problems by predicting societal and social harm elucidated by the Collingridge dilemma and a more general call for more responsibility due to the negative impact of technological innovation (Frischmann and Selinger, 2018), a growing body of initiatives have been taken to develop more ethical and sustainable deployment of new technologies. Stilgoe et al. (2013) have taken one such initiative by developing the RI framework based on their definition of RI as ‘taking care of the future through collective stewardship of science and innovation in the present’ (p. 1570). The proposed framework is set to raise and embed aspects of societal concern structuring in innovation processes through four dimensions; a) facilitating anticipation of the impact a solution can have on society, b) reflecting on attitudes and assumptions on the future, c) involving a heterogeneous set of stakeholders

in the process, and finally, d) responding to changes in societal values and needs. The challenge with facilitating the RI principles in multi-stakeholder collaborations is that operationalising them into concrete design and innovation practice is still open and overlooked in RI research (Robinson et al., 2020; Stahl et al., 2021) and in Information Systems (IS)-related areas such as Responsible AI (Figueras et al., 2022; Minkkinen et al. 2023). This is due to the general RI focus on *governance* of the impacts of innovation instead of the *co-creative* activities that foster responsibility in innovation (Reijers, 2020). In response to this lack, a growing body of literature has pointed out the power of co-creation in operationalising RI into tangible technological outputs (Robinson et al. 2020) through, e.g., a comparative perspective approach (Hess et al., 2021), card-based methods to support shared reflections (Felt et al., 2018), and co-creation as means to engage with different stakeholders (Jansma et al., 2022) to enable facilitate RI in practice. With this article we aim to contribute to this growing area of research and practice from a Scandinavian IS research perspective with its focus on the social and cultural context of technology (Haj-Bolouri, 2021) and the importance of user participation, collaboration and empowerment in the design and implementation of digital technologies (Dittrish et al., 2014).

It has been acknowledged that complex processes of workshops and projects where different stakeholders engage in various product-focused activities also require a well thought long-term plan and pedagogical approach (Berg and Fors, 2017). Creative processes take place in situations marked by social learnings that are irregular and iterative rather than linear, and these processes need to be studied as such to be developed. However, some say that models for how to carry out cross-sectoral collaborations that include citizens and communities (so-called quadruple helix models) are still in their infancy (Galvao et al., 2019) since most research is done at macro-regional levels, calling for more investigations on a project and individual levels (Miller et al., 2018). Furthermore, several authors have acknowledged the gap between the theory and the real functioning; for example, Ngyuen and Marques (2022) investigated the expectations and perceived challenges among stakeholders to be able to present evidence-based suggestions for managing quadruple helix collaborations. In the same vein, we will address these micro-level gaps by empirically exploring how the collaboration proposed by the quadruple helix can successfully be staged through a speculative design research approach to enable the participant's possibilities to foresee the social impact of future mobility. We will do so by presenting a study investigating how speculative co-creation of future socio-technical systems such as AI-driven mobility services can be ongoingly tailored to foster RI for socially sustainable future mobility through the prism of Design Ethnography (DE) (Pink et al., 2022). Thus, our ambition with this article is to contribute to Scandinavian IS with processual knowledge about how to stage, enable and analytically frame the process of making RI and factual knowledge about the limitations and opportunities with this approach to achieve the RI dimensions set through Stilgoe's RI framework. We aim to answer the question: "*How can ethnographic materials be used to tailor co-creation workshops to facilitate responsible innovation?*"

2 Background

Since the 90s, scholars have considered it important to involve society in knowledge creation and innovation that can lead to more sustainable solutions. Three modes of knowledge creation have been proposed, Mode 2 (Gibbons, 1994) and Mode 3 (Carayannis and Campbell, 2006), particularly emphasising problem-solving for society and innovating in heterogeneous and transdisciplinary collaborations. Carayannis and Campbell (2013) highlighted the major role of society in innovation projects through the Quadruple Helix innovation model, acknowledging four essential actors of the innovation system – academia, industry, government, and society. As described above, recent overviews of the field (Galvao et al., 2019; Miller et al., 2018; Ngyuen and Marques, 2022) have identified a gap in research on project and individual levels and thereby calling for more evidence-based guidelines and pedagogical principles for how these collaborations can be staged in practice. Our response to this call in this paper is to present the results from taking a pragmatic design research approach to tailoring and staging a quadruple helix co-creation process through the lens of RI.

2.1 Responsible Innovation

In the wake of the quadruple helix emerged the idea of RI. As mentioned above, RI is concerned with engaging different stakeholders to collaboratively develop innovative, ethical, inclusive, and usable technologies and services (Jarmai and Vogel-Pöschl, 2020). A common challenge with innovation is to foresee what implications the solutions might have on society early enough to be able to change. The four integral RI dimensions - anticipation, reflexivity, inclusion, and responsiveness proposed by Stilgoe et al. (2013) are set to guide stakeholders to ask critical questions about the potential impact of their solutions on society, to reflect on their role in developing these solutions, engage public amongst other stakeholders in the development, and to respond to changing societal values and needs. RI has initially mainly concerned with economics and management science. Since then, it has also found its way to technology design disciplines that promote more reflexive co-creative innovation processes in these contexts. For example, RI principles have guided the development of an auditing framework for narrowing the accountability gap in deploying AI systems. A framework that supports the algorithm developers in, e.g., reflecting on their own biases while developing algorithms (Raji et al., 2020).

In response to the call for responsible technology innovation, there have been suggestions to re-think the actual context and framework of the technical co-creation processes in terms of engaging with the people affected by the technology. For example, Steen (2021), in contrast to fast-moving technology development, proposed embracing *slow innovation* to create a more considerate and reflexive innovation process aligned with RI principles to promote a shift in AI development from company-driven towards human-centred AI.

These developments within technology design disciplines, such as Human-Computer Interaction (HCI), have led to adopting people-centred and collaborative approaches to align with RI principles. For example, Leonard and Tochia (2022) applied ethnographic approaches to understand the context of human cleaners sharing responsibility with AI-driven cleaning robots and how that can contribute to trust development in such robots. Stals et al. (2019) used speculative design to investigate how people's emotional relationships with certain urban environments can inform the design of future technology and services. Webb et al. (2019) described the use of ethnomethodology for a deeper understanding of situated actions, e.g., understanding user needs and surfacing any problems with technology use early, and how that contributes to the RI. Ten Holter (2022) describes the resemblance between participatory design (PD) and RI as approaches involving people to improve the development process. People-centred approaches are not only limited to understanding the users and their relationships to technology but can also structure interdisciplinary collaborations and practices. For example, Fors et al. (2022) apply DE to investigate and anticipate futures by learning with people and stakeholders to design responsible futures and using people-centred approaches not solely for understanding the people and their relationships with technology but also as the foundation for tailoring collaborative and future-looking activities aligns well with the four core principles of RI.

2.2 Co-creation

As collaboration is of the essence in facilitating RI and is not always easy, researchers have investigated the challenges and success factors of meaningful collaboration for RI (Jarmai and Vogel-Pöschl, 2020). They found the time and effort stakeholders allocate in different project stages to determine how meaningful the collaboration is for RI. They highlighted the importance of skilful preparation, facilitation, and documentation of such collaborations.

Although, tailoring such collaborations is a challenging matter. One of the ways to facilitate collaboration for RI is through co-creation. Co-creation dates to the 1990s, when it was used for cost-minimisation and believed to lead to more customer satisfaction (De Koning et al., 2016). As the role of consumers in the innovation system was changing from passive to active, unaware to informed, and isolated to connected, Prahalad and Ramaswamy (2004) coined the term value co-creation. This has later been determined as fundamental for developing shared values in service innovation (Lusch and Nambisan, 2015). The purpose of co-creation was to move from an industry-created value and meaning to develop technologies and services with customers to bring actual consumer value (Ind and Coates,

2013; Voorberg et al., 2015). Engaging society in the innovation process to align the innovation with societal values and needs indicates that co-creation can be a legitimate way to facilitate RI (Steen, 2021). Recent publications in co-created technology development demonstrate how using RI dimensions in technical innovation remains complex. For practical reasons, questions have been raised about how to stay true to the RI ambitions in collaborative practices. For example, Jansma et al. (2022) found it challenging to support all the dimensions of RI at once when they tailored RI-guided co-creation workshops in nanotechnology innovation projects, as every workshop was different. Either there was more industry and government stakeholders or, e.g., the aim of the workshops was biased towards citizens and not policy making. Commentaries have also been made about the time approaches for facilitating RI required (Urquhart and Craigon, 2021). Indeed, co-creating RI is a challenging endeavour, and the successful co-creation process often requires much trial and error (Perks et al., 2012).

Still, co-creation is a widely acknowledged way of democratising innovation (von Hippel, 2005). It involves different stakeholders in aligning strategies with changing societal values and needs, so it is a legitimate approach to facilitating RI. Various methods have been used for investigating co-creation within IS research. Through analysing academic literature, scholars have investigated the conditions, objectives, and outcomes of co-creation in public sector innovation and how public actors can help redefine and improve public services (Voorberg et al., 2015). The wide interest in co-creation has led to various models and frameworks (De Koning et al., 2016).

In addition, it can be seen through the growing body of literature that there are many promising ways of co-creation activities in technology development. For example, Perks et al. (2012) conducted semi-structured interviews and observations with stakeholders, including customers, in a radical innovation project with a car insurance company. Interviews and workshops were used by Jansma et al. (2022) to explore how citizens can contribute to the development of nanotechnology innovation to have a better acceptance of the solutions when they are commercialised. Interviews were also combined with surveys and observations to inform the development of artefacts that were then evaluated with users and clients of travel counselling advisory system (Schmidt-Rauch and Nussbaumer, 2011), and Goncalves et al. (2021) conducted semi-structured interviews to learn how automotive start-up's use co-creation to support digital innovation. Overall, there is no common way of tailoring co-creation activities. The decisions will be guided by various aspects like the context being studied, the stakeholders involved, and the time and effort each stakeholder can allocate. Therefore, co-creation methods can vary from interviews and observations to more complex models of engaging experts, stakeholders, and citizens in designing socially robust socio-technical solutions (Gudowsky and Sotoudeh, 2017).

2.3 Ethnographic tailoring

In this article, we aim to contribute to IS research by demonstrating the opportunities and limitations of deploying anthropologically infused DE (Pink et al., 2022) as an empirical design research approach to tailoring co-creation workshops for future mobility that foster RI. DE is a design research method pinpointed as having potential for IS research through its engaged scholarship that bridges ethnography and design science research (Baskerville and Myers, 2015). Furthermore, it connects with pragmatist strands of design research that work *through* design (Prochner and Godin, 2022), where design operates as a method to generate knowledge through iterations of praxis, exploration, and self-reflection.

Thus, DE is not perceived as a practice where ethnography is merely utilised to inform design or vice versa. Instead, it is viewed as an interventional practice in which interdisciplinary collaboration is fundamental. This approach does not necessarily entail conducting both ethnography and design activities; rather, it involves conducting ethnography in a manner that is inextricably linked to design research and practice in its diverse forms. Following Paul Dourish's (2006) argument that treating ethnography as merely a means to generate design implications, such as systems requirements, overlooks the significance of establishing a relationship between design and ethnography. The DE approach presented in this paper moves beyond utilising ethnography to simply produce findings about what people do, say, or know. Rather, ethnography is part of an engagement process with these facets of human life. Still, it is only when it is mobilised through an analytical process that it should be engaged

interventionally and pedagogically in design (Pink et al., 2022). In this sense, ethnography becomes more than an observational method. It is a creative practice that carries the responsibility of acquiring a deep and conceptually sound understanding of the manners in which probable futures can be envisioned, anticipated, and perceived from within the sensory, corporeal, and experiential aspects of daily life and how these nascent futures can be activated into co-creative trigger materials in the service of RI.

The following section presents how we used this DE approach to tailor co-creation workshops with cities, citizens, industry, and academia. We describe tools that emerged from the different activities and how we used these to facilitate discussions and debates with the stakeholders. We also present the discussions and debates that emerged from using these tools. In short, our ambition is to demonstrate how RI can be staged by letting ethnographic materials not only present insights to influence design in co-creative processes but also how ethnographic materials and knowing can *participate in* forming activities that co-create anticipation, reflexivity, inclusion, and responsiveness in the project.

3 Research design

This work falls under a larger multi-stakeholder research project AHA – Design Ethnographic Living Labs for Future Urban Mobility, focusing on engaging society in designing future mobility to mitigate the risk of creating unintended and perhaps unwanted social consequences of new digital mobility solutions. The AHA project grounded itself in a DE approach (Pink et al., 2022), which structured a process involving a heterogeneous set of stakeholders (described in Table 1) to investigate future mobility in two neighbourhoods collaboratively. Our first step was ethnographically engaging with the communities to infuse co-creative project design activities in the next stage with a deep understanding of everyday life in these neighbourhoods.

3.1 Ethnographic methods and materials

Our research methods to investigate local values, routines and knowledge in the two city project neighbourhoods were based on conventional ethnographic techniques (O'Reilly, 2012). This means we did participant observations with ethnographic note-taking and thematic interview calls (individually and in groups) for twelve months. These techniques were tailored according to the social and physical context of the two areas. We engaged with the residents through drive-along, phone, and online group interviews. In drive-along interviews, we followed the participants in a research vehicle while talking to them through the car's infotainment system and video recording with a GoPro camera. We used a digital map of their area in the online group interviews. We used photos of technological ideas for future mobility to probe the participants to consider MaaS and shared mobility as an alternative to their existing mobility solutions. The ethnographic materials produced through these methods were analysed through qualitative analysis (Merriam and Tisdell, 2015). We have continuously presented these themes and materials in other outlets (see, for example, Ebbesson, 2022; Pink et al., 2021). The format of the themes and the materials were then tailored into narratives in an accessible catalogue¹ to be used in the co-creative workshops. These materials were then infused with DE techniques that included creating speculative materials (Dunne and Raby, 2013) for project participants to elaborate on to create a pedagogy of participation that is significant for our DE approach (as presented in Smith et al., 2024). These ethnographically founded workshop props were designed to create an atmosphere of engagement and intervention in scenarios derived from real-life situations and speculative futures to encourage stakeholders to dialogue and create joint insights during the workshops. Identifying themes of questions and concerns from the stakeholders and accompanying them with the ones from the research activities with the residents of the two neighbourhoods helped us tailor the methods, formulate the questions, and format the upcoming co-creation workshop material with the participants in mind.

¹ "AHA Methodology Catalogue - Design Ethnographic Living Labs for Future Urban Mobility". Available: https://aha2.hh.se/wp-content/uploads/2022/11/AHA_methodology_catalogue_2022.pdf (visited on 26th of April 2023)

In this paper, we concentrate on how these ethnographic materials became activated in co-creative practices of discussions, debates, engagements and joint reflections while *participating with* the ethnographic materials in a series of workshops presented in the next section.

3.2 Co-creation workshops

This paper is based on our work organising, conducting, documenting, and analysing seven co-creation workshops. The order of the workshops is presented in Figure 1, and more information about the participants and duration is found in Table 1. The *first* step aimed at two things. First, at supporting reflections on industry designers' current attitudes and assumptions of future mobility. Second, transforming the ethnographic findings and insights into prompts and speculative narratives (Dunne and Raby, 2013) to provide the stakeholders with new perspectives and alternative versions of future mobility in the following co-creation workshops. The first step consisted of four analysis iterations through method development, co-creation workshops, and reflections with industry designers.

The *second step* aimed to trigger reflections and exploration among academia, city, and industry stakeholders through the previously developed speculative narratives. This step consisted of one round of method development informed by the outcomes from the first step, learnings from the ethnographic fieldwork and co-design workshops, and reflections and observations from industry designer workshops.

The *third step* intended to re-engage with the citizens who had previously been part of the project. We wanted to review the speculative narratives and continue learning how citizens envision future mobility as part of their everyday lives with these speculations. This step consisted of two rounds of method development, two co-creation workshops in a location chosen by the participants, and collaborative reflections with the participants after each workshop.

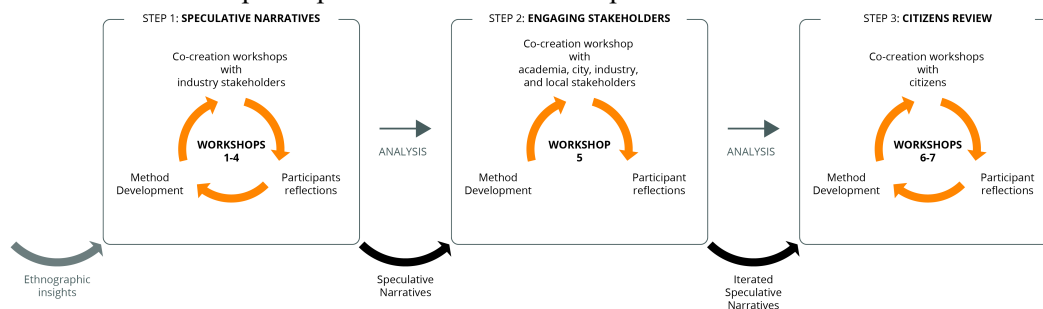


Figure 1. The three steps of the study and the iterative design ethnographic analytic process

The research data that we analysed in this study was documented when the research participants created speculative narratives from ethnographic materials produced through ethnographic fieldwork (in workshops 1-4) and iterated on the speculative narratives (in workshops 5-7) (see Table 2). These encounters were documented in different ways. We observed the participants' discussions while video and audio recording the workshops and taking notes. We also conducted group reflections for about 15-30 minutes at the end of each co-creation workshop, which we then analysed to improve the next workshops. In some cases, e.g., co-creation workshops with industry stakeholders, we also conducted 30-minute individual interviews to follow up with a selection of participants on how they perceived the workshop format and the presented ethnographic material and what they would suggest improving in workshop setup. Additionally, in online and physical workshops, we collected the materials participants worked with for documentation.

In the next section, these findings will be presented through reflexive descriptions of the set-up and outcomes of the workshops and how they feed into each other. By doing so, we combine the insights we made during the project into analytic accounts of how the processes unfolded through method development. These analytic accounts of the process are then discussed in relation to the different dimensions of RI and how RI enabled the workshop participants to foresee the social impact of future mobility services collaboratively.

Workshop #	Participants	Number of participants #	Duration	Environment
1	UX designer, mobility strategist, UX researcher, UX Technical expert	4	2h + 1,5h	Online
2	Service designer, UX designers, brand strategist	4	2h + 1,5h	Online
3	UX designer, UX researchers	3	2h + 1,5h	Online
4	UX designers, UX technical expert	3	2h + 1,5h	Online
5	Industry stakeholders (UX designers, service designers, developers, technical experts); city stakeholders (infrastructure strategists, urban planners); local stakeholders (estate owners, residents, representatives of local organisations and projects)	29	3,5h	Physical
6	Residents	4	2h	Physical
7	Residents	3	2h	Physical

Table 1. Overview of where the data for this study was produced

Workshop #	DE prompt	Documentation
1,2,3,4	Neighbourhood description, resident description, representations of Mobility imaginaries, notes of what citizens' had said	Video recording, audio recording, group reflections, follow-up interviews, co-created speculative narratives
5	Co-created speculative narratives (videos and printouts), guiding questions	Iterated speculative narratives, video recording of the outcome, audio recording of a discussion, group reflections, word cloud
6,7	Iterated speculative narratives (videos)	Audio recording

Table 2. Overview of what DE prompts were used and how the workshop results were documented

3.3 Analysis

According to ethnographic analytic practice (O'Reilly, 2012) and staging of qualitative research (Merriam and Tisdell, 2015), we continuously analysed the materials we produced through the documentation presented in Table 2. This meant that we coded the materials based on our observations of how the co-creative activities played out *in relation to* the ethnographic materials and created categories to label and organise the data to be later sorted into emerging themes. This process allowed us to continuously iterate methods to tailor the co-creation process of collaboratively creating socio-technical solutions that give voice to the people concerned by implementing future mobility services in their living areas. In these collaborative explorations of alternative future shared autonomous mobility visions, we were guided by how these ethnographically founded co-creation activities could facilitate the four RI dimensions – anticipation, reflexivity, inclusion, and responsiveness (Stilgoe et al., 2013).

4 Results

Through our analysis, we construed our results through four main themes that became evident through our documentation. These themes demonstrate qualitatively different ways of participating with ethnographic materials in the project. Our results are presented through conventional ethnographic practice, where each theme is described based on the analysis and demonstrated through examples from our observations, interviews and workshop materials (Merriam and Tisdell, 2015). The themes are presented as opportunities. However, they are not without limitations, which will be described below. Our results show that ethnographic materials open up possibilities to 1. Tuning in the everyday life, 2.

Allowing to relearn what is obvious, 3. Creating healthy friction to reach new perspectives, 4. Neutralising opposition between stakeholders.

4.1 Tuning in the everyday life

Our ethnographic materials were represented through a thematically organised catalogue with narratives and photos of the two neighbourhoods, giving different perspectives on what mobility meant to people. These ethnographic materials shaped the way we organised our co-creation workshops in two ways based on the fact that it takes time to tune into everyday life, which is not presented through graphs or personas. The way the ethnographic material guided us to set up and structure the co-creation workshops enabled us to give time and focus for the workshop participants to familiarise themselves and collaboratively discuss the material without rushing into designing solutions, which often leads to concepts being based on assumptions and preconceptions.

First, we split the workshops into two sessions – familiarisation and design activity. This allowed allocating dedicated time for the workshop participants to familiarise and empathise with the ethnographic material - the neighbourhoods, people living there and the types of relevant and useful future autonomous mobility solutions they had envisioned. Splitting the workshops into two sessions allowed a time of self-reflection and contemplation before moving into the design activity. The design activity focused on designing an autonomous mobility solution considering the different parts of the ethnographic material we had provided, reducing assumptions being integrated into the concept.

Second, the material directed how we structured the actual workshops. We divided the material into four parts, guiding the workshop agenda into five steps. First, the participants were familiarised with the neighbourhoods through rich ethnographic descriptions. Second, they learned about the everyday routines and practices of the representations of different people living in these neighbourhoods. Third, they were exposed to four distinct shared mobility imaginaries from co-design workshops with citizens. Fourth, they had time to get an overview of notes of concrete things citizens had said during their workshop on imagining shared autonomous vehicles as part of their current logistic alternatives. Finally, we asked our workshop participants to consider all the different ethnographic materials, design a future mobility concept, and tell it through a story. Many participants found the workshop format more engaging than the ones they usually experience. *"In the projects I have been part of, you have the hypothesis listed before you, and you are expected to solve them. You don't have the insights laid out as you had in your workshop. I have never been part of a workshop like this where everything is laid out, and you have to make the connections and don't have to assume. Sometimes you feel stupid to pose questions, but this time I did not. I could embrace the journey."* [SJ_1011]

However, the amount of ethnographic material was vast, and despite being split into different parts, given the time, it was hard for the participants to internalise everything. One participant said, *"I felt like all the different parts could have been its own workshop almost."* [TF_1006]

4.2 Allowing to relearn what is obvious

We divided the ethnographic material into four parts giving rich insights into different aspects of the two neighbourhoods (see, for example, Figure 2). We then asked the participants to familiarise themselves with the material step by step.

The ethnographic materials made it possible to tailor the workshops so that the participants were given opportunities to get more than mere insight into the two areas but also new perspectives on their approach to future mobility. We aimed to trigger reflective discussions on the workshop participants' current work practices and their assumptions of people's real-life circumstances. *"What was interesting for me is that it felt like much additional mobility went into catering for the kids' parents. So, if you make a solution for the kids, it doesn't matter what the parents want as it will cater to their needs to, for example, have time for themselves. That's another perspective."* [JH_0921] Our ambition was to think about what ethnographic material could bring to the design process and what they were currently missing when working on future mobility visions. Several of the participants mentioned never getting to consider

the design for the, e.g. elderly, youth, and people with limited mobility, having to mainly work with concepts of individually ridden AVs and not on solutions such as community-owned shared vehicles or utility-based vehicle services.

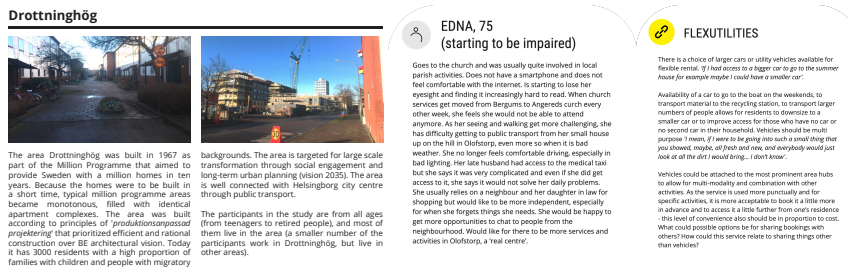


Figure 2. Examples of the descriptions of a neighbourhood, a person, and a mobility imaginary

This indicates how important it is to bring insights from real-world context into the future mobility design process, as it can trigger self-reflection. Also, when tailoring activities around ethnographic material, it is crucial to give time for it to be familiarised as it can help reduce the assumptions and change the projections of future mobility to include more real-life scenarios. This can lead to more relevant visions that trigger informed debate between the public and the industry.

However, as we presented the ethnographic material mainly through text, it required participants to interpret what they were reading, which with given time, had to be done rather quickly. Therefore, some participants wished to have more visual material.

4.3 Creating healthy friction to reach new perspectives

Ethnographic findings and insights can be provocative by themselves, especially when they bring up things that are not considered. For example, when discussing the different types of mobility services we had described, a participant was attracted to an on-demand AV pod service as he thought it could solve many use cases for different people and situations. A changing moment came when he realised that people were worried about the size of the space in these pods. *“The small space that’s been shared with people you don’t know can be kind of an unfamiliar situation for most people these days, compared to public transportation. That’s kind of a challenge, making people comfortable with that.”* [PT_0914] Introducing this friction is an opportunity to trigger discussion and debate. This is especially valuable in multi-disciplinary collaborations as it can lead to co-learning from each other's point of view, giving an opportunity to explore new perspectives and challenge currently existing dominating narratives.

We introduced friction by infusing the ethnographic material with speculative details. We developed speculative narratives (see, for example, Figure 3) that were grounded in people's real-life circumstances and mobility imaginaries. We introduced them to concerns and questions from the citizens, and industry, academia and city stakeholders.

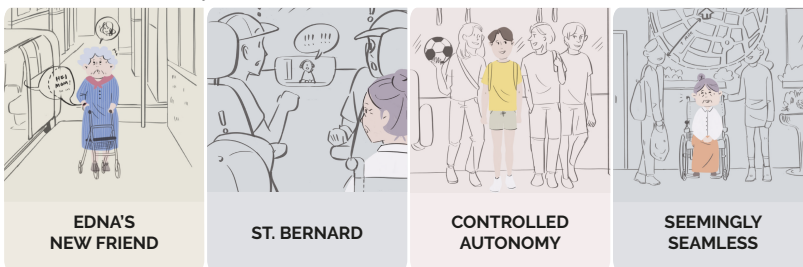


Figure 3. Screenshots and titles of the four speculative narratives

The matter of which concerns and questions are relevant to integrate into speculation depends on the target audience. In our case, provoking socio-technical trust issues, concerns raised by the citizens, triggered debate and reflections from industry and city stakeholders. For example, a group raised the question of the lack of drivers in AVs *“There’s a general safety concern that applies not just to kids but also elderly. Usually, when kids travel alone, a driver or parent is driving, making the kids feel safer.”*

In this [AV] case, there's no driver. But the driver's role is not only driving but also supporting, helping wheelchairs, and helping with all sorts of things like luggage and stuff. How can we replace that role? Do we need a dedicated person on board even though they are not the driver?" [GRP_2110]

Whereas restricting privately owned vehicles from the city centre can spark discussion among citizens. This is important to remember, as the aim of using speculation is to trigger discussion and the emergence of alternative versions of the future.

Ethnographic material infused with speculations opens for exploring new perspectives to currently existing narratives of future mobility. Adding friction to these speculations can guide the discussion and spark a debate, leading to mutual learning amongst the stakeholders. However, it is important to have a fine balance between friction being too subtle to be provocative or too radical to be considered realistic. For example, presenting an AV narrative where a person travels effortlessly from one place to another, which is the case with most of the currently presented future mobility visions, can feel unrealistic and, at the same time, too frictionless to spark constructive debate.

4.4 Neutralising opposition between stakeholders

From our experience in the overarching project, this study is part of, we have experienced the city and industry stakeholders forming an opposition to each other. A common discourse in this relationship is that the car industry wants to overwhelm the cities with its vehicles, and the city adds too many restrictions, disrupting the business.

The ethnographic materials, with their focus on the everyday life of people, provided a neutral space for different groups of stakeholders within and across sectors to meet, discuss and co-create (see Figure 4).



Figure 4. *The city, academia, and industry stakeholders discussing the speculative narrative "Seemingly seamless"*

Given that the focus shifted away from individual stakeholder goals to co-learning and co-creating for people's real-life needs was a powerful way to gain insights also into each other's ways of working and together exploring alternative versions of future mobility. Creating the neutral space resulted in more active stakeholder engagement and belief that the industry, academia, cities and citizens constellation is right for exploring future autonomous mobility alternatives and co-creating favoured ones.

The challenge here is to tailor the ethnographic materials and speculations to be relatable and relevant for the stakeholders, triggering reflections and debate. In one instance, we prompted reflections through questions accompanying the speculative narratives. We asked the stakeholders to think about how the scenario they had just seen relates to their work. This triggered a discussion that didn't only centre around AV technology but also sparked discussions around city planning, business models, and questions of equity regarding future shared autonomous mobility.

5 Discussion

5.1 Fostering Responsible Innovation Through Design Ethnographic Approach

Our project was structured by the DE approach, which is inherently inclusive and anticipatory and works towards responsible futures (Pink et al., 2022). Involving a diverse set of stakeholders creates a challenge

of aligning the different agendas. In our previous work, we have seen how industry and city stakeholders need help understanding each other's perspectives and often feel they have conflicting agendas. According to our results, the use of speculative design and grounding our speculative narratives in the citizens' everyday life, we were able to create a neutral ground for the city and industry stakeholders to align their agendas by focusing on citizen's needs, to learn new perspectives on future mobility and to explore what impact different versions of mobility solutions could have on the society and their work. In these collaborative explorations of alternatives to existing future shared autonomous mobility visions, we were particularly interested in understanding how ethnographically founded co-creation activities could facilitate the four RI dimensions – anticipation, reflexivity, inclusion, and responsiveness (Stilgoe et al., 2013). By doing this, our ambition was to respond to the calls for more research on how to operationalising these RI principles into concrete design and innovation practice in RI research (Robinson et al., 2020; Stahl et al., 2021) and in IS-related areas such as Responsible AI (Figueras et al., 2022; Minkkinen et al., 2023; Reijers, 2020). We have done so by placing the work in the intersection of Scandinavian IS-related understandings of co-creation, PD pragmatist strands of design research that work *through* design (Prochner and Godin, 2022), and anthropologically infused trajectories of DE (Pink et al., 2022; Dourish, 2006).

Our approach was to demonstrate how RI can be staged by investigating how ethnographic materials and knowing can *participate in* forming activities that co-create anticipation, reflexivity, inclusion, and responsiveness. Through this approach, we learned that there are opportunities for shifts in practice toward RI by opening up space for familiarising with everyday life in innovation processes that include socio-technical systems. Firstly, by making everyday life the starting point, stakeholders from different sectors can come together in a common space to discuss the realities, values and anticipations of real people in real contexts in a way that moves beyond general assumptions both between different actors, as well as between actors and demographically represented neighbourhoods. Secondly, due to the qualitative character of the ethnographic materials, they invited stakeholders to speak differently about people in the neighbourhoods than their home organisations in industry and public normally do. Our results showed that discussing people's daily endeavours, problems and how they already solve them in their terms became a powerful practice for the stakeholders to notice and reflect on taken-for-granted perspectives in their different organisations and co-learn what is needed to change in their workplaces to be able to meet across sectors in discussions of responsible futures productively.

These implications of bringing ethnographic materials into the co-creation of socio-technical systems can enable RI practices to emerge (see Figure 5). It directly caters for the involvement of a heterogeneous set of stakeholders as it supports aligning the perspectives by emphasising the needs of the society rather than solely focusing on the stakeholders. Auger (2013) points out that for the participant's to be engaged and to relate to the speculations, they need to be connected to the now. Grounding the speculative narratives in people's real-life situations and social context not only supports exploring future impact but also helps to investigate issues in present mobility, e.g., micro-mobility services appealing more to pedestrians than the drivers and people not wanting to share their vehicles with others (if they are not family or neighbours, then it becomes part of daily routines). This demonstrates how the DE approach can open up a stage for envisioning future mobility solutions, reflecting on the current ones, and reflecting on what we can learn from the current mobility challenges to anticipate and develop more socially sustainable future mobility solutions.



Figure 5. Map of how ethnographic materials enabled different co-creative RI practices through the workshop

Additionally, grounding ourselves in real-life circumstances and environments allowed us to collaboratively explore and reflect on peoples' actual needs for future mobility. Steen (2021) calls this the *slow innovation*. Slow innovation advocates for focusing on the slow-moving ecological and social processes instead of a "move fast, break things" attitude to improve both the RI process and the content. We noticed this in our co-creation workshops where the speculative narratives brought up discussions beyond autonomous technologies to topics such as autonomous mobility regulation, design of the cities, accessibility to mobility services, and safety of sharing with strangers were brought up. These discussions show how our approach can lead to investigating new alleys of future mobility and, therefore, support better foreseeing future mobility's possible impact on society.

5.2 Challenges Imposed by a Design Ethnographic Approach

DE approach requires significant time and commitment from the researchers and other stakeholders. For practical reasons, the research activities, despite being spread out over a long period, consisted of multiple short and intensive encounters with participants. This allowed the stakeholders to allocate time and attention from their everyday commitments, enabling us to recruit various participants. In addition, researchers creating representations of the ethnographic materials and infusing them with speculative design aspects can affect how other stakeholders perceive and use the materials (Baskerville and Myers, 2015).

5.3 Limitations and future work

There is no common way to tailor co-creation activities for the RI, and much of the work is done through trial and error (Perks et al., 2012). Similarly, we tailored seven workshops with ethnographic materials and stakeholders in mind making it hard to replicate the study. Nevertheless, the results from the study can guide how ethnographic materials can be prepared and represented to facilitate RI in co-creation.

Often, in studies like this, the focus is on stakeholder collaboration. For example, Jarmai and Vogel-Pöschl (2020) identified the time and effort stakeholders allocate to a project to determine how meaningful the collaboration is for the RI. We showed how using ethnographic materials supported facilitating stakeholder engagement, reflections and exploration of future autonomous mobility's impact on society. However, the challenge remains to go beyond mere reflections to actually changing current work practices and systematically responding to societal needs and values when developing future mobility visions.

Our initial speculations were created with industry stakeholders, e.g., UX designers, UX researchers, and technical experts leading most of the speculative narratives to centre around a vehicle. As these narratives were guided by automotive industry expertise and attitude, the question remains, how would the upcoming discussions have changed if we had created these speculations instead together with, e.g., city stakeholders or local stakeholders?

Also, as future autonomous mobility relies on AI techniques, it would be interesting to explore how developers developing algorithms for intelligent mobility solutions interpret, discuss, and use these speculations in relation to their work and future autonomous mobility.

6 Conclusion

In this article, we explored how quadruple helix value co-creation (Lusch and Nambisan, 2015) can be successfully staged in the context of developing future autonomous mobility through a DE approach. We presented an iterative design study to investigate how ethnographic materials can be used to tailor co-creation workshops to facilitate RI (Stilgoe et al., 2013) of mobility services. We contribute to the growing area of research and practice of value co-creative service innovation by demonstrating how tailoring workshops based on ethnographic materials enable RI practices to develop.

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