Exploring Reprogramming as a Speculative Design Method: Co-designing Repair-centred Neighbourhoods

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Word count: 5.132

ABSTRACT
Despite increasing attention to repair, participation in repair practices remains relatively limited. Within the ongoing research landscape of exploring strategies, tools, and methods to promote repair, this study contributes by examining how reprogramming as a speculative design method could inform about the organisation of repair services and activities. Reprogramming refers to the promotion of resource-light practices that do not require major changes to existing material arrangements. The aim of the study is to imagine reprogrammed, repair-centric neighbourhoods and to reflect on the effectiveness of reprogramming as a speculative design method in creating these future neighbourhoods. The research consisted out of three steps: expert interviews; the integration of insights from these interviews into a 3D neighbourhood-scale design tool; and three co-design sessions with designers in which the tool was used to explore repair-centred neighbourhoods. The results reveal several challenges, including the balance between centralising and distributing repair services and activities, as well as the importance of trust and communication within repair ecosystems.
As a reflection on the method, this research revealed that designing within the existing infrastructure of a neighbourhood makes it difficult to makes change, but at the same time encourages a more critical and realistic perspective. The study concludes that reprogramming as a speculative design method can help expose dependencies between services, reveal organisational challenges within repair ecosystems, and enable designers to imagine plausible yet provocative repair-centred neighbourhoods without assuming large infrastructural changes.

Keywords
Repair, Practices, Speculative design, Reprogramming, Design tool, Co-design

1. INTRODUCTION
The growing problem of overconsumption within today's linear economy leads to exceeding planetary boundaries. In response, increasing emphasis is placed on the circular economy, which aims to reduce material waste and extend the lifespan of products and materials through strategies such reuse, repair, refurbishment, and recycling (Ellen MacArthur Foundation, n.d.).The Dutch government has set the goal to achieve a fully circular economy by 2050(Government.Nl, n.d.).

An interesting circular practice that has gained attention in recent years is repair. Movements such as the "right to repair" contribute to the awareness around the importance of repairing(*Home - Right to Repair Europe*, n.d.). Nevertheless, research shows that despite the growing attention, actual participation remains relatively low among consumers(AMS Institute, n.d.)

To explore how repair can be made more mainstream, ongoing research focuses on identifying barriers and enablers, as well as designing and testing various interventions in real-life contexts (*ShaRepair Practices*, n.d.). While most existing research predominantly takes a bottom-up approach, this study aims to look at this challenge from a more top-down perspective, using a combination of speculative design and reprogramming.

By using speculative design, the research aims to imagine alternative futures in which repair becomes embedded within everyday neighbourhood life. Speculative design is valuable in this context because it makes abstract and complex futures more tangible, allowing researchers and designers to question and challenge existing systems (Dunne & Raby, 2013).

As a novel approach to explore these futures, the study focuses on reprogramming for reorganising services and activities without requiring large-scale infrastructural transformations. Since infrastructural change is often costly, and research suggests that shifts in practice do not necessarily depend on major infrastructural changes, reprogramming offers a relevant lens for exploring how the practice of repair could be integrated within existing material arrangements(Christensen et al., 2024).
The goal of this research is to explore these reprogrammed repair-centric futures and reflect on the effectiveness of reprogramming as design tool for shifts towards sustainable practices. Resulting in the main research question: *How can reprogramming be used as a speculative design method to imagine how services and activities could be organised within neighbourhoods where repair is a common practice?*

In this paper, the related work section first provides context on repair practices and how existing research is exploring ways to make repair a more common practice. This is followed by the methodological framing, which explains how speculative design and reprogramming are used in this study. The methods section then introduces both the overall research setup and the design tools used, followed by the results, discussion, and conclusion of the study.

RELATED WORKS
In early societies, repair was a natural and essential part of life. However in the 20th century, mass production made goods so cheap and fast to produce that companies no longer had an incentive to make durable products. Instead, they started promoting consumption and discouraging repair, a strategy known as planned obsolescence .(Perzanowski, 2021)

Due to the need for a circular economy, increasing attention to repairability has led to the rise of the Right to Repair movement (Ozturkcan, 2024), Which inspired and set the foundation for the new EU legislation: the "Right to Repair Act," officially entering

into force on 31 July 2026. (*Recht Op Reparatie | RVO.Nl*, n.d.)This act requires manufacturers of a defined range of products, including many electronic devices, to ensure the availability of repair services within an extended warranty period. Furthermore, even after the warranty period has expired, producers are obliged to provide spare parts and repair manuals, and to enable repairs by independent repair providers(Europees Parlement, n.d.).

While such regulations primarily target product-level accessibility and manufacturer responsibility, repair in practice is organised in multiple ways, extending beyond manufacturer-authorised or official repair services. Instead, repair activities are organised through a broader ecosystem consisting of multiple actors. These include manufacturers and their authorised repair services, independent repairers, for-profit and non-profit organisations, community groups, and individual citizens (Bradley & Persson, 2022). Within this ecosystem, independent repair "repair without official approval from the brand owners" plays a crucial role in supporting circularity, as it provides an alternative between costly official repair services, often tied to warranty or insurance structures, and discarding products.(van der Velden et al., 2024)

One interesting form of independent repair is community repair of which a well-known example are repair café's (van der Velden, 2021). Beyond reducing waste and extending product lifespans, community repair initiatives also strengthen social connections and encourage forms of citizenship that are less centred around consumption. (Bradley & Persson, 2022)

Despite the presence of such initiatives and repair services, repair is still not a common practice. Research from CPB shows that only around 30% of people actively participate in repair activities.(AMS Institute , n.d.). Literature identifies several barriers that prevent people from engaging in repair. These barriers include, among others, high repair costs, a lack of repair skills, limited knowledge about where to get products repaired, inconvenience, and a lack of trust in the reliability of repaired items (Rogers et al., 2021).

To better understand how repair can become more integrated into everyday life, Wageningen University & Research, TU Delft, and the AMS Institute are jointly conducting research on this topic (*Sharepairpractices*, n.d.). Their research called *Sharerepairpractices* is structured around five work packages: analysis of existing practices, identification of barriers and opportunities, testing interventions in practice, co-creation with stakeholders, and eventually the development of strategies and tools aimed at strengthening and scaling repair practices. Another dutch project called *Tackling Fixophobia(NWO, n.d.),* focused specifically on the repair of consumer electronics, aiming to develop new theories, tools, and system innovations that can support change across the entire value chain and contribute to the transition towards a circular economy.

As part of this ongoing research landscape, this study explores how a more speculative approach can contribute to understanding how repair practices can become more common and how it can inform the changes needed in the ecosystem of repair.

2. METHODOLOGICAL FRAMING

To better understand the methodological approach of this research, the following concepts are discussed: speculative design, reprogramming, and service master planning.

2.1 Speculative design

Speculative Design is a concept that emerged from Critical Design, introduced in the 1990s by Dunne and Raby(Dunne, 1999) (Dunne & Raby, 2001).Critical Design challenged the traditional view of design as primarily a commercial or problem-solving tool. Instead, it positions design as a means to critically reflect on, question, and challenge existing social, technological, and cultural systems.

Speculative design can not only be used to challenge current systems, but can, through exploring possible scenarios, also help us better understand the present and facilitate discussion about the possible futures, often starting with a 'what if' question. (Dunne & Raby, 2013) One example of a speculative design method is world-building, as it helps contextualize and understanding how technologies operate and evolve within their broader context.(Dunne & Raby, 2013)

In this study, world building and scenarios are used to explore different repair-centered futures. By imagining alternative futures in which repair plays a central role, these scenarios could help identify opportunities, barriers, and pathways for encouraging repair practices.

2.2 Reprogramming

The concept of reprogramming, developed by Christensen(2024), refers to a way of promoting resource-light practices without requiring large-scale infrastructural changes, given that such transformations can be highly resource-demanding. It is based on the idea that current practices are embedded within existing institutional and material arrangements, and suggests that by adjusting institutional arrangements(rules, norms, organisational structures) within existing or slightly modified material arrangements, can already lead to more sufficiency-based practices.

The paper explains how the relationship between the 'software' and 'hardware' of cities is central to reprogramming. The *software* refers to the norms, rules, and relations that shape everyday practices within social institutions. The *hardware*, on the other hand, encompasses the material and infrastructural elements of the city like roads, railways, buildings, and other physical structures.

Christensen describes reprogramming as the process of critically examining how everyday practices embedded within existing infrastructures can be shifted. According to Christensen, the concept can serve both as a way of thinking for policymakers and as an approach to design. This research explores how the concept of reprogramming can be used as a design approach, applied within the context of repair.

2.2.1 Service master planning

As the concept of reprogramming explains, rebuilding physical infrastructure often requires significant resources. Therefore, the focus shifts towards making changes within the existing infrastructure rather than replacing it entirely. This perspective is also reflected in the method of service master planning.(Selloni & Meroni, 2023)

Service master planning is an urban design method that uses co-design and scenario building to explore and design the ecosystem of services and activities. This approach emerged from the idea of collaborating with residents to create meaningful places. Even though this project does not involve co-design with local communities, the focus on services and activities is nevertheless used as a valuable lens to frame this research.

3. METHODS AND DESIGN

This research adopted a qualitative Research through Design approach (Koskinen, 2012). In order to answer the main question, the research is divided into three sub-questions:

- *What services and activities facilitate and support the practice of repair?*
- *What repair-centred neighbourhoods emerge through reprogramming and what do these reveal about the organisation of services and activities?*
- *How does the method of reprogramming help in discovering repair-centred neighbourhoods?*

The study consisted of three parts: expert interviews, the integration of the interview insights into the design of an interactive board, and subsequently co-design sessions, which served as the main data collection method.

3.1 Expert interviews

Semi-structured interviews were conducted with a total of seven experts: two master's students in Industrial Design conducting research on repair, three PhD researchers doing research in the field of repair, one service designer whose master's thesis focused on repair, and a policy advisor for circular economy at the municipality of Boxtel.

The expert interviews were conducted to explore which facilities, services, and activities support the practice of repair (sub-question 1). Although there is already a clear understanding of current repair services and activities, the field is continuously evolving, and the perspectives of experts are highly valuable for constructing relevant future scenarios during the reprogramming activity in the co-design sessions.

The insights gained from the interviews formed the basis for the design decisions of the design tool used during the co-design sessions.

3.2 Design tool

In design research, design tools are valuable as they support users in creatively articulating ideas, experiences, and exploring potential future scenarios, as well as fostering effective collaboration throughout the design process.(Sanders & Stappers, 2012)

The design made to support this creative thinking consisted out of a couple of elements, a 3D map of a neighbourhood in Eindhoven, Service cards, 3D printed product figures, Service/ Activity tokens and a legenda to explain the meaning of the tokens.

3.2.1 The Neighbourhood Map as an Interaction Space

As the main design object, a map of a neighbourhood in Eindhoven was created. This map functions as the interaction space in which participants can engage and work. Since the concept of reprogramming is based on changing practices without requiring major infrastructural interventions, existing elements such as buildings and roads, with which participants can interact, were pre-structured and visualised on the map.

The map is based on the neighbourhood 't Hool and Vlokhoven in Eindhoven, with WoensXL as the main shopping centre. This area was selected because it is characterised by a high concentration of retail stores supporting linear consumption, while repair practices are relatively limited. The main shopping centre is positioned at the centre of the map, while the surrounding neighbourhood is represented along the edges. The full neighbourhood was not constructed, as it would have required too much space and made the setup impractical to work with.

As shown in figure 1, the buildings were constructed from foam, while the services and activities taking place within these buildings were represented through service cards, service/activity tokens, and 3D-printed product figures. The service cards were designed to link products to specific services and activities, provide names for the services, and offer more detailed explanations. The services and activities were represented as symbolic shapes, as this supports participants in identifying and developing relations and patterns.(Sanders & Stappers, 2012) A legenda explaining the meaning of the symbolic shapes can be found in Appendix B.



Figure 1: Buildings and services presented on map (Photo taken by the author)

3.2.2 5.2 Selection of repair services and activities

Based on the results of the interviews, a selection of services and activities was identified that could exist in a repair-centred future. The interviews revealed that different services and activities play distinct roles within the practice of repair. For example, thrift stores and community spaces help draw attention to repair and stimulate interest, while skill-building services are needed to enable actual repair actions. Even though these activities are now presented separately, they often come together, as for example community building and skills building are activities that both happen at repair café's. To help structure and interpret the findings, the repair journey (Stretton et al., 2026) was used as an analytical framework. The services and activities that emerged from the interviews were mapped onto this concept. An overview of this mapping is presented in Table 1. Subsequently, these services and activities were translated into service/activity tokens, which participants could use during the co-design session, shown in figure 2.

Repair Interest	**Resale products** *Such as thrift stores and second-hand markets.*	**Community Building** *Such as community centres, cafés, places with music and boardgames*	
Repair Pathfinding	**Information** *Such as places for Warranty information of a desk informing bout repair options/ facilities*		
Repair Arrangement	**Material supply** *Such as a Scrap 'recycle market, Spare parts stock, Material stock On-demand printing/ production of spare parts*	**Tool supply** *Such as Tool libraries and makerspaces*	**Transport**
Repair Action	**Repair specialists** *Such as volunteers with repair knowledge or business repair*	**Skill Building** *Such as Makerspaces Repair workshops, repair courses Repair café*	
Post Repair			

Table 1: Overview of repair services and activities along the repair journey



Figure 2: Icons of repair services

3.3 Co-design sessions

To address the main research question, co-design sessions were conducted. The aim of these sessions was to collectively explore and construct alternative repair-centred futures.

The method of co-creation was chosen as it is an valuable approach within design research. (Sanders & Stappers, 2008) Co-creation is part of participatory design, in which participants and researchers collaboratively explore directions and meanings. This is an exploratory research approach in which, rather than searching for a single optimal solution, the focus lies on investigating multiple scenarios and directions. Given the speculative nature of this project, this method is therefore particularly well suited to its aims.

In total, three co-design sessions were conducted. Participants included four master's students in Industrial Design in the first session, three master's students in the second session, and three master's students in the third session, alongside one PhD researcher doing research in the field of repair. The sessions were primarily conducted with designers due to their familiarity with and aptitude for speculative and exploratory thinking.

The sessions took place at the TU/e. A picture of the setup is shown in Appendix A. The co-design session consisted of four parts and took approximately one hour in total:

- **5 minutes – Introduction**
  An introduction to the topic, the method, and the neighbourhood selected as the design case.
- **25 minutes – Activity 1**
  This was the primary activity, in which participants used the design tool to create repair-centred futures.
  At the start of the co-design session, the map was constructed based on the neighbourhood as it currently exists. During this activity, participants were asked to modify, replace and remove existing service cards, tokens, and product figures, transforming the area into a place where repair becomes the dominant practice.
  They were given a predefined vision which was developed out of the insights of interview:

> *"I want you to imagine a repair-centered neighbourhood: a place where repair is part of everyday life and visible throughout the community. It is a neighbourhood where people of all generations feel connected, help one another, and share skills, tools, and resources. It supports everyone from experienced repairers to people with little or no repair knowledge.*
>
> *In this neighbourhood, repair businesses and community repair exist alongside each other and might even strengthen one another. Spare parts and materials are easy to access and are shared and reused in smart and sustainable ways."*

- **15 minutes – Activity 2**
  Using predefined personas with repair-related issues, participants were asked to build scenarios within the futures they had created. This activity encouraged deeper and more realistic speculation about possible futures. The storyboard template and personas can be found in Appendix C
- **10 minutes – Interview**
  A short interview focused on reflecting on the created futures, participants' and experiences with the method..

3.4 Data collection and analysis

Qualitative data was collected across all three co-creation sessions, during both activities and the follow-up interviews. Audio was recorded throughout the sessions, including both the co-design activities and the interviews. In addition, the main researcher took observational notes during each session. Photographs were taken to document changes made within the design tool, as well as the final storyboards created by participants.

For analysis, all audio recordings were transcribed. The co-design session of group 2 was translated from Dutch into English for reporting repurposes. The transcripts were analysed using an inductive coding approach, followed by a thematic analysis to identify recurring patterns and themes in the data. Observational notes and visual materials (i.e. photographs of the tool storyboards) were used as supplementary material to support and contextualise the analysis.

4. RESULTS

This chapter presents the findings from the three co-design sessions. The first section primarily addresses the second sub-question: *What repair-centred neighbourhoods emerge through reprogramming and what do these reveal about the organisation of services and activities?* This section compares the repair-centred neighbourhoods that were created by participants during the sessions and highlights their key characteristics and differences.

To analyse these outcomes, a thematic analysis was conducted on the transcripts from activities 1 and 2. This analysis revealed two major challenges that emerged during the sessions.

The final three sections focus on reflecting on the research method itself and primarily address the third sub-question: *How does the method of reprogramming help in discovering repair-centred neighbourhoods?* These themes explore participants' experiences with the reprogramming approach and examine how the method supported the generation, discussion, and development of future repair-centred neighbourhoods. Together, these findings contribute to answering the main research question: *How can reprogramming be used as a speculative design method to imagine how services and activities are organised within neighbourhoods where repair is a common practice?*

4.1 Comparison created future repair-centered neighbourhoods

This section compares the future repair-centred neighbourhoods as presented in table developed during the co-design sessions, highlighting the main similarities and differences between the scenarios.

As shown in table 2, Across all groups, repair services and activities were distributed throughout the whole neighbourhood. This was either an intentional strategy to increase the visibility of repair activities or as a consequence of the stores that felt like they could be removed.

Group 1 and 2 began by reorganising existing stores, as participants considered the complete removal of current services quite difficult. In both groups, product repair services and activities were connected to points of purchase. For example, Group 1 developed product-based districts, which combined retail stores with centrally located repair cafés and specialised repair services situated near relevant stores. In contrast, group 3 reflected critically on this approach, as they argued that the reprogramming process should not focus on relocating repair stores that already worked well but rather on transforming practices and spaces that were perceived as problematic.

A strong emphasis on community and attractiveness emerged across all groups. Especially participants in group 2 highlighted that repair spaces should not be purely functional but also serve as social and inviting places. A future focused only on repair was not considered a desirable future.

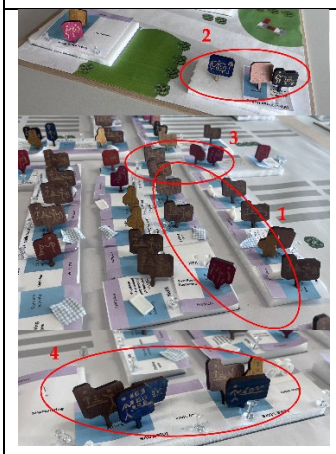
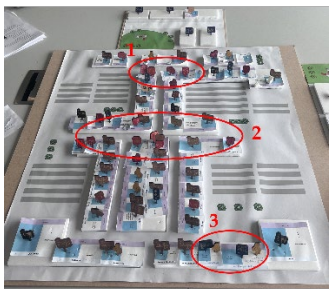
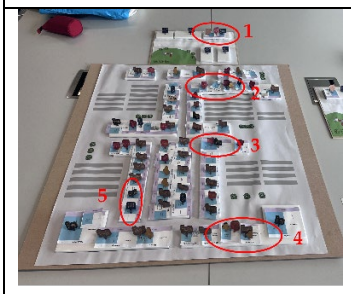
Created Neighbourhood group 1	
	1. Product-based districts (e.g. garment and shoe) with repair cafés integrated throughout. 2. Central exchange centre in the residential area, connected through transport to all repair businesses in the mall. 3. Mall centre functions as a community space and thrift store 4. Former toy store repurposed into tool and material supply hub near the supermarket
Created Neighbourhood group 2	
	1. Cluster with a makerspace, info point, and thrift store later expanded with transport services for furniture. 2. Cosy, lively centre with 'regular' cafés, repair activities and information points, designed as an inviting social space rather than purely repair focused. 3. Former phone store repurposed into tool and material supply hub near the supermarket
Created Neighbourhood group 3	
	1. The community centre was transformed in a place for workshops and tools, so people don't need to go to a busy mall with large appliances. 2. Makerspace as central information point offering workshops close to the furniture store. 3. Thriftstore and transport services close to city center 4. Repair specialist and information service close to supermarket 5. Transport and material supply

Table 2: Overview of created repair-centerd neighbourhoods across the co-design session

4.1.1 Spreading versus centralizing

A common challenge that emerged during the creation of the future neighbourhoods was the tension between spreading and centralizing repair services and activities.

As shown in Table 2, participants initially distributed repair-related services and activities throughout the neighbourhood. Group 3, for example, developed combinations of repair services and spread these across the area. However, this approach created difficulties during Activity 2, when the persona of clumsy 'Machiel' attempted to repair his broken coffee machine (figure 5). To obtain information, spare parts, tools, a workspace, and assistance, he had to navigate and walk to multiple locations with his heavy coffee machine across the neighbourhood. Reflecting on the proposed neighbourhood, the PhD researcher identified this as a key friction point:

"Well, I feel like we already kind of had a friction point where we're talking about whether things should be distributed across the mall or more centralized. And for me, I see that the reason we don't repair things is because it's not convenient."

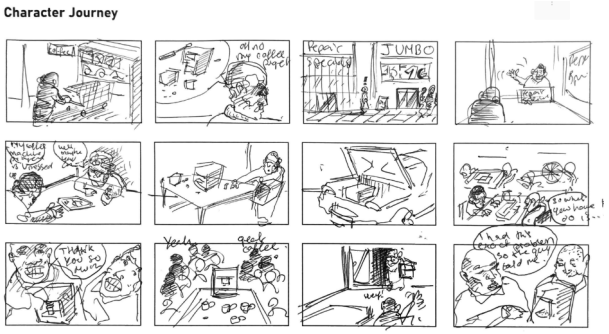


Figure 3: Character journey Machiel (photo taken by author)

In Group 1, participants recognised the importance of making repair visible and accessible across the neighbourhood, while avoiding the need for users to move through the entire mall. As one participant noted: *"because if they're in a rush or they're not really able to walk throughout the whole area."*

To address this, they proposed an exchange centre in the residential area where people could drop off broken items. This hub would be connected to local repair services within the mall, allowing smaller repair and retail stores to remain in place while being coordinated through a central node.

4.1.2 Trust and communication, knowing each other

As shown in the previous scenario, there was a tension between spreading and centralizing repair services, Within these spreaded futures familiarity and communication between repair services became rather important. As a participant group 2 noted:

"'They do not necessarily have to be located next to each other, as long as they are familiar with each other and can refer people to one another."

During activity 2 in group 1, this discussion brought up some tension. In the scenario persona "Sanne" visited a professional bike shop with a broken battery. The repairer preferred to sell a new battery rather than disassemble it, which was too expensive for Sanne. Participants therefore suggested that the bikeshop would refer her to a repair café but questioned whether businesses would actually do this. As one participant noted: *"I don't think a bike store will recommend you to go somewhere else to get your bike repaired."*

Overall, these insights suggest that the success of distributed repair systems depends not only on physical availability, but on the strength of social and professional relationships between repair actors.

4.2 Struggles of making changes stimulated critical attitude

A common struggle that emerged throughout all the sessions, was the struggle to remove existing stores to make place for repair-centered activities, as all participants showed hesitance and felt like they needed a reason to replace existing stores.

Two main reasons for replacing existing stores were shown.

Reasons for replacing existing stores	**Participant quote**
Targeting stores that promote a linear economy	*"I would target the bigger stores , the retail stores that produce products that are not repairable"*
Prioritizing accessible locations	*"It should be closer to your home I think. It would make it more accessible to actually go there"*

Table 3: Reasons for replacing existing stores

The participants also used other strategies to integrate repair activities and services into the neighborhood without removing existing stores and services:

Alternative strategies	**Participant quote**
Adding repair services to existing stores	*"I think we put a lot of extra repair professionals within the existing stores."*
Smarter arrangement of existing store locations	*"we should focus on clustering, sharing resources"*

Table 4: Alternative strategies for replacing stores

Because it was quite difficult to implement changes, the method encouraged critical reflection on which interventions would be most effective. For example, almost all groups concluded that adding repair specialists and providing repair information within existing retail stores could already make a significant contribution to stimulating repair practices. This closely aligns with the reprogramming method, which also describes how practices can be reshaped through making small changes in existing infrastructure.

4.3 Not perfect repair-centered future, but 'realistic'

Across the different groups, participants reflected on how the tool influenced the way they approached repair-centered futures.

Participants across the groups mentioned that the tool forced to stay realistic when thinking about more repair-centered futures. As one participant from group 1 said: *"I think it was difficult because I felt a certain need to be realistic."*

This was also reflected in group 3, where a participant, who was relatively sceptical towards idealistic future visions, explained that combining this approach with existing realities directly confronts you with the challenges of implementation, highlighting that established practices cannot simply be changed or easily reconfigured: *"I'm usually very critical of the more idealistic, but I think that this is really nice to indeed be confronted with the realistic aspects of deploying such a repair café community because it's super difficult."*

In group 1, a participant noted that this method does not necessarily result in idealised visions of the future but rather confronts participants with the behaviours and design choices that sustain existing linear consumption patterns. *'if we really were to reprogram it really to be repair centric we would have removed half the clothing stores, but I think we recognize that there are certain commercial behaviors that are just inherent to shopping centers that we cannot take away.'*

Overall, these reflections suggest that the method does not primarily function as a tool for generating idealised future scenarios, but rather as a means of critically engaging with existing infrastructures and the behavioural patterns embedded within them.

4.4 Tool for systemic design

An important aspect of the method and tool, identified both during the interviews and the activities, was its systemic character.

As a participant in group 3 noted: *"It's not as simple as just removing something and placing it. It's really about the entire system of the mall."* Another participant in this group further emphasised that the approach not only provides a systemic overview, but also supports identifying potential points of intervention within the current infrastructure: *"So, I think it helps to visualize the bigger picture, helicopter view, and that also helps you pinpoint, okay, where can we start with this process?"*

This was also noted in group 1 where a participant stated: *'it is not only just placing it, but seeing the entire flow from start to finish'*

These insights are also reflected in the generated future scenarios. For instance, the concept of the exchange centre demonstrated how issues of distribution can be addressed in a systemic manner.

Overall, these findings suggest that the reprogramming method, as translated into a design tool, can support the addressing of complex challenges, such as the organisation of repair services and activities through a systemic perspective.

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5. DISCUSSION

The findings from this study show that using reprogramming as a speculative design method introduces both opportunities and limitations in designing future neighbourhoods. This discussion reflects on how the method, and the design tool shaped the outcomes of the co-design sessions. It also outlines the next steps for further research.

Reprogramming in speculating futures

A notable outcome of this study was the tension between modifying the neighbourhood and maintaining a realistic mode of thinking.. As also highlighted in 4.3, the method might not be optimal for generating extreme alternative, future-oriented scenarios.

You could argue that working with existing material arrangements may constrain speculative and future-oriented thinking. At the same time, one could also argue that these constraints are beneficial, as they help participants remain close to reality and prevent designs from dissolving into abstract or unfeasible utopias. Whereas utopian approaches can sometimes overlook the complexity of reality, the reprogramming approach ensures that envisioned futures remain realistic and grounded in context.

Working with current material arrangements may limit the exploration of alternative worlds and, consequently, the discovery of new perspectives. To achieve a better balance, design choices could be adjusted. In the current design, for example, the names of shops were directly displayed on the map, and a video of the existing neighbourhood was used during the introduction of the co-creation session. This made participants feel more connected to the existing context, which in turn made it more difficult to propose substantial changes. By making the representation slightly more abstract, speculative thinking could be encouraged. In this way, a better balance between reality and imagination could be created.

5.1 Design tool

A key point that should be acknowledged is the distinction between the effect of the concept of reprogramming, which represents more a way of thinking, and the effect of the design, the translation of this way of thinking into the design tool.

By representing the existing infrastructure on a map and asking participants to reorganise practices of repair through this map, specific outcomes emerged. For instance, it can be argued that a more systemic perspective became visible because of the map-like representation. This effect may therefore not be inherent to the reprogramming concept itself, but rather a consequence of the specific design translation.

If the concept of reprogramming had been operationalised in a different way, it is likely that different outcomes would have emerged. This highlights that the results are not only shaped by the concept of reprogramming, but also strongly influenced by how it is applied.

5.2 Institutional arrangements

Another point of discussion concerns the actual implementation of the reprogramming method in this research. The method is fundamentally about transforming institutional arrangements, such as standards, rules, and regulations, in order to promote more resource-efficient practices. However, this aspect did not emerge strongly in the findings. Instead, the focus of the exercise was primarily on reorganising services and activities and testing these future neighbourhoods through scenarios. As a result, there was limited attention to what these scenarios would imply for underlying institutional arrangements.

Explicitly exploring which rules, norms, and regulations would have existed in these futures could be a valuable next step. For example, the insight that placing repair specialists within retail stores can increase visibility, could be translated into a potential rule stating that every retail store must also facilitate information about repair. In this sense, the generated future visions could serve as a starting point for identifying which institutional arrangements should or could be adapted.

As part of this research, the concept of reprogramming was tested within a hypothetical case study with designers. In this study, a specific neighbourhood was selected; however, applying the method in different neighbourhoods may lead to different outcomes. Further research and real-world applications are needed to better understand the extent to which this method is effective in working on concrete, real-world cases.

6. CONCLUSION

This study set out to explore how reprogramming can be used as a speculative design method for imagining neighbourhoods in which repair is a common practice. By combining insights from expert interviews, translating these into a neighbourhood-scale design tool, and using the tool in co-design sessions with designers, the research uncovered both the organisational challenges the ecosystem of repair and the methodological value of imagining futures within existing infrastructural conditions.

The generated futures highlighted the tension between centralising and decentralising repair services, as well as the need for an ecosystem in which different repair actors maintain strong social and professional relationships. In exploring these futures and tensions, the design tool proved useful in providing an overview and facilitating an understanding of the relations and dependencies between services and activities.

The findings suggest that reprogramming as a speculative design tool can help designers, such as social designers and urban planners, critically reflect on how the organisation of services and activities may support the uptake of circular practices without requiring large-scale infrastructural changes. Taken a step further, this approach could also be used to identify how institutional arrangements might need to be adapted to support and promote repair practices.

7. ACKNOWLEDGEMENT

I would like to thank Lenneke Kuijer for her guidance throughout the entire process of this project. I would also like to thank Ben, Donna, Emma, and Edelweiss for their support and help throughout the project. I would like to acknowledge the use of OpenAI's ChatGPT (GPT-5) in supporting the writing process. The tool was used to check spelling and grammar and to improve the phrasing of certain sections, while all ideas and interpretations remain my own as the researcher.

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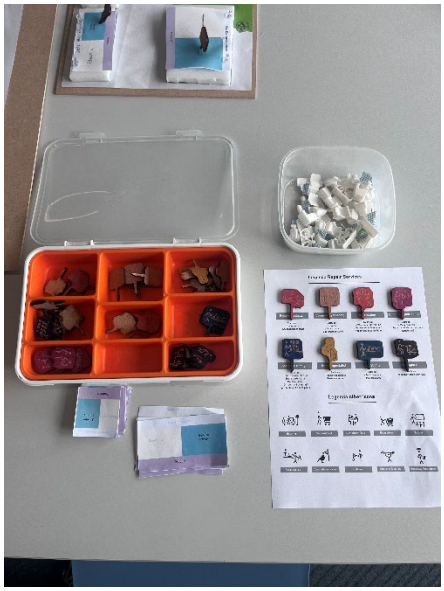
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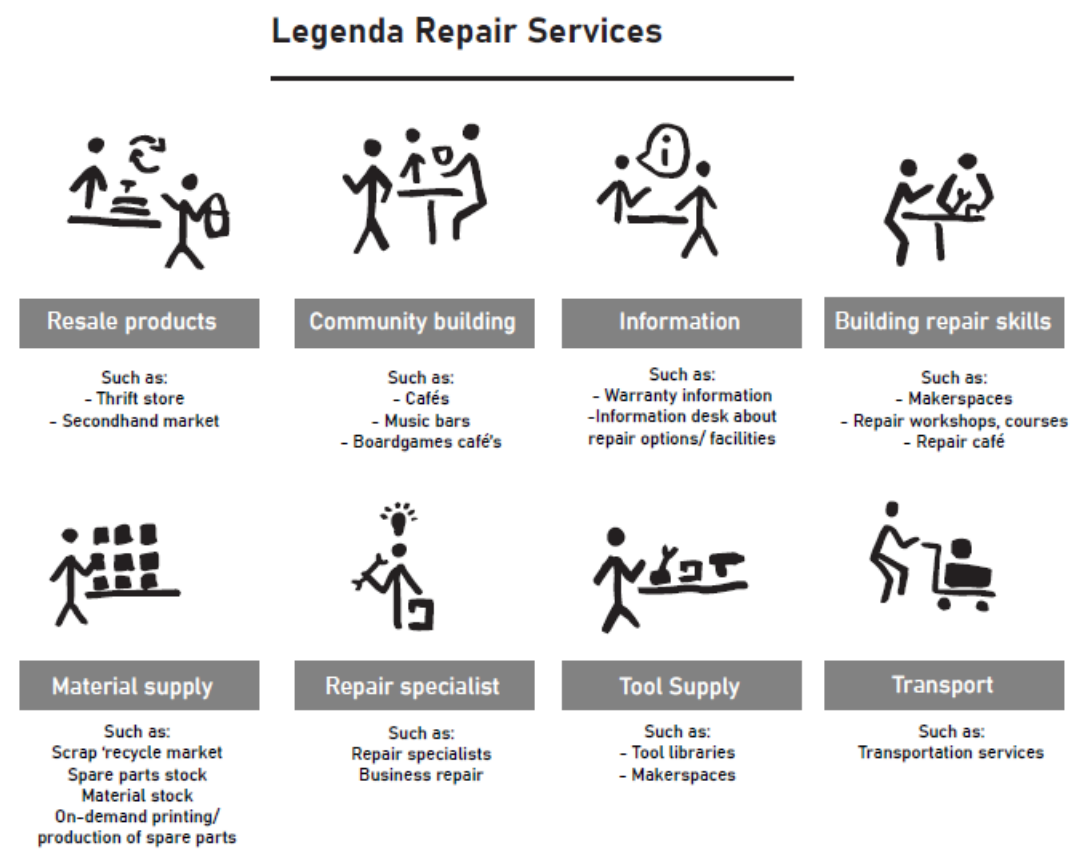
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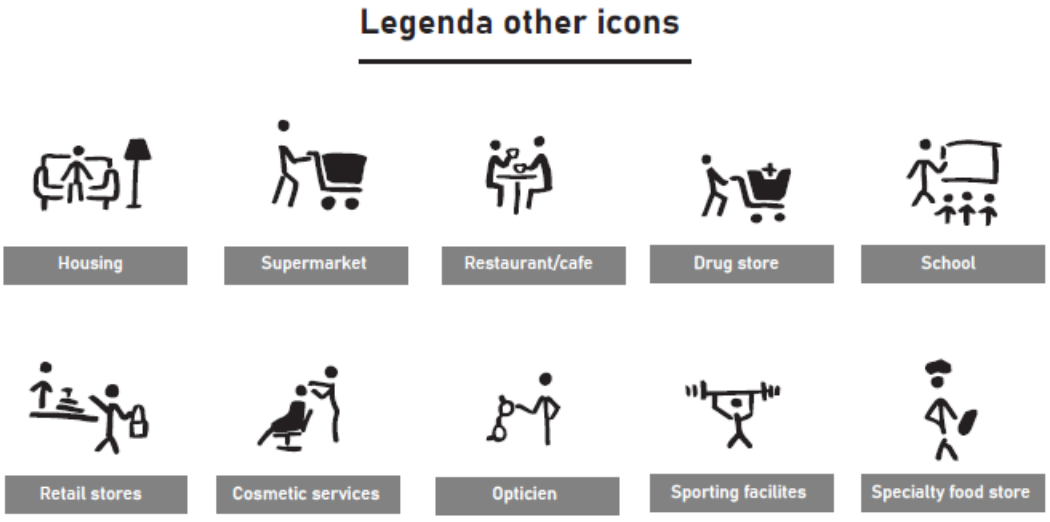
APPENDIX A PICTURES CO-CREATION SETUP AND DESIGN TOOL





APPENDIX B LEGENDA REPAIR SERVICES AND ACTIVITIES





APPENDIX C CHARACTERS



Sanne, 35

Nurse

Sanne is

a busy nurse who sometimes works night shifts, which often leaves her tired during the day and in need of extra sleep. She finds relaxation in meeting up with friends for coffee. Since her job is already physically demanding, she does not enjoy sports very much. Occasionally, she does a workout at home to stay somewhat active.

Sanne is someone who cares about sustainability, but she does not have much time or energy to actively focus on it in her daily life. Because she rarely has enough time to cook, she often grabs something quick and easy, like a falafel (Or döner, if she had really rough night) wrap, whenever she gets the chance.

Sanne is not very technically skilled and rarely thinks about how products work or are put together. When something breaks at home, she usually calls friends for help.

Sanne wants

to get through her busy, tiring days as a nurse, relying on her e-bike for work, groceries, and seeing friends.

After a night shift, she notices the bike suddenly only lasts 10 minutes. The battery seems worn out or defective, and without it her daily routine quickly falls apart.



Machiel, 52

Fiscal advisor

Machiel is

a 54-year-old man who lives with his wife, Sandra, in a terraced house on the edge of the neighborhood. Their two children have both moved out, leaving the house much quieter than it used to be.

Machiel studied Fiscal Economics and smoothly transitioned into a career as a tax advisor after graduating. He now works for an independent consultancy firm, mainly advising businesses. Although he thinks his job is fine and stays fairly busy with work, he feels like something is missing in his life. He goes to the gym twice a week but has few hobbies outside of that. Now that his children have left home, he especially misses the evenings spent playing football on the field behind the house.

Machiel is rather stubborn and can come across as grumpy or easily irritated. Sandra often hears him swearing when one of his mid-life crisis projects goes wrong. Recently, Machiel bought a classic car to restore, imagining it would be a rewarding challenge. However, he quickly discovered that the project was far more difficult than expected. Most of his repair knowledge comes from YouTube tutorials, which does not always make the process any easier.

Machiel wants to...

Enjoy his quit morning ritual. The highly automatic coffee machine he bought two years ago is an essential part of that. After two years, it breaks down: the milk frother stops working and the app demands maintenance.

When he tries to fix it, he runs into special screws, software problems, and parts only available from the manufacturer, with no clear repair manual.



Gerrie, 76

Retired

Gerrie is

Gerrie is a 76-year-old woman who has lived in the same neighborhood for over forty years. Since her husband passed away a few years ago, she has been living alone in the house where they raised their children. She enjoys the peace and quiet of her familiar surroundings, while the busyness of the city can sometimes feel overwhelming.

A few times a week, she walks to the nearby bakery or visits the market, where she enjoys chatting with familiar faces. She values personal contact and appreciates the small, everyday conversations she has with neighbors whenever she gets the chance.

Although Gerrie tries to keep up with modern technology, she often finds it confusing and frustrating. She owns a smartphone mainly for calling and sending messages, but anything beyond that quickly becomes overwhelming. When something stops working, she usually writes the problem down on a piece of paper until one of her children or grandchildren can come by to help

Gerrie wants

Gerrie wants to stay connected with her family and neighbors through her smartphone, which she mainly uses for calling and sending messages.
One day, her phone suddenly stops making and receiving calls. She has no idea what to do, and the settings feel confusing and overwhelming, leaving her unsure where to start or how to fix it.
Without her phone working properly, she feels cut off from her usual contact with others and isn't sure how to fix it on her own.



Malina, 19

1st years HR student

Malina is

a young woman in the prime of her life and is currently in the first year of her Bachelor's degree in Human Resources. She is kind, caring, and social, and loves being surrounded by friends. Although she is confident in many situations, she can still feel a little insecure at times, especially because of the pressure she experiences from social media and the people around her.

Malina cares a lot about her appearance and enjoys keeping up with trends. She notices that many of her friends wear the newest clothes and own the latest phones, which makes her want to keep up as well. She spends a lot of time on social media and is strongly influenced by what she sees online and by the people around her.

Despite this, Malina is ambitious and motivated. She works hard to balance her studies, social

Malina wants

Malina wants to go to a party with her friends in two days and wear her favorite pants. When she tries them on, she notices a hole in the knees. She considers buying a new pair, but doesn't want to throw these ones away since they are one of her favorite clothing items.

She has seen others repairing and customizing their clothes and likes the idea of giving her pants a second life. However, she has no knowledge, no materials, and only two days left before the party, making it feel urgent and overwhelming.