Generous cities – weaving commons-oriented systems for the reuse of excess materials in urban contexts

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Thesis Abstract

This thesis explores the transformative potential of reshaping the way cities handle excess materials. In particular, it explores a shift from industry-oriented waste management to community-based waste prevention through practices of reuse at a local level. The central research question addressed is: ‘How can practices of reuse contribute to reimagining and reshaping the way cities handle excess materials?’. Through a series of interconnected research cycles, this investigation dives into the nuances of cultures of reuse through repair, upcycling and recirculation, and challenges the prevalent mindset focused almost exclusively on recycling, incineration, and landfilling of materials.

The research begins by employing design research methods to understand how discarded and unused materials are transformed and re-distributed in urban contexts. It then investigates forms of embodied knowledge in reuse initiatives, in order to leverage such practices with open-source ways of organising community initiatives. Finally, the thesis connects to policy-making, introducing the concept of ‘generous cities’.

During the doctoral investigation, eight design concepts were created, and three prototypes developed. Altogether, they capture the research findings and expand their potential impact in establishing local systems of material reuse.

The generous city highlights the ability to weave convivial forms of addressing the multiple contemporary crises – social, environmental, economic – by foregrounding collective forms of mutual care, cultural regeneration, and resource conservation. The thesis contributes to scholarship on waste management and urban sustainability, adopting a critical, transdisciplinary, and situated perspective. Additionally, the research offers practical tools to promote and scale community-based waste prevention. It presents an essential pivot from the current focus on recycling towards more sustainable, community-oriented, and generous urban environments.

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My position at the weird border of technology, culture, politics, and science owes immensely to hundreds of peers in collaborative networks in Brazil and abroad. I am only a node in all of that. To name just a few, the dead-but-still-lingering MetaReciclagem network and its cousins – CulturaDigital.Br, Bricolabs, Rede//Labs, Ubalab, Ninho, Tropixel. And the members of reuse.city, a new proto-community featured in this thesis.

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Kasia, welcome into my life. Feel home, stay long.

Declaration

I declare that the work contained in this thesis has not been submitted for any other award, and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas, and contributions from the work of others. The work was done in collaboration with the Mozilla Foundation in Berlin.

Any ethical clearance for the research presented in this commentary has been approved.

Approval for the Research Studies has been sought and granted through the Researcher's submissions to Northumbria University's Ethics Online System on 03.08.2020 and 16.02.2021.

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1. Introduction

This chapter situates the overall context and path of my doctoral research, and the findings along the way. I describe the decisions made, potentialities discovered, and obstacles faced. Then I define the research focus, the questions formulated to address gaps in scholarship, and methods used to generate data and contribute new knowledge. My positionality as a Latin American practitioner with significant previous experience at the intersection of technology, culture, policy, and research is acknowledged. Finally, the chapter describes the structure of the thesis.

A common way to describe the contemporary globalised world is that it is organised chiefly around industrial production. That point of view, although insufficient to provide a deep understanding of the many economic, political and social dynamics at play, is prevalent in the public opinion. The mere fact that it has uncritical wide adoption by the media and the general public has many consequences. Crucially, it makes it all but inevitable to accept that the global economy depends on an increasing extraction of raw materials, their transformation into products, and the distribution of such products to consumers. Contemporary industrial production is, after all, usually structured in such a way that multiple materials are extracted from nature – often in parts of the world distant from one another – and transformed into products through the use of labour, energy and applied knowledge.

That mode of organisation impacts the entire supply chain, but its final section is particularly problematic. It would make sense to assume that the products of industrial production would better stay in use for as long as possible, lest the investment – labour, energy, and knowledge – disappear altogether when products are discarded, or at best recycled. In other words, the resources invested into manufacturing are literally wasted at the end of the product life cycle. The so-called linear mode of industrial production (Webster, 2017) generates increasing volumes of objects that can not be reincorporated into production processes. Such excess materials are largely wasted, despite often still being potentially valuable. Recent policies attempting to increase the rate of recyclable materials' collection address this situation partly, but they cause other sorts of undesirable effects, as will be discussed in this thesis.

Another implication of describing society solely in terms of industrial production is the promotion of a worldview – and consequentially a culture – based on commercialisation and competition, which lacks a holistic perspective of the social and environmental impacts of economic activity, and in particular its negative externalities. Alternatives to address the impacts of industrial production have taken the shape of systemic approaches

such as cradle-to-cradle (C2C) (McDonough and Braungart, 2002), circular economy (Webster, 2017), and doughnut economy (Raworth, 2017). All those takes offer a well-structured narrative and recommendations about production and consumption, material lifecycles and economic systems. They will be analysed in more depth in Chapter 2. For now, suffice to say that there are contradictions in how – or if – those frameworks sufficiently address cultural and symbolic aspects of waste and attempt to find concrete solutions under that perspective.

Relying exclusively on market-based mechanisms limits the potential transformative effects of such proposals. Profit-oriented corporations have historically been incentivised to adopt questionable practices to increase their margins. And that happens not only regarding source materials. Whenever possible in legal terms and acceptable by public opinion – or invisible from it —, such organisations will:

- Increase prices as much as possible, occasionally making use of sophisticated techniques to manipulate consumers' perception in terms of style and identity. That allows them to make their products be seen as more valuable than the competitors' – even in the cases where they are objectively the same.
- Reduce wages and working conditions to the bare minimum established by legal or class-based workers' rights regulations, often relocating their industrial plants to parts of the world where labour is cheaper, or less protected.
- Employ materials from unethical provenance – sometimes relying on child labour, environmentally questionable extraction and processing of materials, poor workers' protections, or even sourcing materials from conflict and war-thorn areas, as well as engaging with corrupt actors.
- Ignore the long-term impacts of their products once they are not in use any more – sometimes actively promoting planned obsolescence and/or concealing known information about the low repairability or the high toxicity of their products (McDonough and Braungart, 2002; Raworth, 2017; Webster, 2017).

I argue that society can truthfully seek novel and holistic ways to address the impacts of excess materials, but profit-oriented corporations should not be the only actors involved. A coalition of stakeholders representative of the many forces at play must be forged. Unfortunately, we must accept that waste production is inevitable for the foreseeable future.

My research centres on how localities can cope with excess materials under a conceptual framing of reuse – through repairs, upcycling, or re-circulation. This specific focus for the investigation is based on two elements. The first is my hands-on involvement in the past with community initiatives promoting the reuse of materials. I build on experiences reusing

discarded electronic equipment in the MetaReciclagem network[1] – active in Brazil between 2003 and 2012. The second factor in deciding on this particular research topic is the scarce literature I found connecting inclusive urbanism, digital equality and environmental issues. Particularly in discussions about smart cities, there seems to be no awareness of the rich scholarship, for instance, on Lefebvre's concept of *Right to the City* (Lefebvre, 2017) and its implications in how policy is designed and implemented. Equally absent are approaches to handling waste in urban contexts that go beyond logistics and discuss impact and benefits to local communities and society.

1.1. The OpenDoTT Programme – Openness And Things

OpenDoTT (Open Design of Trusted Things) was a doctoral training programme led by Northumbria University and the Mozilla Foundation, funded by the European Union's Marie Skłodowska-Curie Actions. Between 2019 and 2022, five PhD candidates have explored how openness, design research, and digital technologies intersect in different areas with contemporary discussion and practice regarding 'internet health', privacy, and trust. I was one of those doctoral fellows. The research topic assigned to me in the programme was 'Smart Cities'.

The program was shaped as a consortium of organisations providing training, mentoring and outreach. It was designed explicitly to promote international cooperation on many layers. The five research fellows came from different continents and academic backgrounds. We were also expected to work from the UK in the first year, followed by 18 months at the Mozilla Office in Berlin. We would have a considerable budget allowance to perform research activities and fieldwork, attend conferences and events, and organise exhibitions and publications.

OpenDoTT had three main phases. The first one was to be conducted at the University of Dundee, where the project was hosted initially before moving to Northumbria University. In that initial period, we would have training modules in disciplines such as research through design (RtD), academic project management and writing, career planning, and practical training to use the making facilities at Dundee's Duncan of Jordanstone College of Art and Design. In the second stage, already in Berlin, we would have training and mentoring on open leadership, open-source prototyping, and privacy by design. Finally, during the third phase, we would turn our eyes to policy to find ways to influence decision-making in the real world. Each of those stages was connected to a series of reports and project deliverables.

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1. MetaReciclagem was a distributed network of community labs in which donated computers were refurbished using free and open-source software. I describe it in further detail in Section 1.6.

The global pandemic of COVID-19 severely impacted those plans, reducing our ability to travel and work together. Still, the programme allowed me to experience diverse urban contexts and incorporate reflections in my work. My research cycles, described in depth in Chapter 3, were designed in line with the three main phases of OpenDoTT.

1.2. Waste And Cities

The entirety of my research journey, from arriving in the UK in 2019 to the moment I type these words in Berlin, followed OpenDoTT's explicit goal of going beyond merely deploying technologies to discuss how to pursue a better future for cities and their populations. My thematic choice for that investigation was to focus on local systems to promote the reuse of excess materials – broken, unfit, unused, discarded objects – in contemporary cities and regions.

Regarding cities, discussion about the reuse of materials is often affiliated with the field of waste management. There are, however, problematic points in such a thematic association. The first question is the extent to which public understanding of waste has gradually been reduced to the attempt only to increase the volume of recyclable materials collected and processed by municipal services. The dominance of a top-down view of recycling as the end goal of waste management leads to distortions that must be addressed, as will be discussed in Chapter 2. The second problematic point, perhaps of a more conceptual nature, is that accepting to define things out of use as waste conditions society's perception and expectations about such materials. To that point, not even the well-known formulation 'waste is matter out of place' is sufficient. The theme ought to be challenged from a perspective that considers power dynamics and conformity to a consumerist society (Liboiron, 2019; Reno, 2014).

In my research, I adopt an alternative take: addressing excess materials in cities and regions through collaborative practices of reuse. In so doing, I shift the focus: from an increasingly automated collection of materials that should disappear from the public eye as soon as possible, to an ongoing effort to identify and expose the potential value of discarded materials, and actualise that value with (and to the benefit of) local agents.

Instead of top-down waste management, the focus of my work can thus be better framed as creating systems for commons-based waste prevention. That is the perspective I apply to my experiments with digital technologies and modes of organising. I depart from the incremental improvement often seen in smart city initiatives: instead of deploying sensors and data collection tools to improve objective control by entities of centralised power, my research experiments with the opposite: the collective generation and governance of data to rebalance power relations (Mozilla Foundation, 2021). I sustain that any solutions –

technological or otherwise – in that context should be co-designed with knowledgeable stakeholders to ensure that relevance, trust, privacy and long-term dependability are incorporated by default. A chief concern is to ensure that those social groups already involved in reusing materials are not marginalised by future developments (Butoliya, 2018; Schröder et al., 2019). Instead, I want to leverage the capacity of such groups – small businesses, community initiatives or individuals – by exploring what would be a labour point of view (Wark, 2015) in the reuse of materials.

That research focus led me to conduct a series of activities around three cycles. I have investigated the behaviour of individuals and groups towards excess materials, mapped flows of second-hand and broken things in cities and regions, created design concepts in response to my findings, and prototyped speculative technologies to help assess the potential value of goods and objects and to make related data available. All those actions were developed through participatory methods, which will be described in Chapter 3.

It may be obvious nowadays, but it is always important to make it explicit: recycling is not the only solution for solid urban waste. In fact, there are many cases where recycling is unsustainable, too impactful or downright impractical (Syberg, 2022). Recycling has acquired a positive cultural value over the last decades, embodying a growing concern for the future of the planet. But objectively, it is an industrial process whose goal is to collect materials that are not in use, and transform them back as much as possible into raw materials that will feed other industrial processes (Jørgensen, 2019). There are accounts depicting the public acceptance of recycling as being engineered precisely to distract attention from the ill effects of the industrial use of plastics (Sullivan, 2020). The requirements for that system to work properly are very high. First, there must be a steady influx of recyclable materials, preferably already cleaned and sorted according to type and quality. There must be an industrial plant with the proper equipment, methodologies, workforce, sources of energy, social responsibility measures, and environmental licences. Finally, there must be an active market willing to buy recycled materials.

Influx, processing, output. Even taken in broad terms, there are many weak points in that design (Norman, 2020). When one tries to consider other aspects, this fractal setting gains even more complexity. For instance, the logistical challenges to collecting recyclables and redistributing recycled materials are already high, even if one does not factor in the cost and environmental impact of transporting things within the city – from neighbourhoods to sorting facilities, to recycling plants, then on to retail and finally to manufacturers willing to use the recycled materials for their production. Furthermore, even that image is based on the reality of a contemporary western/northern city with ideal transportation means, a population aware of the benefits of properly sorting recyclables,

and an industrial sector in need of materials. Most cities and urban areas in the world can not be portrayed that way, which complicates the situation even more.

My take is obviously not to altogether replace waste management and recycling with reuse. Those practices need to handle the greater part of waste, today and in the foreseeable future. My research, however, aims at reshaping the imagination about excess to promote community-based reuse of materials alongside conventional waste management structures.

1.3. Designing Post-consumption Flows

It is disheartening to realise that despite a recent increase in public awareness to issues of sustainability and climate change, the imagination around product design is still very much focused only on everything that happens before a product is purchased. Granted, there have been important changes over the recent decades, as users increasingly moved centre stage of the design process, which brought real-world use scenarios to the fore. There are also excellent alternatives currently under development that offer more sustainable sourcing of raw materials. However, there is little thought about what happens once the products start to fail, or are kept unused for any other reason. Of course, manufacturers are increasingly pressured by the public and policymakers to enable easier repairability and recyclability of their products, as proposed by the *Right to Repair* movement (Right to Repair Europe, n.d.).

Nevertheless, at any given second, virtually every city and town in the world is discarding high volumes of materials. A considerable part of those materials should not need to end up in recycling or incineration, or piled in landfills. Potential value is literally being wasted everywhere. The solution for that is not merely logistical. There are political issues to be unveiled, as well as cultural ones. Waste has deep connections with inequality (Liboiron, 2021). My thesis aims to significantly contribute to that discussion, starting with a reconnection of goods and products with the local and regional contexts in which they are used.

The first time I read about ‘bioregions’ was in the writings of John Thackara (Thackara, 2017). It is a perspective that asks one to think in a systemic way that integrates city, rural areas and nature. It provides a powerful way to expose assumptions often kept under the radar, especially to acknowledge externalities. Even though the themes around repair, reuse and waste are not related to a rural or a natural setting in obvious ways, it is still useful to think on a scale wider than only the city to understand how matter flows and is transformed within it.

Bruno Latour (Latour, 2015) uses the image of ‘black boxes’ to describe mechanisms whose internal functionality is opaque within a system. Such conceptual objects are only expected to receive inputs and, from them, provide outputs efficiently. One may argue that opening up black boxes and making them transparent reduces the overall performance of the system. On the other hand, it is only possible to have a clear picture once we look into the black boxes, expose the assumptions they are based in, and include more people in defining how they operate. The usual depiction of waste management systems is full of black boxes. My research tries to intentionally open up some of them.

1.4. Beyond Circularity

The vision of a circular economy is central to any contemporary discussion about waste and reuse. Nonetheless, my research is not completely aligned with that perspective. One of the many interesting questions I was asked shortly after moving to Dundee came from Professor Jon Rogers, Principal Investigator of the OpenDoTT programme. How about, he asked me, you thought of shapes other than a circle? Once I let that sink in, I began to understand what my main problem with the circular economy was. We can, inspired by the cradle-to-cradle concept (McDonough and Braungart, 2002), accept that ‘waste equals food’, or in other words, that the residues of industrial production could be seen as nutrients that can be fed back to the system. The second step would then be creating ways to ensure that the nutrients are efficiently identified, sorted, cleaned and transformed back into food. It is, however, important to ask what sort of creature we are feeding with those nutrients. In other words, should a more circular economy be used to provide frictionless nutrient flows to an industrial sector that has proved time and again that its only goal is to reproduce itself infinitely with no respect for nature and humankind?

My take differs in shape, if not in substance. Instead of nutrients, I like to think of discarded materials as potential value, or potential wealth. In 2016, I spent some weeks in Nantes, France. I was there invited by a local arts organisation to explore the scenario of circular economy projects in the region. The most valuable thing I learnt then was about the *agents valoristes*, in the original. It is an actual professional role: the person whose job is to evaluate what parts of discarded or donated materials can be either sold, repaired, or transformed. It reminded me of those TV shows of antique traders going to small towns to find potential acquisitions for their businesses. There is situated knowledge, skills and sensibility in that to be understood and put to use. The image of the *valoriste* was a constant inspiration for my research.

One of my favourite authors of near-future fiction is Cory Doctorow. I often say that most people read the wrong *Makers* book. Unlike Chris Anderson’s title that focuses on a ‘new

industrial revolution' (Anderson, 2012), the one written by Doctorow (Doctorow, 2009) is a story of a group of creative engineers in a warehouse in Florida repurposing the excesses of industrial production. One of them says: 'the world is full of capacious, capable, disposable junk and it cries out to be used again' (Doctorow, 2009, p. 34). A good *valoriste* can likewise see beyond the intrinsic characteristics of things, and envision how they can be dynamically reconfigured in different situations. For instance, an unrepairable object considered worthless for its original use could become valuable for an artist looking for particular material characteristics for an artwork.

If society is to cope with the vast amounts of waste being generated every day, the skills of the *valoristes* should be recognised and disseminated. Once that happens, we may see flows of matter not necessarily returning circularly to further fuel the industrial sector, but instead being absorbed and generating social value within cities and community centres, workshops, social enterprises and nonprofits. By treating waste as potential wealth, it is possible to design abundant systems that fight social and economic inequalities by combining the skills and labour of *valoristes*, repair and crafts professionals, amateur upcyclers and other groups active in the reuse of materials.

These initiatives can collect materials from their surroundings, identify the potential value in them, and make sure that that value is reverted to people and organisations in the vicinity. They can occasionally exchange materials with other initiatives in the neighbourhood or beyond it. Only afterwards the materials are to be sent back to the final disposal – recycling first, incineration or landfill when there is no alternative. Taken as a whole, such a system would hardly take the shape of a circle.

My PhD research focused on designing alternative approaches to excess materials. I have entertained the idea of creating technological solutions – sensors, equipment, online resources – to help identify and sort reusable materials, allowing more people to become networked *valoristes*, so to speak. I thought of using blockchain and online ledgers to track the lifecycle of particular objects, as some projects are already doing. I envisioned a future where I would get together with people developing apps for waste pickers in developing countries and see how my research could help. Or to develop concepts for city-based (or, better yet, bioregional) centres for the transformation of idle materials. I wanted to find ways to escape the seldom-challenged idea that only local governments and privately owned corporations should be in charge of all the processes related to waste in cities. What other ways could local societies propose to make good use of those potentially valuable materials?

1.5. Research Focus

Situating my investigation at the confluence of inclusive urbanism, open-source technologies and methods, eco-social innovation and service design, I defined my Research Question (RQ) in the following terms:

‘How can practices of reuse contribute to reimagining and reshaping the way cities handle excess materials – from industry-oriented waste management to community-based practices of local waste prevention?’

The RQ unfolds and can be explored through a series of complementary approaches:

1. Who are the potential stakeholders of community-based waste prevention, how is their behaviour, and how do they interact with each other and with other entities?
2. What skills, methods, techniques, information, and technology can help increase the proportion of materials currently being reused in cities and regions?
3. How to expand practices of reuse in cities through policy-making and cooperative- and commons-based systems?

1.5.1. Methods

Each approach to the RQ was addressed with a particular set of methods, as follows.

1.5.1.1. Stakeholders, Behaviour, Interactions

Stakeholders, their behaviour and interactions were explored with tools of research through design. The Repair Journey investigates how different individuals with diverse backgrounds and lived experiences think and act regarding objects that are broken, unused, unfit or otherwise inadequate. Additionally, interviews with experts in different contexts provided elements to compose an Ecosystem Mapping of existing stakeholders and gaps. The two initial studies resulted in the creation of eight design concepts responding to a focus on waste prevention. They were also instrumental in my familiarisation with contemporary practices in the field of design, as I came from a different disciplinary repertoire. Such a process of entering a different field of knowledge is also discussed in Chapters 3 and 4.

1.5.1.2. Skills, Techniques, Technologies

The skills, knowledge, information, and methods to help assess and act on excess materials were subject to community-based experimentation. A group of practitioners experienced in diverse kinds of reuse initiatives participated in a month-long online co-design lab. The participants formed a proto-community shaped in participatory ways. They

provided valuable feedback as I presented two speculative prototypes based on the design concepts created earlier, and influenced my decision to include a third one. The choice of such an open-ended perspective reflected the structural aspects of the OpenDoTT project. Chief among these was the emphasis on open design brought forth by the cooperation with the Mozilla Foundation. Furthermore, other members of the OpenDoTT Consortium enriched that phase with practical experience on open hardware for prototyping, and embedding privacy by design.

All those elements were assembled through reflective practice against the background of my past engagement with open-source projects both as a professional and an activist. Other influences I would notice later were my previous involvement in participatory action research projects about open science and digital culture; the influence I brought from my Master's degree supervisor who is an anthropologist researching technology and society; and finally, my cultural and social roots in Latin America, which carry a situated perspective on issues about community, life, coloniality, and social change. These questions are discussed in more depth in Chapters 3 and 5.

1.5.1.3. Policy, Systems

As described above, during the first two research phases, I engaged with fields like design research, open design and open-source prototyping, and applied lenses of decoloniality through situated participatory practices. As my investigation moved to consider prospective ways to effect positive change in policy and cities, the outcomes of those other studies were incorporated and reframed. Throughout the research, a concept emerged in response to my core research focus. Particularly when it comes to re-imagining and reshaping how cities handle excess materials. I called that concept 'generous cities', and over time recognised it as the main conceptual contribution of my thesis.

I am naturally aware of the risks of – and usually cautious against – using adjectives to qualify cities. Even then, using generosity in this sense was an intentional choice rooted in research. It allows my work to embed values such as a focus on community benefit instead of corporate profit, and the centrality of care to the social health of communities. Paulo Freire talks about radical love (Freire, 2017), and to my understanding, care seems to be an unequivocal manifestation of it. Generosity is also helpful in offering ways of overcoming the industry-focused worldview, by focusing on the notion of conviviality as proposed by Ivan Illich – a concept evoked frequently in this thesis (Illich, 1990).

I used those elements as a foundation to consider how to design policy and services at a local level. The idea was to contribute in a concrete way to help weave generous cities in

which excess materials can be reused for as long as possible before being considered waste. I consciously use the verb ‘weave’, understanding that systems of care and exchange already exist in cities. In that sense, it would not be a matter of creating anew. Instead, I want to contribute to recognising agents and organisations already active in the field, and support them.

Seeking concrete ways to embed those reflections into actionable measures, I decided to develop further another of the design concepts created in earlier phases of the research, the Reuse Commons. Informed by this perspective and by the results of my research studies and explorations, the Reuse Commons was transformed into a straightforward interactive method to facilitate constructive dialogue with potential stakeholders of ‘generous city’ strategies. The methods and activities developed during the third cycle are described in Chapters 3 and 6 of this thesis.

1.6. Positionality

I am no newcomer to waste-related issues, in particular the focus on reuse and repair. Back in the day, I was a proud founding member and one of the main articulators of the MetaReciclagem network in Brazil. MetaReciclagem was active for almost a decade, setting up computer repair labs in partnership with local and national organisations in all regions of the country. We got involved with dozens of different social and economic contexts whilst learning in practice about culturally valuable material practices in Brazil as well as our similarities and differences with the international hacker / maker / digital fabrication movements – a story I wrote more extensively about in the past (Schmidt Fonseca, 2015). MetaReciclagem had hundreds of members and multiple subprojects, putting me in direct contact with repair communities in Brazil and abroad.

In parallel, I have advocated for – and later consulted on – policies for e-waste management in Brazil. Some years later, I spent a short period as a Designer-in-residence at the VCUQ University in Doha, exploring practices of repair and reuse with the bright students of their MFA in Design program. I also spent a couple of months in Nantes (France) and in Lüneburg (Germany), investigating the commonalities between repair, traditional craft and digital making in an independent project called Transformatéria. I did side activities too, like offering a short course on repurposing materials found in the streets of Santos (Brazil) within a FabLab setting.

During those years, I have worked many times with communities, artists, and groups of students exploring creative approaches to reuse materials. My focus on those occasions was not exactly on the city scale. However, when I proposed that participants reflect upon waste over a local map, they often placed waste-related facilities at some abstract point

outside the city boundaries. In Doha, a student imagined objects piling up in the vast desert before we eventually visited automobile scrapyards in that landscape. During my early days in Dundee, an undergrad student said they imagined that the city council collected things and took them to a private company for recycling. The student had no idea where that took place exactly, though.

Along with my personal experience of engaging with waste pickers cooperatives in Brazil, I learnt that precariousness looms largely. There is a stark imbalance in power relations, with hints of greenwashing. The lack of dependable long-term policy makes the scenario all the more unstable. Those elements are also related to the scenario of global capitalism, as will be explored in Chapter 2. Other past experiences outside of academia also influenced the path I undertook in my doctoral investigation. Some examples are my involvement in setting up – and being elected to – participatory policy bodies; joining an action research project on open and collaborative science; and consulting for cultural institutions and international agencies.

1.7. Thesis Structure

This document comprises seven chapters, plus a section for References. Chapter 1 contextualises my doctoral investigation regarding thematic choice, institutional configuration and positionality. The main Research Question and an overview of the methods used to approach it are described.

Chapter 2 contains a review of context and literature, combining diverse fields of knowledge at the crossroads of which my research takes place. I combine sources such as theoretical authors, technical reports on smart cities, environmental legislation, and critical accounts of global capitalism.

Chapter 3 provides an overview of how my research positions knowledge generation in participatory and inclusive ways. I debate different ways of addressing the need to generate knowledge with humans, particularly those experienced in the kind of activities of material reuse I investigate. That exploration is condensed in the methods used to generate and document knowledge, and in an analogy, I defined it as a ‘spiral of openness’. It gives shape to three cycles of fieldwork and reflection, described in the following chapters.

Chapter 4 is my first fieldwork chapter, in which I report on two design research studies conducted during the first research cycle, the Repair Journey and the Ecosystem Mapping. The studies established the groundwork for my choice of community-based waste prevention as a research focus. The outputs of the studies described in this chapter

converged into a design briefing, and informed the creation of eight concept ideas in response.

In Chapter 5, I document the second research cycle: a co-design lab called reuse.city, whose objective was to explore the point of view of people involved with reuse initiatives. I expected to deepen my understanding of issues, limitations, and opportunities for change. During that time, I also worked on speculative prototypes – the ThingWiki and E-I – based on a subset of my original design concepts created in the first cycle, and established the basis for the third and final research cycle. A third exercise in prototyping was done with the Transformation Labs, another one of my concept ideas. The reuse.city lab was also an experiment in forming and reflecting on an international proto-community of people interested in repairs, reuse and material transformations.

Chapter 6 explores how I reflected on policy-making during the third research cycle, connecting my past experience outside of academia with what I learnt from participants during the PhD research and developing the concept of generous cities. Meanwhile, I returned to another of my concept ideas called Reuse Commons and designed an improved version of it in the shape of a toolkit. At the same time as being a straightforward output with potential uses for communities and organisations interested in my research, creating the toolkit was a way of documenting essential lessons I learnt.

Chapter 7 concludes my thesis, recapping the findings and discussing them. I describe my contribution to knowledge with the concept of generous cities, and point at potential ways to bring forward the topics and insights in the future.

1.8. Weaving Generosity

This chapter describes the driving elements of my PhD investigation. At the end of a long journey – four years in particularly extenuating times –, I look back satisfied with having conducted research studies that enabled me to understand, generate knowledge about, and create ways to intervene on themes whose relevance seems to grow by the day. I started my investigation by exploring the topic of smart cities critically, and decided to focus on waste, owing to my background experience. It is essential to remind that OpenDoTT was a doctoral training programme situated as a University-Academia cooperation made possible by the European Union’s Marie Skłodowska-Curie Programme. The leading industry partner in the programme was the Mozilla Foundation, a nonprofit deeply involved with the history of open-source software development and the ethics of openness and inclusion in technology. In that sense, my research was neither a typical academic exploration in the design field, nor an attempt to generate Intellectual Property for market-based commercial exploration.

As a researcher of Latin-American origin with an activist background, I aimed to leverage my research as a tool for positive change. One of the critical insights my work sheds light on is the gap between smart city initiatives, inclusive urbanism, and waste management.

Beyond supporting grassroots initiatives in repair, zero waste, upcycling, and other forms of material reuse, my research significantly contributes to reshaping the narrative of managing excess materials. Rather than just enhancing the arbitrary efficiency of waste management, I propose to focus on community-oriented practices of reuse that can genuinely benefit local populations, regenerate social bonds, and promote sustainable practices.

To facilitate this shift in focus, I have developed a set of design concepts and a toolkit to promote dialogue, cooperation, and local policy-making regarding the reuse of excess materials. I have also developed the concept of generous cities to ground initiatives in that direction. The following chapters will delve deeper into the processes that have guided me on this path, and explore these themes in greater detail. I expect my findings will enlighten and inspire new ways of thinking and acting in convivial approaches to excess materials and city life.

2. Context And Literature

As described in Chapter 1, my research was initially framed by a project-wide interest in investigating the open design of interconnected digital technologies. Those plans articulated reflection about 'internet health' as formulated by the Mozilla Foundation (Mozilla Foundation, 2022) and incorporated from the start critical aspects such as privacy and security. My initial role in the project was to explore such elements in the context of smart city initiatives. The OpenDoTT programme had a particular emphasis on discussing people-centred cities instead of focusing only on technologies. As also mentioned in Chapter 1, the project was situated in an institutional configuration with vocabularies of fields such as design research, Human-Computer Interaction, free/open-source software, and open hardware prototyping.

It was necessary to explore the confluence of diverse fields of knowledge covering political, technological and environmental bases to contextualise my work and define how best to approach my Research Question. It is important to stress that my investigation focuses on the community-based reuse of excess materials as an alternative to top-down waste management, and that position determined how I approached literature and my research activities.

Smart cities is a term stemming from the Information Technologies (IT) industry and gradually incorporated into public administration discourse. The most common understanding of smart cities relates to using digital and interconnected technologies to improve the efficiency of contemporary cities' management (Cocchia, 2014). That focus, or rather a critique of that focus, would lead me to draw elements from critical urban studies, as will be described in Section 2.2.

I open this chapter, however, proposing a more profound question about the very reasons that led me to take the position in OpenDoTT in the first place. Even though I could be formally considered, in the project, an 'early stage researcher' – as my previous academic career was not linear, spanning intermittent engagements for a couple of decades – I also consider myself experienced in other contexts. My experience outside of academia ranges from professional roles related to technology and media to being an activist for digital rights, media literacy and digital culture, and working with large-scale social innovation projects in nonprofit- and government-led programmes.

That backdrop made me particularly attentive to how the call to apply for OpenDoTT described its intentions in the smart cities topic: 'Can we create cities that are not just smarter, but kinder, fairer and more citizen-centred?'. I naturally suspected early on, but

upon getting immersed in research, it became clear that technology alone would not change much regarding kindness, inclusion, participation, and fairness. Therefore, this chapter starts with a quick but necessary reflection on the contemporary conditions of human life. I concur with authors who call it ‘the trouble’, as described in the next section. Only after setting that context will I move to explore ‘the city’. The following sections of this chapter reflect my choice to focus on the issue of waste – or rather, of excess materials – in cities and regions, in particular around collective practices of reuse and transformation of matter.

2.1. The Trouble

Acquiring a deep enough understanding of the relationship between waste and excess in contemporary cities requires the consideration of diverse disciplines and fields of knowledge. Even more so when the intention is to overcome a superficial narrative about cities, waste and excess and shape an adequate one that puts human beings front and centre whilst paying attention to sustainability, equality, and diversity. To set that scene, it is important for a moment to keep aside aspects that may appear fundamental – such as the materiality of waste or the formal structures of urban administration -and look at things from a broader perspective.

We live in a time of crises. Not a single crisis, but multiple ones. The need to mitigate the effects of climate change – becoming recognisably unavoidable (GAIA, 2022) – is gradually rising to the top of contemporary political and social concerns. To that, one may add a variety of other quite complex situations: the increasingly higher living costs, the disappearance of stable middle-class jobs and their promises, and sharp political division among local societies, families, and groups. We no longer aspire to fulfil a homogeneous bright vision that would increase the quality of life everywhere as seemed to be the case decades ago, willing to expand the 1950s American dream into a highly technological future – justly criticised by Richard Barbrook, it must be said (Barbrook, 2007). Instead, newer generations have to face a scenario of increasingly present extreme climate events; ‘gig work’ conditions that do not provide the means for a decent life (except perhaps for the few lucky enough to work in IT, but even for those, there is no long-term security or a veritable work-life balance); inert authorities with their hands tied; and an international economy that keeps extracting materials from the earth simply to waste them as quickly as possible (Webster, 2017). All the while, the wealthiest people on Earth either prepare for apocalyptic scenarios (Rushkoff, 2019) or to leave the planet (to the extent that anyone believes their propaganda).

I situate my research in that scenario of stark tension. Neither do I wish to develop

superficial technological fixes, nor to look away from the heavy stare of contemporary monsters. It is important to acknowledge the multiple crises to, following Donna Haraway, 'stay with the trouble' (Haraway, 2016). In the attempt to walk on the tightrope of contradiction, I adopt a critical stance whilst still expecting to help construct better futures.

'Staying with the trouble is', in that sense, a decision to observe and act critically. Haraway points to the essential interconnectedness of systems, affirming that nothing can generate itself. For that matter, the author posits the idea of *sympoiesis* (Haraway, 2016), countering the notion of *autopoiesis* in Humberto Maturana and Francisco Varela (Maturana and Varela, 1980). Whilst the Chilean authors proposed that life is composed of self-organised systems continuously remaking themselves, Haraway draws attention to the essentially relational nature of systems. She brings forth the idea of 'worlding' – transforming the noun 'world' into a verb and suggesting that we should 'become-with' the world. I will, however, return to the discussion about *autopoiesis* later in this chapter when discussing the ideas of Arturo Escobar.

Adopting a perspective according to which systems can not be tweaked exclusively by actors on their outside will form the core of how I approach the intention to effect concrete change in the world. It is also influenced by the perceived need to create tools for conviviality, following Ivan Illich. The author proposed in the 1970s an inversion of the infrastructures on the base of how tools are developed and made in current society (Illich, 1990). Such infrastructures would be built on the illusion that machines could be considered slaves to humanity, but in reality, humans were the ones enslaved by machines. Illich counters the idea of industrial productivity with one of conviviality. Conviviality should form the basis for building new tools and, by extension, configuring a society that regenerates social bonds severed by the imposition of industrial capitalism in the contemporary world.

Illich is not alone in questioning modernity, and industrial production, as a linear path towards a single and undesirable future. Anna Tsing and co-authors (Tsing et al., 2017) indicate modernity as the leading cause of the 'anthropocene' – the pattern of a geological era marked by human effects over the planet's surface. Even if Latour (Latour, 1993) proposes that modernity was an abstract goal never truly accomplished, it is essential to identify and problematise essential founding elements of that concept. As varied authors have noted (Castro, 2015; Escobar, 2018; Freire, 2017; Hui, 2018), western modernity is based on abstract ideas about civilisation values that are supposed to be universal. Such an understanding assumes – and enables – the imposition of one type of human existence over others – typically a male, cisgender, white, urban existence owing its

values to representative democracy, market economies and formal education[2]. Whilst recognisably rational and arguably well-intentioned, this set of assumptions often justifies unfair dynamics that sustain a colonial frame of mind.

It should be evident to anyone nowadays, but it's important to stress that coloniality is not a theme that belongs in the past. Neither is it simply a matter of historical reparation in financial or other terms. The history of recent centuries – including the emergence of an industrial society and the scientific revolution centred in the Global North – owes considerably to the intercontinental displacement of raw materials and natural resources and, for a significant portion of that time, to the exploitation of enslaved labour (Gutiérrez, 2016). Such configuration was based on many founding elements, not least of which military power, as well as the imposition and instrumentalisation of cultural and religious values – which enabled the dehumanisation of the 'other'; and unequal access to science and technology.

Industrial development, war and mass media further reinforced and expanded such inequality. And it still shapes contradictions of the contemporary world (Torretta and Reitsma, 2019) along the lines of neoliberal capitalism and its implications in terms of exploitative extraction of resources (in many cases still associated with violence and war), racial inequality (Chakravartty and Silva, 2012) and the environmental impact of economic activity. (Galeano, 1997). This mechanism is still happening today, especially around areas rich in crucial raw materials for digital technologies, such as Coltan in the Democratic Republic of Congo (Totolo, 2009), and Copper and Lithium in Chile (Riofrancos, 2021).

It is to be expected that the field of design – borne out of a global industrialised society – carries such contradictions as founding elements. The idea of decolonising design (Martins et al., 2019) starts by acknowledging such contradictions and proposing alternative approaches that incorporate other ways of thinking. For instance, Arturo Escobar (Escobar, 2018) explores a radical reshaping of design – from a field historically rooted in global industrial capitalism towards a diversity of practices geared towards effecting systemic change in the real world whilst acknowledging deeply contradictory conditions.

Against Haraway's opinion that *autopoiesis* is an impossibility, Escobar adopts a different reading of the term autonomy. He writes that *autopoiesis* is not autonomous in western terms; it is not about self-sufficiency. Rather, Escobar borrows from subaltern social movements in Latin America the concept of autonomy involving a critique of formal

2. I will return to this discussion in more depth in Chapter 3, while exploring my methodological approach.

democracy and an attempt to construct a different form of rule anchored in people's lives. That doesn't mean denying how local systems are essentially related to other systems – broader and connected laterally –, but instead recognising the agency of autonomous communities to design and continuously redesign their existence.

Escobar's articulation of autonomy can be further explored through the lens of 'more-than-human' design. This burgeoning approach in design theory acknowledges that designing is not solely a human activity but is participatory and includes more-than-human elements – such as ecological, technological, and other non-human aspects (Irwin, 2015; Kossoff, 2015). In other words, it recognises that design is fundamentally entangled with the broader ecosystem in which it operates.

This perspective aligns with Escobar's view by emphasising the importance of acknowledging the interconnectedness of systems and the mutual influence between local communities and their broader context. In this sense, autonomous communities are not just designing their own existence in isolation; their design practices are interconnected with the more-than-human world around them. This understanding reaffirms the agency of these communities in shaping their realities, while simultaneously recognising that they are part of a complex web of relations that extends beyond the human realm. Hence, autonomy in the design process does not contradict, but rather coexists with the more-than-human world.

As well as having a global impact, 'the trouble' influences the self-perception of individuals and of their capacity as well. Elaborating on ways to design regenerative cultures, Daniel Christian Wahl highlights the notion of 'inter-being' as central to a needed shift in narrative enabling people to realise their agency (Wahl, 2016). Wahl goes on to list chief elements in constructing regenerative design:

- practising deep questioning – and living with the questions – to avoid superficial insufficient answers;
- promoting transformation instead of aiming for sustainability;
- seeking system change through regenerative cultures.

Wahl's description of inter-being can arguably be interpreted as another take on conviviality – another reminder to focus on what connects humans – be it with each other or with other beings – instead of what divides us. Accepting that 'the trouble' is out there, perhaps the only way to move forward will be designing and putting in motion the necessary regeneration of ties.

The conscious use of design tools and methods to allow communities to challenge the top-down imposition of change upon them – and to reframe it towards relevant transformation – is a perspective I articulate in my research. It is crucial to start by having

a sense of the scenario. The following sections explore how the acknowledgement of ongoing crises and the intention to face them through the critical appropriation of many tools – including some situated in the very origins of 'the trouble' – can be articulated in terms of conviviality. That take seek horizons beyond those of a society shaped and mediated by industrial production only. The research focus will be situated on urban challenges on a local scale that reflect that global context, and subsequently explore issues related to waste, material excess, and policy.

2.2. City Smarts

As mentioned, this research started articulating contemporary concerns – such as openness, trust, and health – about how digital technologies are conceived, developed and deployed. Moreover, it had the mission of situating that discussion in the urban context by engaging with the idea of smart cities. Instead of focusing on how to create new devices that would make the management of cities and towns more effective, I decided to take one step back and start by questioning what could ‘smartness’ mean in that context.

It might be one of many examples of cultural differences made explicit in translation to and from other languages, but it seems relevant to express it here. In my native tongue, Brazilian Portuguese, the adjective ‘smart’ is often translated as ‘esperto’, or ‘esperta’, depending on the gender of the noun. *Esperto*, however, is not necessarily intelligent. Smartness, in this translation to Portuguese, has more of a connotation of a tactical skill combining intuitive and rational decision-making.

Umbanda – one of the most disseminated forms of Afro-Brazilian religious vocabulary – describes *Exu*, the trickster archetype, as that entity who opens paths and connects the material and spiritual realms. *Exu* is smart, he is ‘esperto’. It is not a coincidence that he is associated with communication and miscommunication – failure to communicate is part of communication. However, *Exu*, the trickster, must not be mistaken for the Western concept of pure evil. He is not a devil who opposes good, light, or humanity. *Exu* is a fundamental and integral part of world-making, always challenging humankind to overcome his jokes and traps.

I point to this potentially diverging understanding of what ‘smartness’ might mean for one particular reason: when smart city initiatives started being discussed in Brazil, they were translated to Portuguese as *cidades inteligentes* – ‘intelligent cities’. It might be due to prejudice against the mentioned popular understanding of ‘smart’, which also carries elements of class and race. Whatever the reason, my early perception of using digital technologies, sensors and data-driven devices in cities had a slightly different set of

preconditions. I did not expect only to see urban management-as-usual improved by an additional layer of interconnectedness. When I first started seeing those terms in the public debate, I expected to see critical discussion about adding ‘intelligence’ to municipal management – means to help decision-making to reflect the interests and well-being of local populations. Particularly under the troubled scenario of multiple crises described earlier in this chapter, intelligent decisions would be welcome. But they were nowhere to be seen.

While the use of digital technologies in public administration is definitely nothing new, its current incarnation – particularly around the term smart city – has emerged and was consolidated in the last ten to fifteen years. Stemming originally from the IT industry and its branches in public sector procurement, the idea of smart cities gradually entered the vocabulary of diverse national and local governments. However, it carries a particular worldview tributary of its origins, which deeply impacts local societies and communities.

As smart city projects started to be widely advertised and, in some cases, deployed, that narrative focused on a somehow limited number of areas (Batty et al., 2012; Kellermann and Jones, 2013; Ratcliffe, 2004; Selwyn, 2016; Zanella et al., 2014):

- public transportation, usually control of fleet and traffic lights;
- camera surveillance for public safety;
- energy management and public lighting;
- waste collection and recycling;
- weather sensors and disaster prevention;
- inventory and resource management.

Most of the mainstream narrative – the one reaching public opinion – about smart cities usually comes from two main types of actors: IT vendors and politicians. Rob Kitchin (Kitchin, 2014) lists some adjectives associated with the use of technologies in cities over the last decades: wired, cyber, digital, intelligent, smart, and sentient cities. Over time, those terms consolidated under the term smart cities. Kitchin identifies two main understandings of that. First, using digital devices to generate, process and access data, arguably increasing the efficiency and sustainability of cities. The second would be a transformation through which a city’s economies and governance would increasingly be based on knowledge, innovation, and creativity. The two visions are often intertwined, even more so in corporations’ and governments’ PR discourse.

2.2.1. Urban Scale

According to the United Nations, at some point between the years 2005 and 2010 the

proportion of urban human population on Earth surpassed 50% (United Nations Population Division, 2018). According to estimates, in 2017 that number reached 55% – in absolute terms, more than 4.3 billion people worldwide (Ritchie and Roser, 2023). Cities and towns are the first layer of contact between the individual and society. It is only natural that the growing attempts to use digital technologies and contemporary methods to manage cities have a direct impact on urban populations. However, a significant part of what came to be called ‘smart city’ initiatives has a relatively hollow understanding of what cities are.

Adam Greenfield considers that some assumptions of smart city projects are quite problematic (Greenfield, 2013) considers that some of the assumptions of Smart City projects are quite problematic. In particular, the idea that technologies for the urban environment are generic and easily replicable, disregarding contextual differences between localities and political systems. Crucially, Greenfield suggests that smart cities aim at a sense of objectivity that is not achievable, based on an abstract idea of efficiency that removes politics, dissent, and negotiation. Here one can draw a parallel between the notion of productivity in Illich (Illich, 1990), already discussed in an earlier section of this chapter, and what Greenfield identifies as this unattainable sense of efficiency. Illich and Greenfield share a critique of a system that emphasises productivity and efficiency at the expense of human autonomy and the richness of human experiences. However, while Illich focuses on how societal structures and technologies can hinder personal freedom and conviviality, Greenfield zeroes in on the unrealistically high-efficiency expectations in smart city initiatives that could lead to a depersonalised urban environment. Both call for a more human-centred approach that values creativity, autonomy, and meaningful social interactions.

To Greenfield, the smart city could not exist outside a neoliberal political economy centred in the Global North, revolving around privatising public services and reducing the population to isolated individual agents – ultimately private clients of said services. Smart cities would also be used as experimental test-beds, often without informed consent from local people. The pace of change in the digital realm would make it hard for local authorities to fully understand what they are signing up for, let alone pursue accountable participatory decision processes. There is an underlying assumption that cities should be run like companies, and their services run by businesses, which entails essential issues to be raised concerning ethical questions (Graham and Thrift, 2007).

Another aspect to bear is that IT firms might well be implementing the methods they use to disrupt their markets by testing many simultaneous versions of solutions ‘out in the real world’. For instance, proposals popular among digital entrepreneurs like the Lean Startup

(Ries, 2011) offer simple examples of these methods. In that sense, every attempt to deploy, for instance, sensors and actuators connected to dynamic grids of wireless networking to generate and use data, could be treated as a particular experiment that will provide new ways for vendors to test their hardware, software, ethical framing, branding, and narrative. The unbalance in this situation is that local populations are no longer the beneficiary of technologies, but rather guinea pigs of unavoidable experiments run by governments and IT vendors (Ahmed et al., 2019).

If a unidimensional concept of smart city is hardly consensual in developed cities of the global north, what would be the implications of trying to replicate such models internationally? Power relations are naturally expressed in the social imagination about cities. Writing about the Indian government's plan of creating one hundred smart cities, Ayona Datta sees power dynamics at play, on the one hand, in the fast urbanisation of post-independence, hence post-colonial India (Datta, 2015) and on the other hand with enduring colonial practices of city-making (Datta, 2018). She observes that to young urban people in India, asking critical questions about social and environmental justice in smart cities may lead one to be considered anti-Indian. As a consequence, local powers that support and fund initiatives interpreted as smart cities – whatever shape they take – can also extend their power to the cultural imaginary.

A notable limitation of discussing cities only in terms of data, technology and the physical management of electronic devices is losing sight of what constitutes cities in broader terms. To that point, McFarlane and Sörderström (McFarlane and Söderström, 2017) suggest that the 'urban' part of smart urbanism should be analysed in more depth. Richard Sennett (Sennett, 2023) opposes closed cities to open ones, stating that the latter is easier to repair and enables a more just and abundant society to develop. The contradictory interests of private corporations, local government and populations can, however, be a good starting point.

There is a rich history of scholarship reflecting precisely on those boundaries. Coherent to choices made in this research to give precedence to the perspective of the communities affected by technological development and seldom heard, it is interesting to bring to the fore the theoretical contributions of Henri Lefebvre. His notion of a *Right to the City* (Lefebvre, 1996) asserts that cities are essentially social and cultural constructions. A city would be the site of social exchange – as much a product as a medium (Hubbard and Kitchin, 2010, chap. 37).

Lefebvre's central argument that every city-dweller must have a right to the city is a clear and generative challenge to the way smart city projects see local communities, even more so when there is criticism, opposition or legal questioning of such projects. Willis asks,

‘Whose Right to the Smart City?’ in questioning who are the subjects of smart city projects (Willis, 2019). Pointing at the implications for marginalised communities in the city of Chennai and how the India Smart Cities project was planned and implemented there, such question echoes authors such as Peter Marcuse, who asked ‘Whose right(s) to what city?’ (Marcuse, 2011).

Marcuse is keen on stressing that Lefebvre’s right to the city was not a mere quest for inclusion in the current city shape. Instead, it related to future, evolved shapes of cities controlled by the people who live in them. Seeking humanised smart urbanism, Kitchin suggests using utopia as a method to articulate a future present in which the interests of city-dwellers are reflected and served. In such a future, inclusive deliberation would take place, people would interact in ways other than only market-based relations, infrastructure would be organised as commons, and excesses of platform capitalism would be counterbalanced (Kitchin, 2019).

In the same direction are discussions about the very meaning of citizenship and justice in smart cities. In *The Smartness Mandate: notes towards a critique*, Orit Halpern, Robert Mitchell and Bernard Geoghegan argue that the smart city narrative often oversimplifies complex urban issues, presenting technology as a universal solution without sufficient scrutiny (Halpern et al., 2017). They stress the risk of perpetuating existing inequalities due to the influence of major tech corporations in shaping these initiatives. The authors call for a more democratic approach to urban technological interventions.

Trying also to overcome contemporary contradictions, Evgeni Morozov and Francesca Bria (Morozov and Bria, 2018) argue that the contemporary city is the very place of reproduction of neoliberal capitalism. The political and economic forces influencing how cities are developed and managed may – hypothetically at least – be countered by the concept of technological sovereignty. It would not be about refusing the use of technologies *per se*, but instead defining the terms and shape in which such technologies are developed autonomously. Such a take echoes Arturo Escobar’s take on autonomy: not one of independence, but of building alternatives rooted in people’s lives.

Morozov and Bria hint at the idea of remunicipalisation of services – at an infrastructural level as well as in terms of imaginary. They assert that cities are well positioned to go beyond what philosopher Mangabeira Unger calls a ‘dictatorship of no alternatives’ (Morozov and Bria, 2018, p. 24). One step in that direction would be discussing models of data ownership different from the exclusive extraction of data value by private corporations. Bria and Morozov also echo Paul Mason (Mason, 2016) to propose that non-neoliberal smart cities should have the commons and collaborative production as points of reference, and seek to build municipal data commons for data generated by local

populations. The urban commons are also found in David Harvey's proposals to articulate opposition to global capitalism in cities (Harvey, 2019). The author sees the urban commons not just as shared resources but as the communal processes of managing and creating these resources, which he sees as an integral part of the fight for social justice in cities.

Among the many possible ways to criticise the smart city narrative, the lack of agency for local populations is a frequent concern. It may be redundant to argue that democratic institutions should regulate the deployment of data-driven devices in the urban environment with transparent and accountable rules. Considering the international expansion of smart city projects, it is crucial to clearly associate visions of future with inclusive and participatory governance. In nations where democratic institutions are still emerging and gaining stability, there is a need for even more participation and consensus-making. Not less.

Another aspect of the idea of smartness as applied to urbanism and city management is whether a city can be 'too smart' for its own good. Ben Green wonders about the 'smart enough city' – what would be the threshold over how much technology is necessary or safe (Green, 2020)? Green argues that smart city projects usually aim at optimising for digital order and end up misdiagnosing urban problems and the difficulties of implementing a utopian technological solution. However, he also highlights how technology can alleviate real issues for people and how cities worldwide are experimenting with policies and practices that prioritise the needs of their residents. The author argues that 'smart cities' are not the solution to the challenges of the 21st century, but instead, we should strive for liveable cities that prioritise policy and process reforms over technology innovations.

A case of popular opposition that became well-known happened when Sidewalk Labs, a subsidiary of Google, tried to develop a smart city project in a valuable waterfront area of Toronto, Canada. Activists reported that in a series of meetings with the local population, the company would collect feedback and reshape its narrative but never change their plans significantly (Ahmed et al., 2019). Ultimately, the activists argue that it felt as though the city didn't have the right to refuse that development plan. Still, the local population continued the pressure and voiced their concerns regarding data extraction, privacy and long-term dependability of a totally private smart city development. Eventually, Sidewalk Labs gave up on the project, alleging concerns over the world economy amid the COVID-19 pandemic (Doctoroff, 2020). The episode suggests that the dominance of a top-down smart city rhetoric is not absolute and may sometimes be challenged by social movements.

Duncan McLaren and Julian Agyeman present a vision of cities where sharing is prioritised, not just in terms of physical resources like tools and vehicles, but also in sharing time, skills, and experiences (McLaren and Agyeman, 2016). This sharing extends beyond traditional market-driven platforms and emphasises inclusivity, community engagement, and social and environmental justice instead. Their notion of ‘sharing cities’ proposes a shift from individual or corporate gain to a focus on the collective good, suggesting a holistic and equitable path towards urban sustainability. It is the vision of a convivial society, mentioned earlier in this thesis. Both perspectives argue for systems that enable individuals and communities to thrive sustainably and equitably outside the rigid constraints of industrialised, consumption-driven models.

2.3. Excess, Waste, And Circularity

This thesis seeks to expand the ways in which goods and materials are reused in cities and towns. It focuses on community-oriented practices such as repairs, upcycling, repurposing and re-circulation, among others, to extend the lifetime of things. It does not, however, fit easily within the field of waste management. Obviously, there are important intersections and overlapping, at the same time that there are arguably productive tensions. But it’s not a thesis on waste management.

Defining the boundaries of what I have studied, engaged with and reflected upon deserves more nuanced attention before we start thinking of systems, practices, policies, and design. My research establishes connections between system-wide crises ('the trouble' mentioned in Section 2.1), the urban context explored in the previous section, a global perspective to be discussed on Section 2.3.2, and the skills, experience and knowledge necessary to operate on a more practical level.

The object of my research is not exactly ‘waste’ – those products discarded by people and organisations once they are not deemed useful anymore. Instead, it engages with practices of material reuse carried out by people, communities, and organisations worldwide. It could then be said that the context of this investigation – arguably, its meta-object – is composed of such people, communities and organisations. Nonetheless, its object – to the extent that there is one – is excess.

Excess is a term with diverse meanings. Georges Bataille developed his original theory on a general economy based on excess instead of scarcity (Bataille, 1988). The author argues that life on Earth derives from an initial superabundance of energy originated on the Sun, that expands into our planet. Life forms would receive more energy than necessary for maintaining life, and ensuing excess could be used to grow systems. When limits for that growth were achieved, the remaining energy should be spent – be it in form

of waste, or otherwise channelled. According to Bataille, this was the origin of human habits of gift economies, such as the potlatches in *First People*'s civilisations in the Americas. On the other hand, it was also a driving force behind wars and conflicts – in summary, misguided and destructive ways to channel excessive energy.

Excess from this perspective is then seen as a continuous flow of resources into a system, with physical and social implications. Humans have agency – through social habits, culture, science, the arts – to intentionally turn excess into growth or other positive uses. Such tension and complementarity between excess, abundance, use and waste, informs reflections made in different moments of my research.

Still on the realm of economic theory, there are other interesting takes on excess. David Harvey points to the concept of overproduction in Marx's *Capital* (Harvey, 2010): being oriented solely towards profit, capitalism would continuously attempt to increase production. That would lead to crises that would only be solved by expanding markets, resorting to war and conquest, and destroying excess goods. In the Communist Manifesto, Marx and Engels write that the periodical crises of capitalism would lead to the destruction of part of the existing products, caused by an 'epidemics of over-production' (Marx, 2018, p. 26). Contemporary commentators qualify that argument, saying that such crises do not originate on the lack of demand, but on the lack of effective demand – enough people with purchasing power to acquire goods (Miéville, 2022).

Since the 19th Century, when Marx and Engels developed their view of capitalist political economy, profit-oriented industrial powers have created innovative ways to avoid the crises of overproduction whilst keeping demand in control. Remarkably, the motivation for such innovations is seldom geared towards more equal distribution of wealth, or less environmentally impactful production. Instead, concepts such as 'programmed obsolescence' were developed and adopted across industries, as brilliantly depicted in the documentary film *The Lightbulb Conspiracy* (Dannoritzer, 2010). This way, manufacturers no longer need to destroy goods to balance prices and ensure profit margins before they are purchased. Rather, the planned reduction of product lifetime – through decisions in design and engineering as well as PR – makes consumers discard and replace their goods at a faster pace. The result is a steady growth in the generation of waste.

In their seminal work *Pollution is Colonialism*, Max Liboiron challenges how regulatory agencies classify the presence of contaminants, determining thresholds of absorption above which environments are considered polluted (Liboiron, 2021). Besides relying on debatable physio-chemical characteristics of discrete materials, Liboiron say that such an approach assumes that land, water, the air, and other common goods, are indisputable receptacles of human excess.

Liboiron and Josh Lepawsky are proponents of a novel field called *Discard Studies*, in which a central concept is the idea of externality. They write that waste and pollution cause negative externalities on people and groups of people that did not consent to these externalities (Liboiron and Lepawsky, 2022). This harm is ‘not properly accounted for in the original calculations of benefits and costs’ (Liboiron and Lepawsky, 2022, p. 22). Here again, excess is something external to a system, a force coming from outside that has considerable impacts.

Assuming that global industrial production will not change course significantly on the short term, one can expect that the excess of global manufacturing will keep pouring into cities and regions. That is a characteristic of current times, a sign of 'the trouble', an unbalance in global systems. Nonetheless, Bataille’s take on excess and the ways to make productive use of it can inspire alternatives. Establishing a dialogue with his point of view, we can acknowledge that part of the excess generated by industrial activity will indeed generate growth. Another part, for the time being, will be wasted. A fraction of that, however, could still have value, and that is the focus of this thesis.

To be more specific: the alternatives I seek to develop in my research do not aim at handling altogether all the material excess erupting into cities. My intention is to develop ways to understand what parts of such excess can generate benefit to local communities. That benefit can be economic, environmental, educational, artistic, social or otherwise. It is best attained by concentrating on goods and materials that are:

- prematurely discarded after being used for a time,
- broken or considered unfit, obsolete, or otherwise inadequate, or
- kept out of use for any other reasons.

Because of how materials are handled in contemporary societies, there is no straightforward way to work exclusively with those materials without engaging with the collection and processing of waste. The next section lays the scenario of waste policy in contemporary cities, discussing its accomplishments and limitations regarding the focus of my research.

2.3.1. Waste In The City

Tony Fry posits that cities, though significantly contributing to climate change due to their dense population and activity, are at the same time essential actors in mitigating its effects (Fry, 2014). Fry underscores the importance of reorienting urban design, policy, and innovation towards sustainability, along with capitalising on cities' potential for resilience. He emphasises the need for reimagining the existing social, economic, and political structures within cities to achieve a sustainable future.

Among the many areas under the responsibility of local public administration, the handling of waste seems to be one in which the contradictory dynamics of smart cities mentioned in previous sections are at their extreme. In short, the imposition of a top-down neoliberal perspective that understands cities as mere economic flows and deliberately fails to engage with social considerations. Society at large usually lacks agency in decisions about waste management. In fact, not many people even know what decisions are made and what their implications are. In other words, very few city-dwellers typically know what happens to the waste produced by their households and businesses, and even fewer are involved in conversations about how best to handle it.

Solid waste – the sum of all unwanted materials from households, businesses, community organisations and the public sector – is 'inextricably linked to urbanisation and economic development' (Hoornweg and Bhada-Tata, 2012, p. 2). Typically, the local authority has a provision to handle the waste against charging a tax or fee. Over the last decades, waste management systems have been gradually adopting a set of similar recipes all around the world (Coffey and Coad, 2010). One general trend is the separate collection and destination of recyclable materials and general waste. The latter often ends up in landfills, or being incinerated – a process occasionally used to generate energy. The former is sent to be recycled and turned into raw materials through diverse industrial processes. There are also those types of materials that need special handling, such as medical, electronic or other potentially hazardous waste.

Most of the practices for handling municipal waste are arguably oriented to make it invisible from the eyes of local populations. While there is an understandable – visceral – discomfort of humanity to facing the waste it generates, this discussion acquires particular relevance regarding smart city projects. Many such projects aim at simply increasing the efficiency of municipal services the way they are usually performed – which in itself is already prone to questioning (Greenfield, 2013). Further, they typically do not challenge whether the assumptions those services are based upon are correct. And there is indeed much to question about current practices of waste management.

A topic gaining ground in public opinion about waste over the last decades is recycling. And precisely its growing presence in everyday conversations makes it essential to be objective about what is and what is not recycling. Jørgensen describes the industrial path leading to recycling as follows (Jørgensen, 2019, p. 5):

> Streams of matter, raw and refined, torn from the earth or fashioned from organic matter from eons past, converge, for briefer or longer periods of time, in objects, products, or things, crafted by hand or industrially fabricated, vested in meanings and often subject of controversies. After a period of use, long or short, the individual components separate again into streams. Sometimes this separation is easy, generating new and relatively pure

> materials. At other times it is hard, where materials have become so intertwined that they resist separation. Such separation processes require technical means, but also social organization and cultural valuation.

Recycling, to be clear, is an industrial practice by which discarded objects and matter are transformed into materials for renewed manufacturing. Other possible destinations for discarded material, such as storing it in landfills or incinerating it – even when for purposes of generating energy – are obviously not the same as recycling.

It is important to be strict in such definitions, as imprecision about what can be called recycling frequently leads to significant distortions. For instance, various interesting projects claim to be ‘recycling’ when they are in fact ‘reusing’. That is not to say such initiatives are less essential than industrial recycling. Quite the opposite, from the perspective of this thesis. Still, reusing is not recycling. Treating them as equivalent only favours the large industrial actors who benefit symbolically from recycling on controversial grounds (MacBride, 2013; Syberg, 2022). One of the consequences of such a mix-up is the popular assumption that as long as the rate of recyclables being collected continues to increase, there would be no need to reduce consumption. Just as the absolute volume of materials being extracted and discarded keeps growing, so does their impact on nature and society. Reuse will be explored at length in this thesis. For now, suffice to differentiate it from recycling.

Recycling implies intensive use of energy – for the material processing proper as well as for the required logistics to enable it. In recent years, critical journalistic investigation has associated plastic recycling with a PR effort led by oil companies (Sullivan, 2020). Even more complicated is the recycling of complex materia2.ls such as WEEE – waste electronic and electric equipment –, supposedly regulated but still out of control (Basel Action Network, 2018). Recycling also has contradictory economic implications. Turning manufactured goods back into raw materials, in numerous instances, equates to losing material value. The term ‘downcycling’ is applied for such – rather common – cases in which the output of recycling processes is a material of lower quality than the raw materials initially used for manufacturing (McQuibban, 2021).

Along with its growing presence in culture and society, recycling has also emerged as an critical theme in policy. For example, the European Commission’s 2008 directive on waste established recycling targets for the following decades (European Parliament, 2018). According to this directive, by 2030 the EU should recycle 60% of its municipal solid waste. Additionally, the residual waste volume (collected waste that can not be recycled) should be cut drastically in the same period. A report prepared by the European Environment Agency informs that even though the rate of municipal waste recycling has been increasing, the amount of residual municipal waste – what is left over after recycling

– has stabilised. For that reason, achieving the established target of halving the amount of residual municipal waste requires policies beyond recycling. To this point, a report produced by the European Environment Agency depicts (Figure 1) the operations predicated by the EU Waste Framework Directive (European Parliament, 2018).

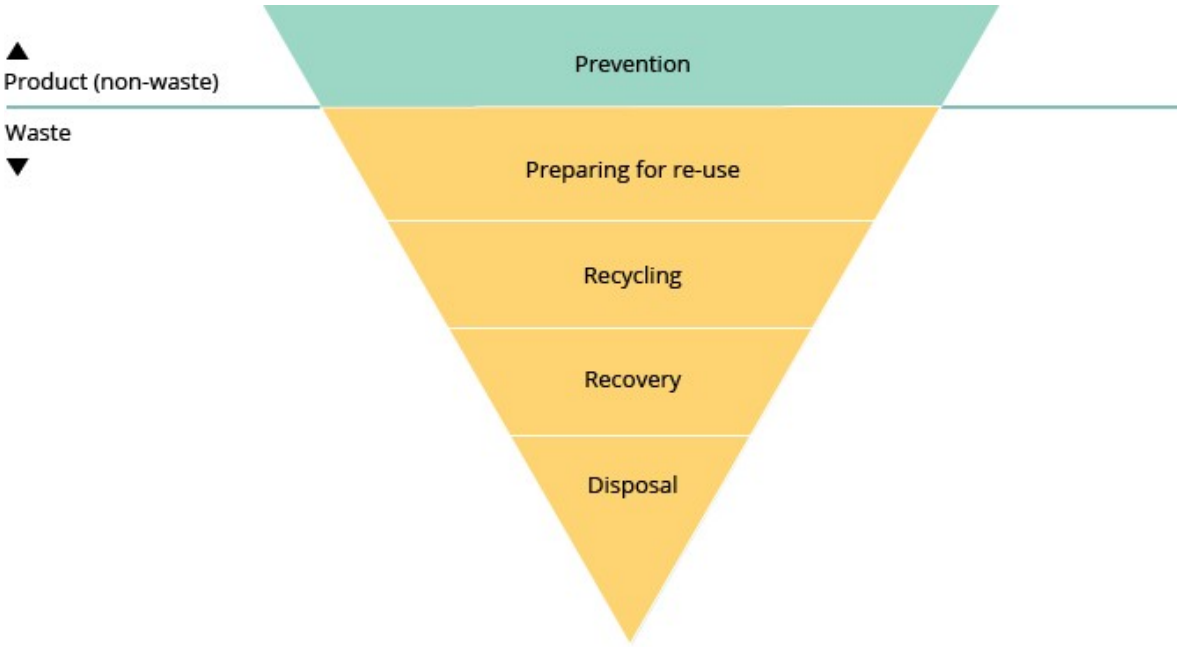

Figure 1: Reaching 2030 Target – EU Waste Framework

It is crucial to bear in mind that the graph depicts a hierarchy of priorities: the first measure to be taken regarding waste should be its prevention, which provides 'the highest effectiveness with the lowest cost' (Esmaeilian et al., 2018). On a second moment, when products reach the end of their use, they can still be reused. Only when the possibility of reuse is unfeasible should products be sent to be recycled.

Practices described as 'waste prevention' or 'waste avoidance' are essential in this context. Indeed, lately there have been significant new developments that consider the idea of reusing materials instead of disposing of them through recycling, landfilling or incineration. Current policy at an international level recommends shifting from a mindset of 'waste disposal' towards 'resource management' (UNEP, 2009). When it comes to smart city strategies for waste management, however, these alternatives are all but absent. In other words: smart city projects don't really discuss waste prevention. There are occasional mentions of waste, but an almost exclusive focus on waste collection, such as smart bins (Aazam et al., 2016) or smart routing for garbage trucks (Esmaeilian et al., 2018). Willis (Willis, 2019) sees the same pattern in the way the project Smart Cities India is implemented in Chennai: technology-centric solutions that disregard that city's established – and largely people-centred – systems of waste collection. According to the

author, in order to justify their own implementation costs, such solutions risk eliminating the informal sector altogether regardless of the impacts on the groups involved with it.

2.3.1.1. Circles

Even considering the centrality of recycling as a means to handle the bulk of municipal solid waste, it is vital to acknowledge alternatives emerging more recently. A cornerstone of such developments is the constructive work of William McDonough and Michael Braungart, chiefly their book *Cradle to Cradle*. The authors assert that industrial production has historically been shaped over a linear path, which they dub ‘cradle to grave’. They suggest that not only the end of the supply chain but the whole of industrial production should be reshaped along the lines of designing fully recoverable products. They propose the formula ‘waste = food’, according to which products should be designed so that after being used, they become nutrients. Such nutrients can be of one among two types – biological nutrients that can be reincorporated by nature, or technical nutrients that can be reinserted in industrial production.

Cradle-to-cradle was incorporated as a building block in the depiction of a 'circular economy' espoused by the Ellen Macarthur Foundation, or EMF (Webster, 2017). The origins of the circular economy are located by some authors in the 1960s environmental movements (Crocker, 2018). Others suggest that the economy was largely circular throughout human history until the end of the 19th century (Aggeri, 2021), having shifted due to the industrial revolution, the rise of the hygienist movement, and the growth of the consumer society. In any case, contemporary discourse about the circular economy is largely associated with the attempt to reduce the environmental impact of industrial production. In that understanding, it proposes that industrial production should be inspired by nature for the design of products (‘biomimicry’), incorporate reuse and recycling at every step of the industrial output, and create novel economic formats based on services instead of product consumption. The EMF produces diverse reports on the potentialities of the circular economy for different sectors and its implications in legislation and application in cities (Ellen MacArthur Foundation, 2019). Their infographic helps people from diverse backgrounds and levels of experience understand the EMF’s vision of a circular economy (Figure 2).

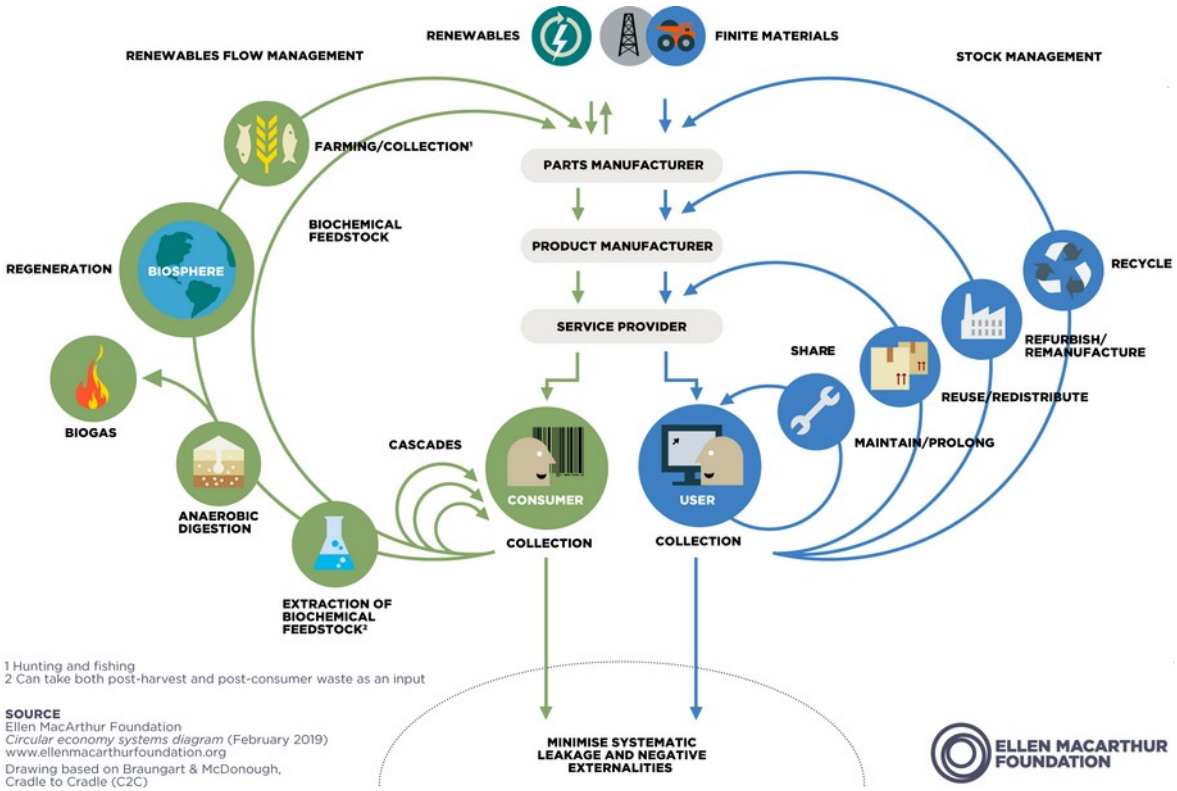

Figure 2: Circular Economy Systems Diagram – Ellen MacArthur Foundation

Such a distilled and straightforward vision made it easier for the circular economy to inform developments in various fields of knowledge. It inspires diverse projects attempting to reshape consumers' relationships with products and manufacturers, and forms the groundwork for further conceptual explorations. Publications such as the re-use atlas (Baker-Brown, 2017) or Radical Matter (Franklin and Till, 2019) were published, as well as reflections on circularity in niches such as urban regeneration (Torre et al., 2019).

Criticism of the EMF version of a circular economy concentrates chiefly – much like regarding the prescriptive blueprints of smart cities, one might say – on the way it gives an unbalanced weight to the interests of industrial actors and governments. Consequently, there is little consideration of local populations or informal actors already active in reincorporating materials into industrial production. Nicky Gregson and others (Gregson et al., 2015) critique the lack of attention given to the current actors involved in waste recovery, such as informal waste pickers. Jouni Korhonen and co-authors (Korhonen et al., 2018) argue that the circular economy's current discourse and practice are too closely aligned with the prevailing linear economic system, potentially perpetuating existing economic and power structures. Mariale Moreno and others (Moreno et al., 2016) highlight the over-emphasized role of design and the lack of emphasis on social aspects within the circular economy concept, which may marginalise those already participating in the process. Implications of the circular economy in international contexts will also be

discussed in Section 2.3.2 of this chapter.

All things considered, CE has successfully been influencing policy and legislation relevant to the topics discussed in this thesis. For instance, the European Union has a Circular Economy Action Plan (European Commission, 2015). It focuses on product design, production processes, consumption, waste management, secondary raw materials and water reuse. Its priority areas are plastics, food waste, critical raw materials, construction and demolition, and biomass. The document also mentions innovation, incentives, and ways to monitor progress. It nominates the European Environment Agency as the institutional body with which the European Commission must cooperate to develop the circular economy. As well as having consequences for projects and policies under development in the European member states, the CE policy was also incorporated as one of the eight elements of the European Green Deal enacted in 2019 in response to the global climate change crisis (European Commission, 2019).

Still on the regulatory front relevant to waste prevention, civil society has made significant efforts recently to promote discussion about the right to repair (European Commission, 2023). Under this perspective, manufacturers should bear the responsibility to enable their products to be repaired for longer periods – for environmental and socio-economic reasons.

A remarkable particularity can be found in official documents, such as the European Environmental Agency's Briefing on the limits of recycling (European Environmental Agency, n.d.) published in 2022. Instead of simply setting targets for the rate of recycling in municipalities, the report uses the more elaborate term 'recycle or prepare for reuse'. From that, it may be inferred that the imaginary around solid waste treatment has more nuanced implications in policy than in the public opinion, often limited to recycling. The briefing describes preparing for reuse as 'checking, cleaning, or repair operations, by which products or their respective parts are prepared to be reused, without requiring any other pre-processing'.

Concrete aspects of the reuse of materials will be further explored in following sections of this thesis, but its appearance in that kind of official communication by institutional bodies is noteworthy. On the one hand, it may signal a change in mindset that would allow alternatives to recycling to be incorporated into waste-related policies. On the other, it can arguably be interpreted as a move that eases the responsibility of governments and companies in the case that the effective recycling rate stalls. It would, in a sense, allow the involved parties to argue that they have acted to increase the rate of separation and collection, but ultimately cannot be held responsible if recycling proper was not as effective. In any case, the reuse of materials should be incorporated into any

contemporary discussion about how to handle waste, be it through the right to repair, building a circular economy, promoting cradle-to-Cradle industrial production, or other constructions that may emerge.

Kirsten Van Dam and co-authors (van Dam et al., 2020) see a significant increase in research exploring the circular economy in industrial design journals, with four main thematic areas emerging: design for circular production processes, design for circular consumption, design to support policy towards the circular economy, and design education for the circular economy. The authors note that while there is potential for design to play a significant role in advancing the circular economy, there are still some areas that need more exploration, and suggest that design researchers should assess the potential and limitations of existing design tools and explore how specific design practices can be applied in different contexts.

Going beyond the idea of a circular economy, Kate Raworth proposes the re-drawing of the whole economic science around her concept of a *Doughnut Economy* (Raworth, 2017). This construction recognises the need to consider the spectrum of potential impacts of economic activity in environmental and social terms. Raworth's work influences a growing number of initiatives developing their local or regional doughnut economy plans. These methods allow societies to discuss critical issues and design metrics to promote and monitor changes within the complex systems they are invariably situated in.

2.3.2. Reuse Out There

Most of the alternatives proposing waste prevention through a circular economy are chiefly concerned with designing products that were not yet manufactured. They do serve as concrete recommendations for more balanced futures in industry and society. The reality, however, is that an incalculable volume of materials has already been extracted from nature and transformed – through energy and labour – into products and objects. That keeps happening on a massive scale even as I type these words. Many – or rather, most of – such products were not built to be easily re-incorporated into industrial cycles – and even when they are, society should be able to discuss whether or not it wants to help provide reliable feedstock to industrial production, considering its broader effects in the world. On the other hand, a significant proportion of said materials might still retain value even if currently out of use. Sending them to be recycled prematurely equates to a waste of potential value. This section navigates the possibilities for the identification and realisation of that value. That includes objects discarded prematurely and those not currently in use for other reasons such as planned obsolescence, difficulty to repair, and other inadequacies.

2.3.2.1. Re-circulating Things

Business journalist Adam Minter is the author of *Secondhand: travels in the new global garage sale* (Minter, 2019). He explores the re-circulation of second-hand goods in diverse contexts: the south of the USA and northern Mexico, Japan, Benin, Ghana, Malaysia and other places. His portrait of second-hand goods circulation brings an interesting perspective to the discussion of waste prevention. Minter constructs a more nuanced view based on his visits to thrift shops, repair collectives, landfills and other commercial and not-for-profit initiatives.

Minter's descriptions question the common assumption that consumers will typically purchase new goods from retailers, use such goods, and at some point send them over to recycling. Such a perfectly circular system hardly exists. That, however, is not negative *per se*, contradicting some of the circular economy champions. Such profoundly non-circular paths – which will sometimes accumulate, cross borders, and regain use – can be understood as instances in which the potential value in unused goods is realised by those in actual need. Minter provides many examples of markets, repair initiatives and informal systems where this kind of recovery and recreation of value happens. Echoing Bataille, such informal systems perform the necessary work of countering waste and channelling excess into productive social benefit.

Second-hand or unused goods and materials can thus be interpreted as containing potential value to be realised through various actions. Such value can be understood in economic terms, particularly in poorer countries and disadvantaged communities that, in such a way, gain access to products they wouldn't otherwise be able to afford, as depicted by Minter. But there are also other aspects of value to consider. Kirsty Maté (Máté, 2018) writes about the experience of the ByeBuy! Shop, host to activities such as a swap shop, story exchange, repair deli and slow market. She sees interactions in the shop as vehicles to increase the value of goods, increase social engagement, and reduce consumption. For instance, the swap shop activities allow participants to share not only goods but fundamentally stories connecting people to objects and to each other. Expanding on similar initiatives, Ruth Lane and Wayne Gumley (Lane and Gumley, 2018) see the redistribution and reuse of goods and materials by social enterprises as possessing social as well as economic value.

Liesl Clark and Rebecca Rockefeller bring inspiring situated learning about reuse, particularly the re-circulation of materials through their 'buy nothing' initiative (Clark and Rockefeller, 2020). Reflecting on their findings when conducting such activities, they correlate material generosity and gratitude with the existence and regeneration of social bonds within communities. They identify stories as fundamental to creating shared

memories and ‘knit people together’. Unlike with socially-aware generosity, the authors say that anonymous giving does not provide social value to a community. They also create a replicable plan for zero waste initiatives, composed of seven elements:

1. Give.
2. Ask.
3. Reuse and Refuse.
4. Reflect.
5. Make & Fix.
6. Share, Lend and Borrow.
7. Gratitude.

If the reuse of second-hand goods and materials through what can be called re-circulation provides a straightforward path to conserve resources and re-create value by merely identifying excess and relocating it, there are other forms of reuse which require a more physical kind of intervention. Lane and Gumley propose that a circular economy should not only increase the focus on redistribution instead of recycling but support repair and maintenance as well (Lane and Gumley, 2018). Additionally, a third type of physical operation to aid on reusing excess is by upcycling – adding value to objects by moving them up the industrial chain instead of down. I will explore repairs first, then move on to upcycling.

2.3.2.2. Repair

Steven Jackson proposes a seminal position on repair and maintenance in *Rethinking Repair* (Jackson, 2014). As an exercise of broken-world thinking inspired by Donna Haraway, he suggests viewing information technology and new media under a framing of erosion, breakdown, and decay instead of novelty, growth, and progress. The focus on information technology is particularly relevant in exploring repair practices to the extent that such context is often based on the quick adoption and discarding of devices, platforms, and behaviours.

Jackson posits that repair constitutes a critical way to maintain order and meaning in complex sociotechnical systems, and preserve and extend human value. He argues that repair has both a material and a social dimension. Similarly, Henke and Sims describe repair as a way to restore both social and material orders (Henke and Sims, 2020). For instance, repairing a fallen bridge is also a way to repair a city’s transportation network and public trust in engineers and public servants. Richard Sennett (Sennett, 2023) points out that cities need constant repair, which is time-sensitive and burdensome.

David Nemer used his ethnographic work about computer centres in Brazilian favelas to

ground his book *Technology of the Oppressed* (Nemer, 2022). In the same direction as Jackson's broken world thinking, Nemer states that breakdown is not an exception regarding technologies. Particularly in places with unstable infrastructure in terms of energy supply, protection against extreme temperatures, or connectivity – as is frequently the case in Brazil. Nemer identifies repair as an example of what he calls mundane technology – ordinary technology, already available and being appropriated by common people every day. From that perspective, the significance of repair is one of developing skills to postpone the inevitable failure of technologies – perhaps another manifestation of human agency to counter entropy, to refer to Bataille once again. The tension between keeping the world working against decay is found in an influential essay by Andy Russell and Lee Vinsel titled *Innovation is overvalued – maintenance often matters more* (Russell and Vinsel, 2016). The authors have also been promoting important exchange through *The Maintainers Movement* they organise (The Maintainers, n.d.).

Graham and Thrift suggest we should look at breakdown and failure not as something atypical but rather the vehicle for how societies learn about themselves, and how to reproduce themselves (Graham and Thrift, 2007). They go on to describe three core elements of repair and maintenance:

- decay is inevitable;
- repair and maintenance can be sources of variation, improvisation and innovation;
- repair and maintenance generate a considerable volume of economic activity seldom portrayed in accounts of global cities (Russell and Vinsel, 2016).

Analysing the role of ordinary people in postponing inevitable failures, David Nemer argues that repair highlights the dynamics between systemic instability and individual creativity (Nemer, 2022). Even understanding that this depiction recognises the agency of human ingenuity to overcome challenging contexts, my perception differs slightly – in terms if not in essence. The term 'individual' might lead one to read that formulation owing to western portraits of scientists and inventors as heroic lone rebels who take on the world independently. Instead, considering Nemer's explicit reference to the work of Paulo Freire, I prefer to imagine such an individual as a critical actor that belongs to and helps to maintain communities around them. That is, an individual whose awareness is raised through identifying structures of oppression, and fundamentally positioning herself on the same level as other oppressed individuals. It might be better to think in terms of *individuals-in-community*. Otherwise, I concur with Nemer on situated creative solutions as ways to counter contextual instability.

Nemer also draws attention to the work of Messias and Mussa (Messias and Mussa, 2020), positioning the Brazilian term 'gambiarra' as a decolonial technique driven by

precariousness. The term is used by Brazilian cultures to describe improvised solutions for everyday problems – mainly when one does not possess the appropriate tools, materials, skills, money, or time to solve such issues in the way considered correct (Schmidt Fonseca, 2015). It is akin to similar notions in other cultures, such as *jugaad* in India and *rikimbili* in Cuba – brilliantly depicted by designer Ernesto Oroza in his work on the 'technological disobedience' (Oroza, n.d.). Menotti (Menotti, 2010) defines *gambiarras* as creative solutions in themselves, in contrast with the idea of prototypes as mere rehearsal of future mass-produced solutions. Fernanda Bruno, proposing a dialogue with the philosophy of french author Gilbert de Simondon, describes *gambiarras* as open-ended objects (Bruno, 2017).

Yet another contribution of Nemer (Nemer, 2022) is his stance of understanding repair beyond material and objective terms. He proposes to interpret it as a quiet kind of caring beyond mere material hacks. In a similar take, Jackson (Jackson, 2014) implies that repair references ethics of mutual care and responsibility, bringing together action and meaning. Care is also a central theme in the work of Professor Joan Tronto, who theorised an ethics of care (Tronto, 1993). According to Tronto, care and politics are deeply intertwined, even more so in democracies. To her, the very substance of democracy is the allocation of care and responsibilities. Complementary to Jackson, Tronto asserts that care includes everything we do to maintain, continue and repair our world. She proposes a 'caring revolution' that seems to be aligned with Ivan Illich's intention to reshape industrial society around conviviality.

2.3.2.3. Upcycling And Repurposing

Along with the two dimensions of reuse already explored – recirculation as a means to realise potential value, and repair as caring with material implications and social ones – there is a third kind of practice also relevant to my research on convivial ways to deal with excess materials. Upcycling is a way to refer to an activity that can hardly be called a novelty. To frame it, let's first consider that even with types of materials of which products can be recycled to maximum efficiency there is a considerable loss of value – e.g. some kinds of glass, aluminium and other metals, and rare other materials. The complete recovery of material properties for reinsertion in production cycles does not prevent the disappearance of external elements applied to the original products – electricity and other forms of energy, human labour, specific knowledge and skills (Schmidt Fonseca, 2017a).

The quality of the resulting material degrades considerably when it comes to the great majority of so-called recyclable products – such as paper, plastics and others. In other words, recycled materials have lower quality than the original recyclable products. Not to mention that the more complex the original product is, the more energy and advanced

equipment are needed to recycle it. In many cases, that leads to a situation in which the cost of recycling exceeds the value of recycled materials. An extreme example is that of WEEE (waste electric and electronic equipment), whose production levels increase yearly without significantly improving its recyclability.

As referred to earlier, some authors suggest that ‘downcycling’ seems to be a better way to define those practices (McDonough and Braungart, 2002). In other words, instead of a fully closed circle, the most appropriate depiction would be a downward spiral, degrading at every turn – or even an open circular shape that never completes a full cycle. Countering that current, the notion of upcycling refers to those activities to divert an object from the waste stream and create new value by transforming, reshaping, remixing or telling a different story about them. Braungart and McDonough wrote a second book, *The Upcycle*, exploring exactly such aspects that go beyond the materiality of industrial production and connect more widely with culture, creativity and societal trends (McDonough and Braungart, 2013).

2.3.2.4. Transforming Excess In The World

This chapter is written in a time of intense discussion about how best to reduce the impacts of human-caused climate change. As well as the physical, social and economic contexts explored above, the reuse of materials is also deeply tied to environmental considerations. Authors such as Scoones and co-authors analyse critically the use of the term ‘green transformations’ in response to the effects of climate change (Scoones et al., 2015). According to them, depictions of such ambitions often fail to address the political side of expected changes. Additionally, the authors find that most narratives around green transformations seldom mention justice.

Standing from a societal standpoint, the authors suggest that there are four strategies to propose change: shaping/resisting structures, reframing knowledge, realigning institutions and incentives, and finally, mobilising and networking. None is to be adopted exclusively, but they overlap and may confer different effects in diverse contexts. The authors stress that the challenge is engaging with paths that are simultaneously green and just.

Pursuing more desirable societal change is not only a matter of developing a better plan. Scoones and colleagues sustain that policy-making – in the sense of only designing better policies – is not enough. Effective transformation requires the ‘messy politics of day-to-day negotiations and alliance-building amid shifting circumstances, opportunity structures and prevalent uncertainties’ (Scoones et al., 2015, p. 23). Andy Stirling writes that there is no progressive transformation without struggle and engagement of the social groups directly impacted by policies (Stirling, 2015). To the author, there is a link between democracy and

sustainability, both of which should be driven by emancipation. Stirling does not believe in transformations conducted by illustrated elites. Instead, he proposes the grassroots ‘culturing’ of change rather than controlling radical change as seems to be the assumption in moderate reformist contexts (Manzini, 2016).

Transformation often requires alliances between actors with diverse and often diverging goals. Schmitz says that green transformation must include interests that are not themselves green but support green causes (Schmitz, 2015). Effective cooperation is more likely to happen when different – sometimes essentially contradictory – motivations are contemplated. Unfortunately, this is not often the case when it comes to the design and implementation of green policy. Similar to the point made about smart city projects, these initiatives typically come with a solid top-down approach based on a monolithic view of how economies and societies work. The world, however, does not fit neatly into such predefined schemes.

Ashish Chaturvedi and co-authors (Chaturvedi et al., 2019) reflect on the impacts of circular economy strategies over groups actively handling discarded and recyclable materials. Granted, such groups frequently operate under precarious conditions in the informal economy. But the authors are worried about whether such transformative strategies wouldn’t be marginalising even further the groups already living at the borders of society. Not only would such a take exclude people in actual need, but it risks ignoring their embedded knowledge of the territory, everyday materials, culture, and society. According to the authors, understanding the closing of material cycles as a source of income and entrepreneurship should not equate to seeing it as an opportunity only for big businesses. Instead, this transformation would be a political process that should identify multiple narratives and create opportunities led by the actors already involved in the field.

Similarly, Schröder and co-authors (Schröder et al., 2019) assert that a circular economy that leaves out the poor is not really closing the circle. The world cannot afford to make sustainability a luxury. According to the authors, the circular economy has much to learn from the concept of solidarity economy, which establishes a primacy of people and social purpose over capital (International Labour Organization, 2022). That is, the circular economy should incorporate discussions over power relations, value systems and solidarity principles. Here again, echoes of Illich’s conviviality come to the fore.

Members of informal waste management sectors should be in the picture, as they already operate some forms of circularity. But even when these actors, such as waste pickers, are included in circular economy strategies, their role is often instrumental only, leaving aside their experiential knowledge and grassroots innovative answers. They are not invited to shape, design and decide how to implement such strategies. The authors problematise

the field, asking whether the circular economy should give more to those already winning, or rather create new opportunities for those who have lost out in the contemporary neoliberal economy and its implications.

Noble (Noble, 2019) compares initiatives in India and Brazil as a telling case. A project in Delhi implemented public-private partnerships to privatise waste management. As a result, about half of the informal waste pickers reported lower income and job losses. In comparison, informal waste pickers in Brazil are highly organised in political terms. That allows a combination of bottom-up organisations represented by the national waste pickers movement and top-down policies that were enacted by former governments. The sector is connected with cultural and social values and is present in about 1,000 of the country's 5,500 municipalities. It is not to say that the Brazilian context has solved the problems of the field, as I pointed out in Chapter 1. Still, the point about engaging with situated actors and communities in an inclusive way is valid.

Practices of reuse oriented towards repairs, recirculation, and upcycling can play an important role in devising strategies for green transformations that centre on justice, conviviality, and regeneration. Incorporating the perspective of those already involved with the field is crucial to planning and designing future developments. Perhaps the question should not be how to create market-based circular solutions that will eliminate waste in the future. A more appropriate starting point is how to focus on those groups already working to reabsorb excess – to channel excess into productive uses, as Bataille proposed – and improve their current capacity through expanded knowledge, new technologies and better incentives and governance systems. For that end, however, it is essential to go a little deeper into the material activities involved with the reuse of materials and understand what kinds of skills and knowledge are involved.

2.3.3. Transforming Matter: Skills, Craft, Tools

The abilities, creativity, and methods that allow significant increases in the proportion of materials being diverted from the waste stream to be reused can be better understood by decomposing the entangled dimensions of materiality and the human effects on it. Against an understanding of the present *Zeitgeist* as a cyberpunk reality, Evan Calder Williams (Williams, 2011) proposes the image of 'salvagepunk' in fiction as more appropriate to explore contemporary contradictions. The author sees *cyberpunk* characters as too competitive and individualistic, never genuinely trying to break the all-powerful capitalist conglomerates. Whilst *salvagepunk* – for instance, as seen in the Mad Max movies – combines cooperation, learning, courage and, to an extent, a return to a hunter-gatherer frame of mind. That mix, as we'll see, is indeed part of every day in many initiatives

dedicated to the reuse of goods and objects across the world.

Re-using material objects under a frame of abundance is an essential social skill for survival – perhaps one that has accompanied humanity since its early days. Marshall Sahlins describes mechanisms that not only explain the exchange of gifts in ancient times but can also help understand non-market value interaction between individuals and communities (Sahlins, 2020). The intricate relationship between material usability, kinship and social ties was present when humankind was hunting and gathering. It persists today, even having been through ages of settling, manufacturing, crafting and communicating. In other words, it is intrinsically connected to our identity as humans. And conviviality, since way before the industrial revolution was even in sight.

Cory Doctorow is a celebrated digital activist and author of near-future fiction. His books explore the implications of technologies in the economy, politics and everyday life. In 2009 he published a book called *Makers* (Doctorow, 2009). The story can arguably be categorised at lest partly as *salvagepunk*: after the merge of two collapsing large corporations – Kodak and Duracell – the resulting organisation decides to invest in various small-scale entrepreneurs. Among them are two engineers working out of a warehouse in Florida, chiefly by upcycling discarded electronics and other second-hand materials into custom products or small batches. They are eventually joined by a journalist and a business person, and experiment with alternative ways to create, communicate and manage. Ultimately, they will engage with a nearby community and become gradually more politically active.

A common element in diverse manifestations of *salvagepunk*-evoking situated material creativity – such as those represented by the aforementioned notions of *gambiarra* in Brazil, *jugaad* in India, *rikimbili* in Cuba and similar ones – is obviously situational. It is not a coincidence that such cultural expressions are often rooted in locations that face precarity as part of everyday life. When similar material practices can be found among wealthier nations, their presentation tends to have a different weight. The French term *bricolage*, the many uses of the verb hacking and its variants, and contemporary terms such as voluntary frugality do not respond directly to one’s survival or basic sustenance needs.

If such emerging manifestations often adopt a characteristic of intentionally beating complex systems, the ones coming out of precarity propose an inverted perspective. Instead of an extra layer of cleverness over stable material conditions, *gambiarra* and its cousins can be seen as a means to interpret the world as ever-abundant and plentiful of possibilities – a look into excess and how to channel it. It can also be framed under a decolonial mindset by offering ways to make ends meet outside the mechanisms of an

economy fully submitted to the desires of corporate actors operating through market forces.

However relevant the perspective adopted by industry and policymakers on creating a circular economy in the near future by influencing product design and supply chain, the enormous volume of waste already generated over decades of economic growth remains unsolved. In other words, excess is there and will keep growing. To face it, there are several local initiatives experimenting with the idea of zero waste: small businesses and community organisations working to extend the lifetime of products. It can be by creating secondary flows – donating or re-selling – for unused goods such as clothes, furniture, appliances or other objects. In other cases, it is about repairing broken products or upcycling – making them fit for purposes diverse from the original ones.(Clark & Rockefeller, 2020)(Clark & Rockefeller, 2020)

Richard Sennett directs his deep gaze into the practices of craft, exploring diverse settings – from a medieval workshop to more contemporary trades (Sennett, 2008). He quotes sociologist Douglas Harper's belief that making and repairing form a single whole. Similar to how Graham and Thrift see repair as a way to understand the world (Graham and Thrift, 2007), Sennett writes that 'it is by fixing things that we often get to understand how they work' (Sennett, 2008, p. 199). He distinguishes a 'static repair' – through which something is restored to its original form – from a 'dynamic' one, where the object's form or function is changed. Sennett also focuses on the characteristics of the tools used for repairs – from all-purpose to fixed ones. According to him, all-purpose tools are more prone to be used for dynamic repairs precisely for their flexibility.

Sennett went even deeper in classifying repairs when exploring how they manifest in cities (Sennett, 2023). A craftsperson could, per the author, follow three strategies to face something broken: *restoration* (akin to the static repair above); *remediation* (the object does what it was originally meant to do); and *reconfiguration* (when the object is recomposed in function as well as in form). In reconfigurations, the craftsperson becomes an inventor of form instead of a mere 'servant of forms conceived by others'. Sennett proposes a spectrum of openness along those three forms. Restoration would be a closed type of repair; remediation would set free the materials while retaining a stricter relation between form and function; and reconfiguration would make that relation loose and hence more open.

Indeed, there are concrete similarities between reuse-oriented activities and those of crafting, making and creating meaning. Setting himself the mission to explore cultural and material aspects, anthropologist Tim Ingold considers making a process of growing. That is to say that an object is not made so that a craftsperson imposes form (internal to their

mind) into objective materials. Instead, Ingold sees the maker as ‘a participant amongst a world of active materials’ (Ingold, 2013, p. 21). Also, it is not the form internal to the maker’s mind that creates the object but her engagement with materials. Finally, the author reaffirms a take he had made in the past – that the properties of materials are not attributes but histories. In that sense, a thing is constantly in flux to becoming something else. Those elements can inspire a dive into the materiality and cultural implications of reusing goods and materials and how they relate to craft and making.

2.3.3.1. Hacking, Making, Reusing

In the past fifteen years, a renewed interest in manufacturing and making in digital contexts has emerged. Among the many authors tracing the origins and development of the field, it’s interesting to focus on those exploring political dimensions of its manifestations. maxigas (maxigas, 2012) recounts the evolution of the image of hacklabs, initially emerging in European cities within anarchist or autonomist contexts.

Hacklabs were community-organised spaces providing access to digital technologies, often reusing donated or second-hand computers, and simultaneously using and developing free and open-source software. They would be interested in contemporary political issues from a largely post-capitalist standpoint. The author counters such format of hacklabs with that of hackerspaces. The latter would be more generalist in interests and less overtly political. He acknowledges that the terms are, in general, used interchangeably but still points to essential divergences in worldviews between hacklabs – emerging in the early 1990s and multiplying in the early 2000s – and hackerspaces, appearing in the late 1990s and spreading across the world in the late 2000s.

Such groundwork in the form of explicitly political hacklabs and implicitly political hackerspaces would also manifest when digital fabrication machines started to be deployed in varied contexts. maxigas and Troxler (Troxler and Maxigas, 2014) use the term ‘shared machine shops’ to talk about both hacklabs and hackerspaces together with makerspaces and FabLabs. Toombs, Bardzell and Bardzell identify the modern maker as someone who builds things – sometimes for anti-consumerism reasons but usually for practical outcomes (Toombs et al., 2014). While generic descriptions of FabLabs often emphasise elements of community and inclusion, they are in reality shaped by their local and institutional contexts (Kohtala and Bosqué, 2014).

Early descriptions of 3D printer concepts mentioned revolutionary objectives of overcoming market-based exchange (Söderberg, 2013). However, more recently, the narrative about FabLabs focuses on technologies and takes industrial capitalism and its extractive practices for granted. Indeed, bestselling author Chris Anderson was intent on

promoting to a broader public the concept of digital fabrication as the core of a new industrial revolution (Anderson, 2012). It would allow designers and inventors (in the USA and Europe, based on the examples he uses) to prototype products later to be produced in developing countries. Such a perspective is all but complacent with international economic power dynamics underlying global industrial production, and contributes to exacerbating them even further.

Active in design and advocacy, the Fab City network (The Fab City, 2022) intends to establish long-term commitment for cities to gradually transform their economies to be more reliant on local production, talent, and management. Discussions about waste within Fab City strategies have been growing recently. In particular, the notion of moving from 'PITO' to 'DIDO'. That is, from a paradigm of 'product in – trash out' to 'data in – data out' (Fab City, n.d.). In other words, the Fab City movement argues that products should be manufactured, used and later reprocessed as much as possible within city boundaries. That makes perfect sense: if cities are to address the trouble represented by the large and growing production of excess materials, the reuse of materials must be part of it. Community spaces inspired by makerspaces and FabLabs can definitely contribute, as long as they depart from a fabrication-only vocabulary and treat reuse, repairs, repurposing and upcycling with more care than wasteful economic activities. And that requires a deeper discussion about waste.

In earlier works, I criticised the shift from a maker culture described in terms of building alternative socio-economic arrangements through the use of digital technologies towards one that wanted to create a new industrial era without considering the unsolved problems of the previous ones (Schmidt Fonseca, 2017b). That is true even for proposals that incorporate the idea of a circular economy but fail to address the sociopolitical context in which they take place or its implications. For the same reasons that a top-down perspective to smart cities will fail to address the everyday concerns of city-dwellers, it is likely that top-down circular-inspired digital fabrication will miss the point of solving present issues.

Ben Bridgens and co-authors point out that design for a circular economy is based to a great extent on designing for disassembly, remanufacture and reuse whilst retaining value on the supply side (Bridgens et al., 2018). Alternatively, they propose that designing for upcycling combined with the availability of community resources may help overcome such distortions whilst slowing down the flow of materials (Schmidt Fonseca, 2017b).

Potential connections between hackerspaces, repair cafes, and the circular economy have been explored by Martin Charter and Scott Keiller (Charter and Keiller, 2014). They propose that such spaces and activities may be the ideal setting for the emergence of

grassroots innovations to counter an unsustainable consumer culture. Those citizen-driven initiatives could help the circular economy's 'closing material loops' goal whilst promoting community engagement, knowledge exchange and economic opportunities. Smith (Smith, 2015) points to the need to pay attention to social aspects of repair besides the technical ones. Sharon Prendeville and co-authors (Prendeville et al., 2017) identify the potential of makerspaces to acquire a role in distributed manufacturing circular production systems and discuss the importance of founders and managers as gatekeepers of circular practices. Smith sees makerspaces filling gaps in circularity, becoming sites of democratic knowledge production and validation, and helping expose power dynamics (Smith et al., 2018).

Prendeville and colleagues (Prendeville et al., 2017) identify four guiding themes to orient makerspaces towards a circular economy: foster an enabling culture; build local connections; stimulate practical know-how; build individual and community capacity. Even though the authors conclude that makerspaces might play a critical role in a future circular economy, they argue that everyday concerns of such spaces keep them from adopting a clear posture in that direction.

Technologies and methods similar to makerspaces and FabLabs could address waste if the narrative focused on transforming matter rather than fabricating new things from raw materials (Schmidt Fonseca, 2017b). For that, it is also helpful to draw from the real-world experience of craftspeople and repair professionals in making things work under adverse conditions – circling back to the idea of *gambiarra* presented earlier. It is equally important to interpret such initiatives as potential ways to channel excess under a frame of conviviality.

2.4. Summarising The Trouble: The Value Of Excess Materials

Jørgensen (Jørgensen, 2019) describes the bases of recycling proper, including characteristics of the main groups of recyclable materials. He goes on to question, even if subtly, the validity of recycling in objective terms. That is the concrete effect of implementing systems for the separate collection of materials to be sent to industrial recycling. The author concludes that, even if not as relevant as one might expect, organising systems for recyclable collection makes society pay ongoing attention to waste-related issues. That opinion, I argue, may be challenged by factoring in what can be described as a feel-good effect. People who separate their waste might even feel more liberated to consume resource-intensive newly manufactured goods.

A study funded by the World Bank (Hoornweg and Bhada-Tata, 2012) indicates that the

yearly production of solid waste by world cities amounted to 1.3 billion tonnes in 2012 and was expected to increase to 2.2 billion tonnes by 2025. Whatever measures are taken to implement a circular economy, improving the recycling rate and reducing consumption will not detain such growth. Of course, new policies such as the EU plans for waste, circular economy and right to repair may impact on the longer term. But every day, global industrial plants manufacture goods that will be used and discarded in a few years, months, or days. As much as cities and society act to increase the ability to slow down the pace of extraction, production, and discard of goods, the unavoidable trouble – to lean once again on Haraway (Haraway, 2016) – will remain: the volume of materials in flow will keep exceeding humankind's capacity to absorb them for the foreseeable future. That excess must be actioned upon.

A change in how waste-related policy is designed was made explicit in a report produced in 2015 by UNEP, the United Nations Environment Programme (UNEP, 2009). It suggests a shift in vocabulary from waste management towards the notion of resource management. What remains to be discussed, however, is the shape of that management. Global consulting firm Accenture published a short report suggesting there would be 4.5 trillion dollars in reward for circular economy business models (Lacy and Rutqvist, n.d.). The document also indicates an increase of 50% of a typical company's gross profit while reducing material use by 90% through recovering and remanufacturing of used components. Finally, they see a billion dollars that could be made in manufacturing by transforming previously wasted value. That perspective raises questions: who would be rewarded by the adoption of more circular production? Additionally, what are the negative externalities that such changes would ensue?

There is economic value to be generated or recovered by reusing materials. However, there are risks in accepting that waste should be equated to natural resources and exploited exclusively by profit-oriented markets. Firstly, reproducing and amplifying the same distortions and unbalances that led to the development of an unconscious industrial mode of production where excess lies unchecked. Waste and its global circulation paths are recognised indicators of international inequality (Schlitz and Laser, 2019). A telling example is the inconsistency in the circulation of e-waste / WEEE between continents, as mentioned earlier in this chapter. Although regulated by the Basel Convention and scrutinised by national and regional organisations, the attractive profits made by not adhering fully to the rules gives rise to considerable leakage of improper equipment among countries (Basel Action Network, 2018).

As indicated earlier in this chapter, there are clear examples of growing inequality when top-down circular economy initiatives take over waste management in localities where

informal waste collectors are active and sometimes thriving. Particularly in low- and middle-income countries, the informal sector is more dynamic and effective than the formal one (Scheinberg et al., 2010). In these cases, allying with the informal sector can effectively reduce the overall waste management costs for municipalities (Chaturvedi et al., 2019).

The other risk associated is of giving away even more agency for corporations to decide over the everyday life of city-dwellers. It would be too tempting for them to generate data points enabling increased control over how and when consumers used (and re-used) objects and materials, as pointed out by the critical perspectives on the smart city earlier on. Inspired by Bria and Morozov's take on technological sovereignty to overcome the contradictions of smart cities (Morozov and Bria, 2018), it is important to ask: what would it mean for local societies to reclaim sovereignty over excess materials available in their territory? Additionally, what would be the best way to do that in convivial and regenerative forms?

2.4.1. Assessing The Potential Value Of Materials

Combining material techniques necessary for repairs and upcycling with the possibilities of digital making can, as pointed earlier in this chapter, increase the reuse of materials while promoting knowledge exchange and creating local opportunities. However, particular attention must be given to another set of skills: assessing the value of discarded materials. Cherrier talks about the revaluation of waste through repair and repurposing (Cherrier et al., 2018). Such revaluation could also happen within the household and not only in an industrial setting, as is implied for recycling. It also requires knowledge of the physical characteristics of objects and their components. The author suggests that the value of waste is relational, depending on material and social factors. This understanding is crucial for diverting a growing proportion of discarded and unused materials in cities from the waste stream and putting it back in circulation through reuse-oriented transformations. For that to happen, there is the need to find ways to evaluate such materials. In other words, to assess their potential value.

Performing this kind of assessment poses particular challenges. To start, the wide diversity of materials. We're talking about different types of objects, from distinct makers, with little standardisation and typically little access to spare parts or replacements. Second, even on the rare occasion of more or less homogeneous sources of materials, their state will likely vary substantially. That wide range of variables impacts the value the objects or their materials can acquire after being repaired or upcycled.

In Nantes (France), an organisation called *Les Ecossolies* offers a unique education

programme for the professionals of material evaluation (‘*agent valoriste*’ in the original) (Les Ecossolies, 2023). The programme covers the following areas (translated from the original in French):

- Collect, sort, and value objects and materials.
- Inform, guide, and raise awareness about the importance of reuse.
- Network with stakeholders involved in waste prevention and management.

It seems appropriate that one of the few initiatives providing training for professionals in evaluating second-hand materials is conducted by an organisation based on the principles of the social and solidarity economy (*Ecossolies* takes its name from ‘economie sociale et solidaire’). The solidarity economy – already mentioned in Section 2.3.2 of this thesis – is the field engaged in activities based on ‘voluntary cooperation and mutual aid, democratic and participatory governance, autonomy and independence, and the primacy of people and social purpose over capital in the distribution and use of surpluses and/or profits as well as assets’, according to the International Labour Organization (International Labour Organization, 2022). It can offer possibilities for considering social value in investigating waste prevention through convivial practices of material reuse.

On a fundamental level, one of the main obstacles to developing more circular, regenerative, and inclusive systems to manage discarded or unused materials is the economic structure. Graziano and Trogal assert that repair and maintenance labour must be de-alienated (Graziano and Trogal, 2019). In other words, the surplus value generated must be put in the hands of these workers. The problem is, as the authors note, that maintenance work in a broad sense often relies on unpaid or state-paid labour. For the commonsensical understanding of economics, maintenance does not generate value. According to Russell and Vinsel, maintenance is essential to sustain everyday life (Russell and Vinsel, 2016). They praise the everyday maintenance of technologies that were ‘innovated’ long ago – in the same direction that Nemer identifies mundane technologies, and Jackson describes broken world thinking.

Unbalanced incentives for innovation are also analysed by Mazzucato (Mazzucato, 2018a), who discerns between ‘makers’ (in general terms, scientists and inventors working on basic science under public funding) and ‘takers’ (primarily, the so-called ‘innovators’ that pack inventions into highly profitable products and invest hugely into ways to avoid paying taxes that would potentially fund further research).

The same reasons that lead to what circular economy actors describe as a linear mode of production, summarised by the actions ‘take, make, discard’, can be said to promote such disproportionate attention to innovation, and little regard for the socio-environmental

effects of the industrial modes of production. That is as true to current neoliberal global capitalism as it has been to historical communist experiments. Wark (Wark, 2015) identifies the struggle against nature as a central element present in the social and cultural imaginary of the USSR. Such a mode of understanding the role of (organised, rational) humankind against an unruly and wild planet Earth would be the cultural bases of the anthropocene.

To overcome such condition, Wark proposes to focus on a molecular level (small scale, high engagement) rather than a molar one (distanced, depending on large-scale political revolution or reform). Such a take finds echoes in Thackara's mapping of ultra-local, highly rooted initiatives promoting real change in each of their bioregions spread worldwide (Thackara, 2017). That leads the discussion back to Escobar's understanding of *autopoiesis*, which suggests that communities ought to design themselves through collective and situated engagement (Escobar, 2018).

Naturally, local communities interested in designing convivial systems to face corporate greed over excess materials are up to starkly unequal combat. Some constitutive elements for that have already been covered in this chapter, such as social value (Clark and Rockefeller, 2020), objective skills ranging from craftspeople to repair professionals, and the ability to assess the value of materials in objective and relational ways. In this context, digital technologies can come to aid. Even though there have been improvements in the availability of data about recycling (Open Data Manchester, 2022; Recycleye, n.d.), the same cannot be said about the reuse of materials. Presently, incipient attempts at using data to help create a circular economy focus chiefly on the corporate or public sectors (Orko, 2022) and allow only a marginal space for community-driven initiatives (Circular Design Innovation, 2021; Open Repair Alliance, n.d.). More on the informative side, in 2021 the French government introduced the *Repairability Index* (Ministères Écologie Énergie Territoires, n.d.), which in its current phase provides information about limited types and brands of products.

Particularly for WEEE, interesting developments implement specific software to monitor the health of reused equipment on an ongoing basis. They can even predict the probability of failures, as described by the creators of eReuse in Barcelona (Franquesa et al., 2015). The authors also write about a points-based mechanism allowing the system to reward positive behaviour by donors and cooperative receivers of donated electronic devices.

2.5. Conditions For Community-based Waste Prevention

This chapter sets the groundwork for my doctoral investigation into ways of reshaping how cities handle excess materials. I am interested in practices of reuse through repair,

upcycling and re-circulation that enable a shift from industry-oriented waste management to community-based waste prevention. The references established in this review of literature and context set the conditions, limitations, and possibilities for creating local alternatives. I analyse excess as an unavoidable condition of the contemporary global economy, and explore ways to counter the wasting of such excess by channelling its potential value.

I navigate through the landscape of smart city projects, adopting a critical perspective. Smart cities, with their roots embedded in neoliberal ideologies, are often conceptualised as technology-driven solutions for urban sustainability. However, critics argue that their often industry-oriented approaches can overlook local communities' context, needs, and aspirations, ultimately reinforcing social and economic inequalities. Therefore, challenging the smart city rhetoric and its implementation practices is paramount in engaging with community-based, socially aware initiatives.

The topic of waste, particularly, receives a considerably superficial and insufficient treatment in smart city initiatives. They merely try to add layers of digital technologies to extend traditional industrial, top-down waste management models that typically disregard the potential value of discarded and unused materials, focusing on disposal rather than prevention. By contrast, community-based local waste prevention might help implement circular economy principles, underpinning the transformative potential of cities.

The circular economy is also examined critically in my research, unpacking its inherent tensions and contradictions. While its ambition of resource optimisation is laudable, its actual practices can sometimes align with the neoliberal paradigm, prioritising economic values over social and environmental ones. By focusing excessively on the point of view of corporations, the circular economy might exclude those groups already active in the recovery of excess materials. The perspective of my investigation is to seek convivial and regenerative ways to counter wasteful practices of the prevailing industrial paradigms.

My literature review focuses also on the potential role of the right to the city. This foundational concept underscores people’s rights to participate in urban decision-making and to shape their urban environment. My research questions provide a roadmap to understanding the stakeholder dynamics in community-based waste prevention, the necessary skills, techniques, and technology for amplifying the reuse of materials, and policy and systems implications for fostering such practices in cities. Exploring these questions provides an opportunity to reimagine how cities handle excess materials, transitioning from industry-oriented waste management to community-based waste prevention and focusing on conviviality instead of productivity. My investigation aims to bridge the gap between high-level urban sustainability agendas and ground-level,

commons-oriented practices. The following chapters will explore those topics from varied perspectives.

3. Methodology – A Spiral Of Openness

This doctoral investigation aims at exploring waste prevention through community-based practices of material reuse. The underlying goal is to develop more appropriate ways to handle excess materials in cities and towns. Appropriateness, in this case, is not a condition measured objectively from a top-down perspective such as that from industry or the public sector, but rather a multi-faceted configuration informed directly by the right to the city (Lefebvre, 1996), conviviality (Illich, 1990), systems-based and circular approaches to handle materials (Ellen MacArthur Foundation, 2019; Raworth, 2017), awareness of the scale of 'the trouble' (Haraway, 2016), and the inclusion and protection of human agents in the diverse areas of activity associated with excess materials. The research focuses chiefly on social but also economic, political, cultural, technical and environmental considerations.

To address such complex issues, I sought to explore situated ways of learning and doing that help build bridges between established scholarship, ongoing developments in the world, the research studies I designed and conducted, and the experience embodied over decades of my own practice. Rather than affiliating to a predefined methodology, I adopted various methods in iterative processes that were transformed at every turn. I called that constructivist approach a ‘Spiral of Openness’, and will describe it in this chapter.

My research addresses issues that amalgamate multiple pressing matters, such as the global climate crisis, unsustainable industrial practices, the exertion of power in local contexts, and the concrete work conditions for people engaged in the reuse of discarded or otherwise unused things. As well as offering a direct contribution to means to reflect and act on such matters as they pertain to excess materials in cities, my work also proposes ways of researching that offer a fractal and constructive way to respond to this kind of entangled configuration. I describe it in this chapter by weaving references about knowledge production, reflections on personal and collective activities and how they link to the current state of the world. These elements also relate to the critical use of particular methods of generating, capturing, and sharing knowledge that will be described in more detail in the following chapters.

An important characteristic will be evident in the coming pages: I intentionally include myself in the text. It comes first as an exercise if reflexivity inspired by my background as a Latin American Master's researcher supervised by an anthropologist, Rafael Evangelista. Additionally, it is a conscious exercise of inscribing my research in decolonial design (Martins et al., 2019) and Arturo Escobar’s broad interpretation of design

incorporating social and political considerations (Escobar, 2018). In that, I am inspired by the oral tradition of the *griots*, story-tellers present in some West African communities and the African diaspora. By re-telling traditional stories interweaved with personal episodes, the *griots* preserve, transmit and actualise history and culture (Hale, 2007). My use of a rather personal account of the methodology for this thesis is meant to document the knowledge embodied in my experience as a researcher and as an experienced practitioner in the field. The occasional repetitions and diversions are part of that rather personal take.

In summary, my investigation seeks to co-create knowledge and systems that encourage community-based and convivial waste prevention as an alternative to industrial waste management. Combining methods of constructivist design research, participatory action research and open-source technologies, I adopt a participatory and iterative approach involving stakeholders engaged in practices of reuse in cities and regions. My research espouses the view that knowledge is socially constructed (Freire, 2017), and that multiple valid interpretations and ways of understanding can coexist. Therefore, the investigation is conducted not in isolation but in dialogue with experienced participants, acknowledging the skills, methods, and technologies they employ. Through this shared process of exploration and reflection, my research aims to collaboratively identify and enact opportunities to reshape how local groups and communities can handle excess materials in cities.

3.1. Human Knowledge At The Border Of Disciplines

My research happened in a time of global uncertainty following the effects of Brexit, the arrival of the COVID-19 pandemic, and the Russian invasion of Ukraine. I could consequently observe how unstable conditions impact the way society addresses excess materials in aspects such as access to infrastructure, manufacturing practices taken for granted, disruption in global supply chains, cultural aspects of the consumption and use of goods, individual behaviour towards objects, and rapidly changing legislation and regulation on diverse scales.

All the while, reflected more personally on cities, waste, excess, and the reuse of materials. I moved with my family from Brazil to the UK and later to Germany. A significant part of my research journey was imprinted by the experience of being a foreign PhD candidate from the Global South. Among the many implications of that is the particularity of learning how public services worked in a different context, and how behavioural or cultural assumptions should be considered when investigating excess materials.

My research topic has also undergone significant transformations following the growing

public awareness and institutional acknowledgement of the climate emergency and, consequently, of the need to reduce carbon emissions and mitigate extreme climate events. Such a multi-faceted configuration could be investigated from diverse knowledge fields. Waste in cities deserves attention, for instance:

- from material sciences, product design and production engineering with considerations about resource efficiency and reusability;
- from disciplines concerned with environmental protection and the impacts of the toxicity and chemical characteristics of manufactured goods;
- from an institutional technical/engineering perspective on waste management, e.g. creating or improving technologies to better collect, sort and recycle goods and materials;
- from a macroeconomic level, creating ways to leverage sustainable business models and incentivise stakeholders to pursue responsible actions regarding waste and excess materials.

Notwithstanding such a diversity of established avenues to explore, my investigation followed a particular path inspired by McKenzie Wark's proposal of thinking from a 'labour point of view' (Wark, 2015). I sought to generate, capture and share knowledge regarding handling excess materials in cities while experimenting with solutions that featured human beings at centre stage.

A fundamental remark is necessary here. The focus on human rather than technical aspects of excess materials also had a specific framing. The human I wanted to establish a dialogue with was neither simply the city-based user of waste management services nor the individual agent occupying a relative power position in manufacturing or the in the public sector. Instead, as will be described in Chapters 4 and 5, I focused on people who had practical involvement with the reuse of materials and reflected on their experience. From my prior involvement with the field, I knew that various conditions are entangled in how knowledgeable actors engage with the materiality of objects while repairing, transforming and repurposing things. Global economic considerations sit side by side with, for instance, environmental awareness, manual skills, aesthetic visions, personal stories, and many other variables. Further, I did not want the potential outcomes of my work in terms of design or technologies to alienate the people already doing largely unseen crucial work in the field. On the contrary, I wanted to equip those actors with convivial tools to expand their working capacity.

How, then, to untangle those threads and generate knowledge that can contribute to scholarship and, at the same time, be relevant to those active in the field? This chapter proposes a combination of complementary approaches. Firstly, a dialogue with research through design (RtD) to acquire an overview of the investigation theme, define a focus for the research and generate design concepts. Second, inquiring about the potential of

open-source development practices to engender iterative community engagement and co-creation processes. Lastly, by expanding onto the field of science and technology studies to discuss the socio-political context of potential better alternatives for handling excess materials.

Deleuze and Guattari draw the image of the Sorcerer or Shaman as a being in an ongoing process of *devenir*, of becoming (Deleuze and Guattari, 1987). The state of becoming would be characterised by constant flux. Sorcerers dwell at the margins, refusing categorisation, and their internal transformation is mirrored outside as change and disruption. In my research, the conscious decision to occupy the sometimes uncomfortable position of working at the borders of distinct disciplines without becoming affiliated with any one in particular is influenced by that concept. This decision involves a touch of sorcery, understanding that following purely rational paths won't be sufficient to address 'the trouble' (Haraway, 2016) we are compelled to confront.

3.2. Design, Industrial Mindset, And Science

For the purposes of this thesis, excess in cities is composed of those goods and objects prematurely discarded or kept out of use for various reasons. The existence of such excess is inherently entwined with system-wide contradictions of contemporary economy and with a productivist industrial culture that doesn’t account for its externalities, as discussed in Chapter 2. Though pervasive in neoliberal ideology, this culture is arguably not exclusive to global capitalism. Wark points out that even the nations that concretely attempted to advance communist economies have replicated a worldview that perceives humanity's role on the planet as one of conquering and imposing itself over nature through mining, building, and industrial production (Wark, 2015). It seems unlikely that the climate emergency can be resolved without fundamentally challenging such assumptions.

To overcome such a pervasive frame of mind, it is necessary to incorporate alternative ways of seeing the world which are not based on simply re-enacting and renewing industrial practices. That might be an unusual quest in a doctoral investigation based on a school of industrial design in a wealthy nation such as the one where this work is situated. Still, design, as a field of practice and inquiry, has increasingly engaged with pressing contemporary social, political, and environmental issues. Insights from science and technology studies (STS) help critically examine the role of design in shaping human-technology relationships. Rather than viewing design as a purely technical or aesthetic activity, these intersections with STS underscore its socio-political dimensions, exploring how its processes and outcomes are entangled with societal values, power dynamics, and systems of knowledge (DiSalvo, 2015).

Enzo Manzini argues that in the current societal context, everyone can participate in design processes and thus influence change (Manzini, 2016). He stresses the emergence of 'diffuse design' contrasting with 'expert design'. Diffuse design refers to the spontaneous design activities that individuals and communities engage in, while expert design refers to professional, structured, and technically skilled design practices. Manzini argues for an evolution in the role of the design expert from a position of centralised control to one of enabling and facilitating the creative and design potentials of others. In this sense, expert designers are more like facilitators, or 'design mediators', encouraging and guiding the process rather than being the sole authoritative figure responsible for making decisions.

The 'turn to the social' in design has led to a growing emphasis on participatory and co-design approaches. Seeking to democratise design, the emergence of topics such as 'transition design' and ‘design justice’ use design strategies to address complex socio-ecological transitions (Costanza-Chock, 2020; Irwin, 2015). This socio-political orientation of design signals a shift towards more reflexive, inclusive, and contextually grounded practices that can respond to our contemporary world's complex and intertwined challenges.

In my research, I integrate these two scales. Transition design to create progressive tools that promote system-level change towards more sustainable futures. And design justice as a principle and a reminder that measures for waste prevention should recognise the skills and embodied experience of people already engaged with the field at a local level. By focusing on the point of view of those agents, I expect to contribute to creating solutions that improve their working capacity and social impact, instead of merely replacing them with automated technologies. Here again, the notion of designing for regeneration proposed by Wahl can be of help, as it helps raise awareness about the fundamental interconnection between living beings and the planet – ‘inter-being’, as the author names it (Wahl, 2016).

In his attempt to ‘write an epilogue to the industrial age’ (Illich, 1990, p. 3), Ivan Illich projects a future convivial society in which technologies serve ‘politically interrelated individuals rather than managers’ (Illich, 1990, p. 6). Illich argues that a society based on the idea of industrial productivity leads to a technocratic disaster, enslaving people to tools. In contrast to industrial productivity, a convivial society would support ‘autonomous and creative intercourse among persons, and the intercourse of persons with their environment’ (Illich, 1990, p. 18).

To set the foundations for a convivial society, Illich suggests a distinction between convivial tools and manipulative tools. He implies that hand tools lean towards convivial

characteristics, whilst power tools (moved at least in part by energy converted outside the human body, for instance, electricity) would favour the centralisation of power and thus risk being manipulative. He does not dismiss power tools but draws attention to this ambivalence.

An *aggiornamento* of Illich's ideas to our contemporary society requires this perception of ambiguity to be applied to digital technologies as well. Beinsteiner (Beinsteiner, 2020) discusses the similarities between the work of Illich and that of philosopher Bernard Stiegler. Both argue that a convivial society requires limits to technological complexity. To compensate for the profound changes brought to the economy by machine learning and other AI developments, Beinsteiner sees – echoing Illich – the need to balance participatory and distributive justice. The latter would refer to the fair distribution of resources and benefits in society, while the former relates to the ability of individuals and communities to participate in decisions that affect their lives.

Illich asserts that contemporary science is intrinsically intertwined with sustaining the industrial age (Beinsteiner, 2020). Such a scientific-technological complex is not neutral but reinforces the power of experts and institutions, limiting the potential for conviviality. Scientific knowledge and technological skills have been professionalised to the point where they are inaccessible to the layperson, thus eradicating the ability of individuals to control their own lives and contributing to social inequality. Just as regarding power tools, though, Illich's criticism of how science itself has become a dominant force in modern society does not lead to outright rejection. Instead, he argues that science needs to be reined in and put in its proper place as one tool among many for understanding the world and solving problems. He also argues that science needs to be democratised, so everyone can participate in scientific inquiry and decision-making. Overall, Illich's criticisms of science are aimed at how it has been used to marginalise other forms of knowledge and to create a technocratic elite.

Antonio Lafuente and Adolfo Estalella argue that the public nature of science is not absolute and that there is a democratic deficit associated with the lack of discussion about the type of science needed (Lafuente and Estalella, 2015). They also discuss the complex relationship between academia, government, and businesses and the importance of recognising the contributions of amateurs, artisans, and activists to science. Problematising the image of 'citizen science', which often allows only very restricted participation by the people potentially impacted by scientific developments, they propose the term 'common science' as an alternative. In such a case, it would not be a matter of collecting participant feedback to generate situated knowledge. Instead, the very purposes of science-making should be defined in participatory ways.

My investigation incorporates that perspective by increasingly establishing a dialogue with groups of participants interested and experienced with the reuse of materials in urban contexts. Besides generating situated knowledge that allows me to understand the field from diverse disciplinary contexts, I also engage with design research methods to create concepts and prototype them openly, as will be described in Section 3.6. By doing that, my research can be embodied in artefacts to feed new developments, as well as establish and maintain a convivial relationship with interested parties.

3.3. Embodied Learning And Critical Appropriation

Paulo Freire used to say that 'knowledge is not transferred, but rather created by human beings mediated by the world' (Freire, 2017, p. 79). By that, he implied an understanding of knowledge as something actively constructed rather than passively received through the interactions of people amongst themselves and with their environment. This perspective is foundational for what I sought to develop during my doctoral studies. By focusing on relational aspects of knowledge generation, I intend to acquire an understanding of the overlapping elements impacting my research topic – an understanding deep enough to inform the creation of alternatives without superficial assumptions or falling into technological solutionism.

The emphasis on fostering open interactions, mutual learning, and the co-creation of knowledge is a consequence of such a position. It reflects the choice of a constructivist take to design research, according to which knowledge and understanding are constructed by the learners actively participating in learning instead of passively receiving information. This approach draws on the epistemological stance that knowledge is subjective and co-constructed between the researcher and the participant rather than being an objective truth that can be discovered (Cross, 1999; Guba and Lincoln, 1994; Sanders and Stappers, 2008).

Tim Ingold says that 'Anthropology is studying *with* and learning *from*; it is carried forward in a process of life, and effects transformations within that process' (Ingold, 2013, p. 3). He distinguishes this vision of Anthropology from Ethnography, which would be 'a study *of* and learning *about*', serving mainly documentary purposes. Jorge Luis Borges' fictional short story titled *The Ethnographer* (Borges, 2004) reflects on the limits of ethnography from another standpoint. In the story, a university student spends more than two years living among Native Amerindians, hoping to learn a secret only revealed by the medicine man of that people to his initiates. Once the student is shown the secret, he returns home. However, he tells his professor he can not share it. The professor suggests it is because

the English language can not express it, and the student replies:

> That's not it, sir. Now that I possess the secret, I could tell it in a hundred different and even contradictory ways. I don't know how to tell you this, but the secret is beautiful, and science, our science, seems mere frivolity to me now.

As pointed out by the movements intending to decolonise design practice and research (Martins et al., 2019), a similar divide arguably affects participatory studies that offer little discussion about power, agency, and decision-making. Such studies may produce relevant outputs and inform positive developments. Still, to identify elements that contribute to finding solutions for complex problems, it is essential to establish ways of knowing that go beyond what Borges' ethnographer calls 'our science'. Designing solutions for excess materials in contemporary urban contexts that do not marginalise the people already involved with the field must start by acknowledging and overcoming those limitations. For that reason, my research sought to establish relations with knowledgeable stakeholders not only in terms of their rational understanding of the issues in focus but fundamentally putting attention to the experience they embody in their practice and worldviews.

Ingold says anthropologists are justly proud of participant observation as a method and discipline (Ingold, 2013). My research is partly connected to that perspective but also carries elements of reflective practice. In that sense, I am simultaneously coming from two deeply complementary sides. I am a researcher affiliated with a British University, approaching a loose international group of people engaged in a particular set of activities: repairs, community organising, and social entrepreneurship, among others. In that aspect, I inevitably occupy a position of relative power, expecting to learn with said people by observing and participating in diverse activities, and to translate what I learn into knowledge recognisable as a valid contribution to scholarship. At the same time, I am a long-time practitioner, having created and led community-based initiatives of material reuse; collaborated with cooperatives and social enterprises; taught about repair and reuse; and been a designer-in-residence in diverse organisations. Even during my PhD investigation, I was observing the field and actively engaging with it through writing, creating design concepts, prototyping and organising events and discussions that reverberated beyond my academic activities.

All that led to a situation in which I was simultaneously facilitating conversations as an external party to a proto-community as well as being an ordinary member of it. Here, I use the term proto-community consciously. I did not see the participants directly involved in my research studies or observed indirectly in other initiatives as a community *per se*, in superficial terms. With that, I mean that there was no single common trait to offer a predefined sense of belonging to the same community. Instead, there was a diversity of

commonalities in their various locations and contexts, background experience, expectations, and levels of engagement, which allowed for a more expanded and dynamic field of action. Such a combination of diverse actors could indeed become a community in the longer term, but to this point, this is only a latent possibility.

3.3.1. Critical Appropriation

So far, I have described foundational elements of my research methodology: a focus on the lived experience of human agents to design convivial ways of addressing contemporary problems, the co-creation of knowledge both through participant observation and reflective practice, and the awareness that I am at the same time an institutionally situated researcher and an experienced practitioner immersed into the research topics. In addition to that, I adopt an attitude that deserves a little more exploration. I call it critical appropriation.

One of the most important things I learnt by participating in repair initiatives – chiefly through the MetaReciclagem network in Brazil – was to always try to balance acceptance and refusal. Projects working in precarious conditions in communities in the developing world should not accept the assumptions of initiatives coming from wealthy nations at face value. At the same time, we should not reject them altogether. The MetaReciclagem network would receive donated computers from Brazilian corporations, then disassemble and refurbish them, scavenging for spare parts and using open-source software. We did the same when interacting with international funders, national government agencies and other bodies. The critical appropriation attitude was something like, ‘We see what you are offering, and we want only the parts of it that may benefit us’.

Such a perspective owes to diverse factors already explored in previous works (Foina et al., 2005). Ultimately, it can also be linked to a crucial moment in forming contemporary Brazilian culture. Oswald de Andrade, one of the members of the Brazilian modernist movement, published the *Manifesto Antropófago* (the 'cannibalist' or 'anthropophagist' manifesto) in 1928 (de Andrade and Bary, 1991). The self-called modernists were responsible for a rapid reshaping of Brazilian cultural identity. From the late 1900s, the country had seen an immense transformation. It was one of the last nations to abolish slavery, only in 1888, one year before a military coup deposed the emperor and proclaimed a republic. Its economic elites expanded their wealth by exporting coffee beans and sent their kids to study in Europe. Those young people – some of whom became intellectuals and artists – eventually returned to Brazil from places like Paris and London. Back in the homeland, they were confronted with the huge contradictions between their cosmopolitan experience and the fertile cultural mix of Brazil’s newly

urbanised populations – often for lack of a better choice. The abolition of slavery was not accompanied by any process of reparation, agrarian reform, nor the offer of better living conditions.

What many modernists would propose, and Andrade's manifesto sharply captures, was that Brazil remixed its diverse cultural traditions, borrowing only the interesting parts from each. The manifesto is inspired by an episode that reportedly happened to Bispo Sardinha, a Portuguese Bishop from the 16th century. Sardinha is said to have been so admired by the native Brazilians that they killed him and ate his flesh, as was customary in some communities. The manifesto says, 'I am only concerned with what is not mine. Law of Man. Law of the cannibal' (de Andrade and Bary, 1991, p. 1). That disposition echoes how Brazilian cultures merged with the international culture over the rest of the 20th century – Bossa Nova with Jazz, *Tropicália* with 1960s Rock and Roll, and *Manguebit* with electronic music. Likewise, it is reflected in the way the country adopts digital technologies. MetaReciclagem was the same. Critical appropriation of technologies for social change, as we described then.

These elements are foundational to the way my academic career took shape. I always felt myself as lingering at the border of disciplines, instead of being clearly affiliated to one. Here too, I am *only concerned with what is not mine*, borrowing parts of methods as I construct my path in between fields of thought and work. The path of my doctoral investigation was also one of critical appropriation, borrowing and recomposing methods and perspectives.

3.4. What Is Not Mine – Methods Of Borrowing

Having followed the public debate about recycling and reuse for a couple of decades, I did not expect my research to create new ideal solutions to be deployed uncritically everywhere in the world. Rather, my take was to think along the lines of bioregionalism (Sale, 2000), seeking to identify potentialities in local contexts to nurture appropriate systemic convivial responses. Further, I was particularly interested in a deeper level of reflection. Not only in terms of physical conditions present in localities, but crucially in the potential to engage with and further develop ecosystems of knowledge, culture and skills to address the excess of materials in cities.

In other words, it wasn't only a matter of addressing an objective gap in knowledge. Of course, as discussed in previous sections of this thesis, my investigation does target the lack of thoughtful and situated experimentation on how to help prevent waste generation in the urban context whilst also addressing socio-economic issues. I do propose, however, that it is not only a matter of generating new knowledge that can be applied to new

technologies. It is rather about creating fertile ground for a plurality of ways of knowing that enable the creation of novel technologies.

My take differed from a more traditional design approach that would recruit participants to inform, provide feedback or validate concepts I had created. I was interested in establishing connections through which experience could be shared and built upon in ways that made sense to those involved. It was not only a way to counter the image of a Renaissance individual genius, but also a way to re-enact Andrade's *cannibalist* approach: create connections with skilled people in order to metaphorically 'eat' their experience.

In line with the constructivist perspective inspired by Paulo Freire (Freire, 2017), I am cautious about using the word 'knowledge' as something that can be externalised from the human experience. If knowledge is created by humans with humans and can not possibly be transmitted, it seems better to talk in terms of embodied skills, lived experience, and other similar terms. In this sense, the codification of knowledge in the form of a doctoral thesis is a very personal action. As mentioned above, I am guilty of the occasional repetition or diversion as I document my individual discoveries. Nevertheless, my research was as much a collective as an individual endeavour. It involved going beyond merely collecting participants' input to validate and refine my hypotheses, design concepts and analyses. Not only did I learn from participants' habits, practices and worldviews, but we were invested together in generating knowledge through collaborative interaction.

A better choice would perhaps be to talk of knowledge in the plural. That is easier to do in Portuguese and other Latin languages: we talk of *conhecimentos* in the plural, as a way not to conform to the single noun *conhecimento*, – which sounds authoritative while risking eliminating other ways of knowing. 'Forms of knowledge' is a possible solution, but it lacks the same conciseness.

Acknowledging these contradictions, my research required a mixed and hybrid approach regarding methods, tools, and documentation. As stated, my approach was intentionally open-ended, without a predefined method or framework. Instead, my take on methods kept changing along the research. I was cannibalistically inspired by three fields of knowledge, for the most part:

- Research through design (RtD) as interpreted by the discipline of human-computer interaction (HCI), where my PhD was situated institutionally;
- Open methods as devised and promoted among other organisations by the Mozilla Foundation, the leading industry partner of the OpenDoTT programme; and
- Participatory methods and practices used in STS (social studies of science) that I bring from projects I was involved with prior to my PhD.

The ongoing iteration between those references allowed me to create the hybrid approach I call a ‘Spiral of Openness’ borrowing from different fields without however affiliating to any of them. The final sections of this chapter will advance an overview of that approach with notes on its application during my research. First, I offer some (critical) notes about the three fields I borrowed from.

3.4.1. Research Through Design

Research through design (RtD), or design research, is an interdisciplinary methodological approach that integrates design practices with research processes, offering concrete and verifiable tools for knowledge creation and problem-solving (Zimmerman et al., 2010). This section provides an overview of the origins of design research and its adoption in Human-Computer Interaction (HCI). Its relevance to my research is discussed, focusing on the benefits of using systematic tools to collect and analyse data. I also discuss the potential power imbalances between designers and research subjects and ways to address such imbalances.

Design research has evolved from diverse disciplines, including architecture, industrial design, and interaction design. Seminal works by Schön (Schön, 2017), Cross (Cross, 1999), and Frayling (Frayling, 1993) laid the groundwork for its methodological development. RtD offers a range of concrete and verifiable tools to transform intuitive and organic design processes into systematic and reproducible methods (Zimmerman et al., 2010). Such tools have been employed in my research to ensure scientific rigour and reproducibility in the research process, avoiding unconscious assumptions when collecting and analysing data generated in interactions with human participants.

The field of Human-Computer Interaction (HCI) has seen a significant evolution in its approach to design research over recent decades, shaped by the changing landscapes of technology and human needs. It was primarily focused on usability and functionality in the 1980s and into the early 1990s. Influenced by the emerging field of cognitive science, researchers aimed to understand and improve the interaction between humans and computers (Card et al., 1983). The discipline was primarily dominated by computer science and psychology experts, and the research methodologies employed were mainly experimental, with a heavy emphasis on quantitative analysis (Grudin, 1990).

As personal computing became more widespread in the mid-1990s, HCI shifted its focus towards User-Centered Design (UCD). UCD emphasises understanding user needs, preferences, and context of use and involves users throughout the design process (Norman and Draper, 1986). Methods from anthropology and sociology, such as

ethnography and field studies, became increasingly prominent, and there was a growing recognition of the importance of qualitative research methods (Bødker, 2006).

The growing popularisation of the commercial internet – and later, social media and mobile devices – led HCI to experience a ‘socio-cultural turn’. With that came a growing emphasis on social and cultural aspects of technology use. Interaction Design (IxD) emerged as a subfield of HCI, focusing on creating meaningful relationships between people and the technology they use (Winograd, 1997). Design research in HCI began to adopt a more holistic approach, considering the interaction between individual users and computers and the broader social, cultural, and organisational contexts in which these interactions occur (Dourish and Bell, 2007).

Some prominent design research tools include ethnographic studies (Suchman, 1987), participatory design (Simonsen and Robertson, 2012), prototyping (Helander et al., 1997), and iterative testing (Buxton, 2007). These methods enable the generation of contextually grounded solutions that address real-world problems while incorporating the needs and preferences of the target audience.

The tension between theory and practice is a recurring theme in design research, stemming from the intrinsic differences between the empirical nature of design and the conceptual realm of research. Scholars like Cross (Cross, 1999) have advocated for an approach that bridges this divide through a 'designerly' way of knowing. Similarly, Sanders and Stappers (Sanders & Stappers, 2008) underscored the value of 'doing' in design research, emphasising the importance of practical, hands-on engagement. Frayling's typologies of design research (Frayling, 1993) offer a way to conceptualise the balance between theoretical and practical aspects, each corresponding to different degrees of integration between theory and practice.

Adopting these tools in my research reflected the need to bridge the gap between intuition and scientific reproducibility, leading to more robust and reliable outcomes. Even though I have been involved with diverse open and participatory projects before my PhD, I often relied more on 'hunches’ and intuition. I felt lacking in terms of objective methods for collecting and analysing data. RtD offers plenty of tools to address that. On the other hand, it is crucial to take into account the considerations made earlier about participation on a deeper level. The use of design research tools may incur an imbalance in power relations between the designer and the research subject, with the former prioritising the interests of the study's funders over the latter's agency (Simonsen and Robertson, 2012). I adopted a cautious approach to the design research process to mitigate this issue.

I have used participatory design methods to promote the active engagement of knowledgeable persons in the design process, thus considering their perspectives and

needs throughout the development of solutions (Simonsen and Robertson, 2012). Additionally, transparency and open communication with participants were maintained to build trust and foster a sense of shared ownership in the studies (Irwin, 2015).

Given the benefits of the concrete and verifiable tools offered by design research and the importance of addressing power imbalances, RtD tools were part of my methodological approach. In the initial stages of the research, design research tools were employed to gain a comprehensive understanding of the fields related to addressing excess materials in cities and to ensure the relevance of the research questions. By experimenting with these tools, I aimed at establishing a foundation for further exploration and investigation into the problem areas. The particular focus of my research on waste prevention was a direct result of using design research tools in two particular studies called Repair Journey and Ecosystem Mapping, described in Chapter 4. As a result, I created eight concept ideas, which were then incorporated as building modules for subsequent phases of research. Some of those design concepts were subject to speculative prototyping, as will be described in Chapter 5. Finally, as a way to document and embed the discussion around my research findings, I have designed a toolkit based on another of my concepts, the Reuse Commons, as described in Chapter 6.

3.4.2. Openness In The Digital World

The Mozilla Foundation is a renowned actor in open-source technologies and practices. It occupies a peculiar niche, being a nonprofit advocating for ethical and trustworthy principles for technological development whilst also being closely associated with the Mozilla Corporation, responsible for products like the Firefox web browser. The two intertwined organisations share crucial cultural elements while maintaining considerable differences. The Mozilla Corporation owes more to the vocabulary and aspirations of startups and tech corporations, while the Foundation is more active in policy, inclusion and human rights. As the leading industry partner of the OpenDoTT programme, the Mozilla Foundation contributed significantly to shaping the structure on top of which my doctoral studies took place. In particular to this point was its approach to project development and management, known as ‘open leadership’.

This section provides an overview of Mozilla's open methodologies, mainly focusing on the Open Leadership Program (Mozilla Foundation, 2019), and discusses its benefits and limitations in the context of my investigation.

One of the key aspects of open methodologies inspired by the startup environment is the emphasis on rapid and cyclical iteration in project development. Mozilla’s open leadership

program encourages establishing solid communities that can actively contribute to project development and provide valuable feedback. The digital nature of these projects allows for a cyclical acceleration between incremental versions, ensuring continuous improvement and adaptation.

This community-driven approach to project development aligns with the principles of participatory design and user-centred design in industrial design and HCI (Simonsen and Robertson, 2012). By fostering collaborative environments where diverse perspectives are valued, Mozilla's open methodologies can facilitate the development of more relevant, usable, and responsive solutions to users' needs.

However, critical examination of such vision of open methodologies reveals certain limitations. Particularly regarding the assumption of a ‘project leader’ as the driving force behind these projects. This perspective perpetuates the image of the ‘enlightened genius’ – often portrayed as motivated, persuasive, and competitive – who convinces others to contribute to their project, preferably on an unpaid voluntary basis. This approach may undermine the genuine spirit of community-building and reciprocity, leading to superficial engagement and a lack of shared ownership.

Moreover, the entrepreneurial, Silicon Valley mindset that permeates digitally-inspired open methodologies contributes to the instrumentalisation of community members as entities without agency, only relevant when they are used to ensure the project's success. Such an approach may limit the potential for deeper participation, involving more extensive debates on the project's relevance to real people's lives, shared ownership of the process, and openness to collaboratively defining outcomes and metrics.

In light of these remarks, my research has used such open tools critically, adopting a more inclusive and participatory approach to project development. This entails moving beyond the ‘project leader’ assumption and fostering a genuinely collaborative environment which is intentionally undetermined, and where all participants have a say in the decision-making process and the definition of project outcomes.

In line with my position of critical appropriation, I have adopted practices directly inspired by Mozilla’s Open Leadership program. For example, conducting online meetings and dynamics, documenting processes in open, iterative and accessible ways, and publishing such documentation early on using version-controlled public repositories. The design study called reuse.city described in Chapter 5 was largely a reinterpretation of those references, combined with participatory action research, as will be described in Section 3.6.2.

3.4.3. STS And Collaborative Knowledge

The ongoing reflection regarding appropriate research methods, my own position and the expected results of the investigation brought my work closer to the Social Studies of Science (STS, science and technology studies). The discipline critically examines science and technology's social, cultural, and political dimensions. Elements from Participatory Action Research (PAR) were employed in my research in dialogue with STS to investigate waste prevention in urban settings with attention to social, environmental, and technical considerations. This section outlines the rationale for using PAR and STS, discusses the challenges associated with participatory methods, and outlines strategies for addressing power imbalances in the research process.

PAR is a collaborative research approach involving researchers and participants working together to understand a problem and develop solutions (Kindon et al., 2010). It aligns with the epistemological stance of STS, which emphasises the co-construction of knowledge and the intertwining of social and technical elements (Jasanoff, 2010). In the context of waste prevention, PAR can facilitate an understanding of the sociotechnical dynamics at play while actively involving stakeholders in shaping waste prevention and reduction strategies.

Participatory methods can also present challenges, though. Remarkably, participants can be expected to take the lead in the research process, while researchers adopt a passive role, nudging rather than driving the process. In response to this critique, my research seeks a balanced approach, acknowledging the dual role of the researcher as both participant and investigator. This approach is guided by the understanding that researchers and participants both bring unique perspectives and skills to the research process, and that meaningful collaboration requires an active engagement from all parties involved (Cornwall and Jewkes, 1995).

The dual role of the researcher – as investigator and participant – may raise questions about power relations, particularly regarding the generation and sharing of knowledge. To address this, I sought to balance my relative position as a researcher as an intentional act of what ultimately can be described as conscious undermining of one’s relative power. Such a take reflects the influence of Paulo Freire's critical pedagogy (Freire, 2017) in my work. It is about creating spaces for participants to actively question everything – including the means of interaction, the assumptions and the very purpose of the research, whilst emphasising the dynamic generation of knowledge in the researcher-participant relationship over the production of research outputs.

Acknowledging the challenges associated with participatory methods and seeking to

address power imbalances, I set out to foster a genuinely collaborative environment where forms of knowing would be co-constructed, and many voices were valued. This approach aligns with the broader aim of building inclusive and sustainable strategies for conviviality and fostering a proto-community where everyone can contribute to and benefit from collectively produced and convivial waste prevention strategies. To do so, I operated in a spiralled rather than a circular-elliptical way. As described in Section 3.6.2, PAR was incorporated in the design and conduction of the reuse.city research study.

3.5. Open… Or What?

Underlying the OpenDoTT programme, there was an arguably inevitable tension caused by the distinct nature of the organisations involved. In particular, the Mozilla Foundation was not the typical 'industrial partner' to an academic institution. A design school deeply tied to an industrial background such as Northumbria's would probably align easily in terms of vocabulary and expectations with a for-profit corporation. For instance, topics such as intellectual property, authorship and concerns about competitive advantages would arguably be closer to a consensus by default. However, Mozilla is a nonprofit foundation firmly rooted in open and collaborative practices, with an explicit emphasis on ethical and fair ways to influence how technologies are developed and shared. This difference – which in some circumstances could become a divide – is also a part of the point made earlier in this chapter about diverse modes of knowing and the changing boundaries of science.

The topic of openness, in particular, was a crucial part of the programme, and it is vital to consider its different possible meanings and implications. What does 'working open' oppose to? A usual take is to think in terms of binaries, 'open vs proprietary' being a prominent one. But what does that opposition denote? Within digital technologies, the term 'open' is largely – whilst not exclusively – associated with the use of open-source licensing for software and hardware. Open-source software was first popularised among programmers, system administrators and other technically oriented professionals. Most websites in the world run on top of free/open web servers such as Apache or Nginx and software like PHP and PostgreSQL. Many of them use free and open scripts such as WordPress, or run applications on top of node.js and others. Additionally, web browsers like Firefox and Chrome, and mobile operating systems such as Android, are notorious examples of successful open-source software (Pinto et al., 2018).

The open-source imaginary has its roots in activism to counter the unbalanced power accumulated by large corporations as information technologies moved from a niche sector to a presence in practically all fields of knowledge. Richard Stallman famously created the

basis for the free software movement when he understood the limitations imposed by a printer manufacturer onto the software required to operate their hardware (Williams, 2002). Later, other names such as Eric Raymond would found and popularise the open-source movement (Raymond, 2001). In that context, 'open' opposes to 'closed', and such opposition echoes on issues of transparency and inclusion.

Over the decades, that understanding of openness has disseminated through the whole IT sector, albeit often on a level much more discursive than practical. It has also had effects on the academic world, having influenced developments such as the policies of open access for scholarship. Besides, it has spread culturally to many sectors. However, a pretty particular understanding of openness frequently makes the rounds.

The vision of what 'open' means within the discourse of open-source technologies has some defining characteristics. Usually, a particular software, hardware schematic or creative product is considered 'open' when it is publicly accessible online and is published with licences recognised as 'open' by the open-source communities. In the case of software, there are slightly different definitions for that.

The OSI's (Open Source Institute) definition of open-source focuses on the availability of the source code, which equates to a recipe or set of instructions for compiling the software (Open Source Initiative, 2006). The Free Software Foundation's vision of free and open-source software is explicitly more political, based on 'four essential freedoms': to run, edit, contribute to, and share (GNU Project, n.d.). In both cases, the centrality of licensing attributes an entirely transactional nature: software code is treated as an object that can be handled and manipulated by those with the knowledge to do so. The licences are agnostic to the intentions, context, and assumptions of whoever is using or modifying the software. They do not require any relationship or communication whatsoever to be established between the user and the original author or authors of the software.

Expanding that thinking into the so-called creative sectors gave rise to initiatives like Creative Commons (Creative Commons, n.d.), which pioneered a legal standard that made it easier for authors to pick flexible licenses to publish their images, videos, music and texts rather than refrain from posting digital versions on the internet where they could be copied. In its roots, the movement to promote such flexible licensing schemes sought to enable greater access to cultural and educational resources, and to provide more agency and possibilities to content producers. It was, however, based on particular assumptions regarding authorship, audience and fairness.

An international working group organised by Delhi-based Sarai/CSDS discussed the limitations of such expansions in 2005. The resulting *Delhi Declaration of a New Context for New Media* is an important reminder that emerging discourses about new media at that

point were based on particular assumptions in terms of literacy, intellectual property, authorship, access, working conditions and others (Abraham et al., 2006). In the same publication, a text written collaboratively by the participants of a workshop hosted by the Waag Society questioned the dependence of objective licensing to consider cultural objects as 'open':

> You can only steal something if it is owned by someone in the first place. If things are not 'owned' but only held in custody, then they can only be 'borrowed' as opposed to being stolen. So what you call a 'pirated' DVD is what we would call a DVD 'borrowed' from the street, and the price we pay for it is equivalent, or at least analogous to an incremental subscription to the great circulating public library of the Asiatic street. (Abraham et al., 2006, p. 19)

These critical takes point to the need to decolonise the imaginary of digital openness. Even typical tropes of cyberpunk literature owe to that imaginary. Stories such as the world-acclaimed novel Neuromancer (Gibson, 2016) centre on the image of the lone hero taking on the world. Not surprisingly, the hero is often a white man with access to resources (be it legally or illegally), well-versed in tech and with a perfect domain of the language spoken by authorities and the elites.

In *Doughnut Economics*, Kate Raworth questions the extent to which university curricula owe their contents to a largely endogenous universe (Raworth, 2017). Even when such programmes gather student feedback, they often only reinforce self-selective dynamics involving relatively homogeneous participants. Raworth draws on the notion of 'WEIRD' to question such a self-referential nature of academic content creation. *WEIRD*, as coined by Henrich and others, would be a way to describe the way the public debate is biased by people coming from 'western, educated, industrialised, rich and democratic' nations (Henrich et al., 2010).

From a global social sciences perspective, the *WEIRD* hypothesis itself can be interpreted as too ethnocentric. By overlooking cultural, social, and economic complexities present in distinct societies and espousing an arguably prescriptive and linear way of understanding progress, it may even lead to further distortion and prejudice. As referenced earlier in this thesis, theorists like Paulo Freire and Arturo Escobar (Escobar, 2018; Freire, 2017), among many others (Galeano, 1997; Gutiérrez, 2016), challenge the Western-centric views of knowledge, political structures and culture. They underline that different societies have complex social and psychological structures. Further, they draw attention to the role of historical dynamics of colonial oppression, economic exploitation, and the intentionality of Western powers in promoting division and fragmentation within the local societies of the poorest nations. Such conditions fundamentally influence the structure of society, ordinary people's trust in institutions and the tactics they develop to ensure living conditions.

Such a perspective encourages a more pluralistic approach and a more nuanced way of understanding international cultural and behavioural dynamics. It recognises that cultural, social, and historical contexts may shape human behaviour and cognition in ways that a *WEIRD*-centric vocabulary might not adequately capture. However, used consciously, the *WEIRD* framing can be a useful way to focus attention on the limitations found in elements often promoted as universal while being themselves aspects of cultural imposition. For that, it is useful then to add some more elements to the *WEIRD* acronym to make it a bit denser and more reflective:

- Western / Northern, inheriting from former Empires and powerful nations;
- White / Male / Cis-gender;
- Educated, or rather 'taught' a worldview that reinforces its institutionally-recognised form of knowledge as the only valid one;
- Industrialised, largely constructed historically by seizing on externalities, replacing nature with artifice and enjoying the cheap availability of raw materials and labour;
- Rich, often owing to structural unbalances, primitive accumulation and/or war;
- Democratic… to an extent, but importantly, the *WEIRD* perspective needs to believe in its representative mechanisms and power structures as the only way to achieve true democracy.

Curiously, the *WEIRD* framing can be a good way to start conversations with people who fall in the description, helping crack into the boundaries of a limiting common sense. Such a soft common sense is reinforced in central sections of the public debate globally. Including, as noted by Raworth, academic curricula, and also the press and public opinion, as well as the language used by international agencies and the world of diplomacy.

For what it's worth, despite its limitations, the *WEIRD* view helps summarise the very narrow landscape of thought reproduced in free/open-source discourse. It is thus essential to move beyond such a limited view of what 'open' means. In 2014, I worked with cultural producer Luciana Fleischman on a study about experimental practices on culture and technology in Brazil. Instead of the transactional nature of open licensing, we entertained the idea of a 'culture of openness'. Here's an excerpt translated from the original in Portuguese, *Arranjos Experimentais Criativos em Cultura Digital* ('Creative Experimental Arrangements in Digital Culture') in which generosity emerges as central to a culture of openness:

> One could instead work with the idea of a 'culture of openness' that is processual and always dependent on intentionality and context. (...) On the one hand, it would allow us to escape the limitations of a transactional logic that devalues the potential of free production due to a supposed short reach of

> a given cultural product, and on the other hand, assert the intentional gesture of generosity as an element for politicising the making of culture, present in humanity since millennia before the first computer was even made. (Schmidt Fonseca and Fleischman, 2014, p. 8)

That study was partly a reflection on the development of Brazil's digital culture strategy, carried out by between 2003 and 2010 by its Ministry of Culture with a high level of participation of the civil society. At that time, we have openly embraced Creative Commons licences to make explicit the generous nature of what we were trying to accomplish (Foina et al., 2005). We were hopeful and optimistic, which made us overlook deeper aspects of exploitation, economic sustainability and power imbalances, including the insufficient diversity on our team. Hope and confidence are certainly core elements of free/open projects, but it is important to acknowledge and observe that critically, even in hindsight. In any case, there was an expectation that everyone else would join in what we saw as the best way forward. We were often disappointed in crossing paths with people unwilling to join the 'cult of the open'. True collaboration, however, cannot be mandatory, as Geert Lovink notes in The Principle of Notworking (Lovink, 2005, p. 13):

> Key to our effort to theorize individual and collective experiences is the recognition that there must be a freedom to refuse to collaborate. There must be a constitutive exit strategy. At first instance, this may be a mysterious, somewhat paradoxical statement. Why should the idea of the refusal be promoted as the very foundation of collaboration, as Christoph Spehr has suggested? It almost sounds like a new dogma, a next rule, *notworking* as yet another human right. The question of 'free cooperation' is, in essence, one of organization and comes up after the crisis of the (Fordist) factory model and its political mirror, the political party.

The binary opposition of proprietary vs commons-based modes of organising wealth and value can be seen as biased by the *WEIRD* perspective. Of course, European modernity was partly forged by the enclosure of land previously managed as commons – the primitive capitalist accumulation (Marx, 1981). Nonetheless, it's important to note that the specific historical experience of Europe is not universal. In many parts of the world, the arrival of modernity implicated different transformations – for instance, the destruction of large swathes of forest and its replacement with plantations, exploiting of slave labour, and exterminating of native populations through violence or disease on the way. Whatever relation there was between people and land beforehand was not necessarily similar to the medieval European commons. Nor was it replaced by labour rewarded with money in a 'free market', it's worth noting. That broader understanding of the scenario makes the dichotomy between *Creative Commons* and 'copyright' seem even more reductive.

3.5.1. Open Circularity

I have so far explored alternative ways to think of openness, beyond the narrow definitions

coming from the idea of flexible licensing for intellectual property. Not only open as non-linear or not enclosed, but open-ended too. How does that work for recurrent processes? There are well-known iterative approaches in the startup world. For instance, the *Lean Startup* (Ries, 2011) claims to allow for course corrections through a circular structure along phases called ‘build, measure, and learn’.

However, these approaches rely on a clear definition of the project leader’s identity and centre decision-making capability on that person or group. In that, they reproduce power imbalances such as the ones mentioned in earlier sections of this chapter. Such methods imply that one must ‘start with a great idea and convince a community of interest to join your cause’. That sounds to me like competition and not true collaboration. What if I don't have a clear idea and want to avoid exploiting other people's free labour? Can I start building community before I know what I want to accomplish – if anything? Can I change my mind and change my very own point of view with every interaction? And while I’m at it, can I do that with genuine care for people and cultivating meaningful relationships?

Thinking about circularity as a way to interact with the world in a broader sense creates interesting possibilities. Working with grassroots communities in Brazil, I learnt that focusing on ‘projects’ with a starting point, a clearly defined team, and an expected finish line is nonsensical in many social contexts. What does it mean to say you have started the project only on that specific day? What about the many earlier paths that brought you to that point? And who says the project will end? The sun will come up the next day. The seasons will keep returning, or so we hope. And equally important: how do you treat authorship when a neighbour offers by chance an insight that changes the whole nature of the collective effort?

In the manner of the *griots*, a measure of success of a collective effort is checking whether people are willing to remember, own, talk about, and reconstruct its memory continuously. So there is indeed an aspect of circularity that may be brought to the discussion of openness. Not the ‘open project’, but rather open and convivial ways to effect change in the world. If that is the goal, its shape may not be perfectly circular, or at least not in the form of a closed-loop circularity. If we are willing to change things, we may not want them to return to the point of origin.

A colleague in Brazil, Fabiane Borges, organised a series of online meetings about spatial techno-imaginaries and alternative futurism at the height of the COVID-19 pandemic. In one of those meetings, astrophysicist professor Germano Bruno Afonso was presenting his research on ‘Ethnoastronomy’. He offered this beautiful description of a cave painting made by ancient Amerindians, as explained by today’s *Pajés* (‘Shamans’):

> This one is a spiral, ok. And what about this spiral? (...) The most beautiful

> explanation I found was the following: it represents the beginning and the end. And that in our life we'll never be circular, which is represented by an ellipse. It means that whatever position we're returning to, even if things have not changed, we ourselves have changed. So it is not the same. The circle does not close to become an ellipse. (Borges, 2020)

A spiral shape is a way to move forward in a circular yet open form. And to make it truly participatory and inclusive, the transitional authoritative role played by a project leader must be self-challenged. In that meaning, collaborating should mean more than simply convincing others that one's idea is groundbreaking, revolutionary or worth contributing to. With a focus on establishing relationships, the Spiral of Openness invites participants to reflect on and transform their roles continuously. Instead of an initiative-based leadership, it's possible to work with rotating generosity-based leadership, as suggests the image of *tuxáua* in some Amerindian cultures:

> Every village has a tuxáua, who has the power to solve internal conflicts and quarrels, summoning meetings, scheduling celebrations and rituals, defining the agricultural activities and commercial transactions, ordering the building of houses etc. The tuxáua is in charge of hosting guests, demonstrating his generosity and carrying out the ceremonial role of offering çapó – guaraná sticks grated in water, a beverage drunk in large quantities daily that also has ritual and religious functions. (Instituto Socioambiental, n.d.)

Rotating leadership and collective generosity should be at the core of open, post-scarcity initiatives. The Zapatistas, who have been experimenting with alternative modes of organising society for decades in over a thousand communities in southern Mexico, have the principle of *mandar obedeciendo* ('to lead by obeying') (Subcomandante Marcos, n.d.). It implies the decision to focus on the collective outcomes and in an ongoing relation of care instead of the exertion of arbitrary authority. The Zapatistas are structured locally in *caracoles*, or 'snails' – yet another spiral-shaped image to denote the evolving and open-ended nature of community identity.

Promoting generosity-based authority is not that easy in an institutional configuration that values clear boundaries and objective productivity measurements – such as academia. In such a setting, generating recognisable output – publishing papers, presenting at congresses, submitting reports – is unavoidable. But the ongoing care and maintenance of the collective relationship is of utmost importance and should not be carried out merely for opportunistic motivations. In that sense, the community itself is the project, and the research outputs are but one among other enabling factors.

A possible way to move forward into truly open, spiral, and transforming ways of creating knowledge is to start with malleable definitions seen and elaborated differently by different participants. Here the concept of 'boundary object' (Star and Griesemer, 1989) is useful. Boundary objects serve as a means of translation, allowing individuals from different backgrounds, disciplines, or communities to understand each other's perspectives without

necessarily requiring consensus. They provide a shared reference point that each group can understand and utilise differently according to their unique needs and contexts. That allows the translation, coordination, and alignment of different perspectives and interests, facilitating cooperation between distinct social worlds between which mutual understanding is often problematic.

As actions unfold, the collective definitions ought to keep changing. The spiral never returns to its point of origin – the composition of the community, its goals and objectives, and the ways of coming together and organising itself are continuously transforming. Difference and contradiction are the flip side of diversity and true openness, and help distil improved versions and visions. It is a combination of the multiplicity of perspectives, levels of engagement and forms of cohesion that will determine whether a group of people can even be considered a community – seen as a collective possessing a diversity of commonalities and ongoing communication.

3.5.2. Addressing Excess Materials In A Spiralled Way

Throughout this chapter, I discussed forms of incorporating distinct modes of knowing to understand multi-faceted and complex issues of contemporary societies. I proposed to overcome the limits of a worldview based solely on industrial productivity – notably elements loosely identified by the acronym *WEIRD*, while recognising the limitations of such definition – and contribute to co-creating convivial futures. For that, I use elements from distinct disciplines and cultures in what I call critical appropriation. To visualise, if not structure, the knowledge generated in that process, I propose a spiral shape. That allows me to combine characteristics of openness – participatory and open-ended – and circularity. True to the nature of the Spiral of Openness, it is crucial to retell stories, revisit framings and redefine the scenario. This section reviews my research topic after the methodological expansion and considerations carried out in the above sections.

As stated earlier in this thesis, my review of literature and context pointed to a significant gap in knowledge at the crossing points between a) the smart city narrative, b) systems and policies to handle excess materials and waste in urban contexts, c) environmental policy and climate resilience, d) social inclusion in and through local communities, and e) democratic participation and participatory policy-making. The framing of my research can better be defined as exploring absent elements when approaching such diverse thematic affiliations, as follows.

1. Smart cities are often described from a top-down perspective, emphasising the priorities and goals of the public sector, IT vendors and for-profit consulting companies operating internationally. As noted in the previous chapter, there is significant critical scholarship on the smart city narrative

highlighting the need for more transparency, public awareness and democratic decision-making. Responses to such top-down perspectives are suggested through participatory mechanisms, data sovereignty policies and attempts to translate the idea of a right to the city into smart initiatives. Such critical voices are often constructed concerning social justice movements, the rights of minorities, opposition to global neoliberal capitalism, and concerns over a perceived trend in public opinion of adopting an almost exclusively market-based worldview to manage public services. It is important, though, to understand such movements not only in terms of rational opposition/expansion of a productivity-oriented worldview, but crucially as forms of challenging the way of construing arguments. It is not a matter of developing better arguments in the productivity arena but shifting the place of conversation from a top-down vision towards a human, convivial and situated, whilst system-aware one.

2. The aforementioned critique and the ensuing proposals seeking to provide more agency to local populations often focus on the implications of smart city initiatives that are more visible to public opinion. Common examples are fields such as the video surveillance of public areas, the management of traffic and passenger transportation, or environmental monitoring – particularly on aspects such as air and water quality, temperature or humidity and noise levels. Nevertheless, regarding the central topic of my research – waste and excess materials –, such a critical perspective is hardly seen, if at all. Proposals of incremental technology-based improvements to established waste management practices do show up in literature, albeit with an almost exclusive focus on increasing the objective efficiency of waste collection logistics or on designing equipment and industrial technologies to allow a better sorting of the materials sent for recycling. The underlying assumption that recycling is always the best solution for discarded goods and materials is seldom questioned by those proposing smart bins or data-driven route planning for garbage trucks. That assumption is connected with the arguable lack of awareness between urban populations on what is made with the materials they discard daily. Waste lies at the opposite end of the product lifecycle, when compared to production/consumption. As the latter deserves a great deal of media coverage and investment in public relations, the disposal of materials is unsurprisingly not perceived as worthy of attention. Further, the human and situated point of view of the people already experimenting actively with alternatives to tackle excess materials in cities and regions is currently outside the debate. My research establishes ties with people experienced in that area and foregrounds their lived and embodied experiences.

3. As a contextual and evolving note, pursuing a more circular economy is increasingly gaining traction in some fields of activity. That movement can be witnessed in the nonprofit and for-profit sectors and makes its way into policy circles. The European Commission published in 2020 its directive promoting a shift towards a circular economy (European Commission, 2015), and a growing number of important actors in the corporate industrial world have been claiming to espouse circularity to comply with new regulations and *Zeitgeist*. In such contexts, however – and again – the circular economy is pictured almost exclusively from the perspective of manufacturers, who long to access a continuous supply of reusable materials with known provenance. Here too – as much as in the smart cities context – there is an attempt to reshape large-scale infrastructure and operations without considering real-world human beings' needs and desires. In what can be seen as analogous to the smart city narrative, a top-down perspective is again imposed onto the affected communities and populations with little discussion about their

implications, relevance, and methods.

Three points may then summarise the context in which my research questions were shaped:

a) the smart city narrative often fails to consider the perspective of real, situated people living in cities and should be challenged from a *Right to the City* point of view;

b) waste management in smart city projects is even further distanced from issues concerning the everyday lives of ordinary people;

c) attempts to promote more circularity in current waste disposal practices echo the top-down perspective on public service provision. They would benefit from a framing around conviviality and deep participation.

These three elements share an unbalance in power relations mirrored not only in the ability to make decisions but also in the way central actors see knowledge being developed in the field. What follows may be a superficial depiction, but it still echoes significant dynamics: when an international consulting firm is commissioned (by local/regional public authorities or by industry-led associations) to project future scenarios for waste management and a circular economy, they are expected to adopt a world view aligned with whoever funds their strategies and reports. The knowledge generated in such studies is arguably biased by a top-down, resource-oriented, *WEIRD*-centred perspective.

My research aims at balancing such a scenario by bringing to the fore the experience and skills of people invested in promoting change who are directly involved in the material and social aspects of the reuse of materials in cities. It is important to understand the expectations of city-dwellers, activists, social entrepreneurs, and other stakeholders. To incorporate and face such conditions, I built my research spiral using diverse methods – engaging with participants along the way and constantly returning to the definitions, the research questions and the disciplinary borders.

As described in the following sections, I started by using tools rooted in RtD to acquire a first overview of the research topic and to validate the relevance of the research questions by engaging with people with diverse perspectives on the reuse of second-hand or unused materials. I was also interested in mapping the kinds of organisations and materials flows involved. At the end of that phase, I created design concepts for subsequent stages, informed by my conversations with experienced actors.

Second, I adopted open methods inspired by digital initiatives but combined with a deeper and situated view of the role of human relationships in community settings. To co-create knowledge in a participatory way, I designed and conducted an online co-design lab with knowledgeable practitioners. Meanwhile, I was also refining, recombining and prototyping a subset of the concept ideas created earlier.

Finally, I have explored the idea of adopting commons-based alternatives to address excess materials in local contexts, based on principles of generosity and conviviality. I was particularly interested in how that can relate to and improve existing policies and influence the creation of new ones. To document and concretely discuss participatory policy-making, I returned to another of my original concept ideas. In reflecting and experimenting, I designed a 3-steps interactive method to mediate conversations about the reuse of materials in local contexts. The resulting toolkit can facilitate the creation of convivial solutions for excess materials that respond to local necessities, community culture and expectations, and concrete conditions.

All of those activities were conducted with a continuous reflection about my role – as a student, as a researcher commissioned to investigate the role of technologies in building better cities, and also as an individual coming from the Global South and actively engaged with the fields of activity I was investigating. The following section describes the methods I have used to engage with participants, co-create knowledge, and document my processes and findings along the way. In the following chapters, I go deeper into my fieldwork and naturally reiterate and retell the main story of this thesis – about the co-creation of convivial and decolonial ways to address the excess of materials in contemporary cities.

3.6. Making The Spiral Concrete

The methodological approach described in this chapter resulted from multiple iterations and course corrections. It was built along ongoing interactions with participants, supervisors, colleagues, and members of networks and communities I am part of, as I approached the question of how to reimagine the ways cities handle excess materials. As can be apprehended in this chapter, instead of defining a clear methodological framing from the onset, I went through a continuous process of estrangement and accommodation, learning and sharing, experimentation and change. There were admittedly distinct phases, in which – not necessarily in the following order or composed of all of these parts – I would set my attention on a particular section of my research interests, explore literature and early reflections, brainstorm ways to approach, conduct experiments, document my activities, and return. Each of those immersions was connected to distinct phases of the OpenDoTT programme. I call them research cycles as a reminder of the overall spiralled shape of my research.

It is also important to clearly describe the concrete activities conducted as I went through that route to amalgamate the diverse perspectives that compose my view on knowledge generation and community building. This section depicts the studies and reflections composing the three cycles of my research spiral.

3.6.1. First Cycle – Repair And Reuse Of Materials In Cities

Once I defined the objective of investigating the relation between urban issues, waste, technology and local societies, I set out to understand how best to approach that confluence by using the methods and tools of Research through design I was introduced to through the OpenDoTT training modules. My initial intention was to have a deeper view into how different agents perceived products and objects that were not in use for some reason and how those materials were transformed and circulated – or not – in contemporary cities. To understand that scenario better, I created two research studies called Repair Journey and Ecosystem Mapping. Both addressed the absence of socially oriented alternatives to manage solid waste in contemporary cities and formed the groundwork for creating design concepts in response. The studies were conducted almost simultaneously and provided diverse yet complementary perspectives.

In line with the intention to evolve the contemporary development of convivial alternatives to the industrial area proposed by Illich (Beinsteiner, 2020), the research studies conducted during the first year of my doctoral investigation meant to engage with participants to:

- Scope the investigation and make choices about the research focus and approach;
- Understand how the reuse of goods and materials in cities was perceived and acted upon at a human scale;
- Map how things circulated (or did not circulate) after they were purchased, used and eventually considered inadequate for some reason.

The Repair Journey was an exercise where participants attempted to repair or transform objects while keeping a journal of their findings, reflections, and outcomes. The Ecosystem Mapping was based on interviews with people experienced in reuse, repair, waste and second-hand goods. Both studies were impacted by the COVID-19 pandemic, as described in the following sections. Nonetheless, they offered relevant outputs for the first cycle of my research spiral. The studies allowed me to refine my research focus better and to identify elements later incorporated into conceptual as well as practical aspects of the investigation. Finally, the analysed outputs of these studies provided crucial elements to brief the creation of eight design concepts that responded to my discoveries and would allow me to expand on them in subsequent phases.

3.6.1.1. Repair Journey

Design Probes are often used in design research as a means of providing open-ended interaction with participants while steering the focus of the interaction to a particular theme or issue. Probes are objects intentionally kept incomplete so that participants can bring

their own contributions to the fore. Examples of probes used in design research are cameras, portable diaries and other artifices, which are handed to research participants for a period of time and with/through which they are asked to interact (Wallace et al., 2013).

As a way to engage on a deeper level with city-dwellers regarding their behaviour towards the reuse of inadequate objects, I have conceptualised an idea originally called ‘broken probes’: people from different backgrounds in the city of Dundee would receive objects either broken, obsolete or unwanted for any reason, and be asked to go around the city trying to make such things usable or/and valuable. The process of trying to make sense of those arguably unfitting objects in the city would inform a mapping of the ecosystem around waste, excess, reuse, and discard.

Upon refining the study, I decided to remove the nominal focus on ‘broken’ as that would imply a pre-existing judgement of value. Instead, the final title of the study was ‘Repair Journey’. It was designed to investigate how materials can be repaired, adapted or transformed in urban contexts and the subjective conditions involved. In particular, I expected to understand how the value of an object is perceived in different situations by city dwellers and how accessible are the possible ways of handling or transforming such an object.

The main objective of the Repair Journey was to explore what should be different in cities to allow local individuals, groups, and organisations to reuse more of the materials they currently discard or leave unused. I would explore what individuals can do to transform materials that are either broken, not working properly, outdated, ill-fit or otherwise inadequate in cities. Each participant would focus on one object in such conditions and spend two weeks trying to make them usable or valuable in any form. Participants would be asked to keep a repair diary along the way. During that period, they would be asked to reflect upon the practical and conceptual sides of repairing, reusing and repurposing the object and document their impressions.

Due to the restrictions on the circulation of people and goods imposed due to the COVID-19 pandemic, however, the shape of the study had to be changed. The original plan was to organise an event at a scrap shop in Dundee to engage community members and hand them selected broken objects and physical journals. The non-presential alternative during the first waves of COVID-19 was to move the event and the study to an online setting. It was conducted remotely with participants from different parts of the UK, as will be described in Chapter 4 of this thesis.

3.6.1.2. Ecosystem Mapping

In addition to the Repair Journey, which investigated behaviour towards repair at an individual and household scale, my research also required me to learn more about how the reuse of materials takes place on the urban scale. For that purpose, I designed another research study to interview participants and produce a map of the ecosystem comprising waste, repair, and reuse. Through the study, I expected to challenge the usual assumption that waste management should be entirely outsourced to private for-profit corporations that will recycle, incinerate or landfill materials discarded in cities. I wanted to acquire a systemic understanding of how broken or discarded materials circulate in the urban context and where and how they are manipulated and transformed. I was looking particularly at how potential value is assessed in different kinds of organisations and what types of equipment, methodologies, and data sources would aid in that.

Initially, the plan was to visit places in the Dundee area responsible for solid waste treatment, as well as organisations and companies that repair, repurpose or receive donations of different types of materials. Interviews with managers and staff would accompany the visits. However, as well as for the Repair Journey, I had to reshape the study due to the effects of the COVID-19 pandemic. That had an impact on my recruitment strategy and geographic boundaries.

Instead of knocking on doors of different types of organisations to recruit potential interviewees, I had to change to an online configuration. Further, most of the local organisations in Dundee that I expected to include in the Ecosystem Mapping had closed doors and were not reachable via phone or email. Others informed me they did not have anyone available to be interviewed. Finally, one organisation only replied after my data collection period had expired. I ended up reshaping the study to expand to other regions. Instead of an Ecosystem Mapping of a particular locality, I would concentrate on a conceptual one, focused on types of organisations and how materials were assessed and transformed and circulated between them.

3.6.1.3. Design Concepts

As the final movement in the first cycle, I created a series of design concepts that responded to and expanded on the findings of the two research studies. As described in Chapter 4, the outputs of both studies were analysed and translated into a design brief depicting in broad terms the potential target audiences and areas of intervention. Subsequently, experimentation and further reflection resulted in the creation of eight concepts that simultaneously embed the critical perspective essential to cover the complex issues raised by my literature review and methodological choices while still being relatively concrete. This concreteness – in some cases, being almost palpable – allows for

ways of engaging with the research issues other than only theoretical and critical reflection, as described in the next sections.

3.6.2. Second Cycle – Community-growing

The second cycle of the spiral started with the intention to expand the understanding of my research topic by incorporating the point of view of people with lived experience in the field. Inspired by the *agents valoristes* mentioned in Chapter 2, I wanted to build upon the skills and abilities of these professionals. The quest to better understand how to assess the potential value of materials and how to actualise it through stories and concrete interventions inspired the creation of a new research study, in the form of an online laboratory. Its goal was to enable me to engage in co-design exercises with practitioners experienced with community-based reuse initiatives – through repair, upcycling or redistribution of broken, second-hand or excess materials and goods. Meanwhile, I would be prototyping a remixed subset of some of the design concepts from the first cycle. Such prototyping was aided by training and mentoring provided by members of the OpenDoTT consortium. The online co-design lab enabled me to engage with participants not only as an external observer but performing reflective hands-on practice in the design of potential solutions and learning directly from that.

The study was initially called ‘Tech for Reuse’ but was eventually renamed ‘reuse.city’ to make it easier to understand and communicate online. It revolved around the possibility of augmenting and replicating value-assessing skills through digital systems, both in software and hardware. In addition, harkening back to the context of smart cities, I wanted to investigate what kind of infrastructure or public service could increase the volume of materials diverted from the waste stream to be reused in cities and regions. I was interested both in existing infrastructures and in ideas still untried. In adapting to COVID-19 times, the study would be conducted exclusively online. That opened the possibility of inviting people from around the world – beyond the United Kingdom or Germany, where I had by then moved to.

The research study recruited participants to join an online co-design lab planned to last about a month. As an exercise of shaping an open-ended spiral, reuse.city focused on growing a community, based on my desire to connect on multiple levels with a group of people instead of starting from an objectively predefined idea. The shape adopted by the co-design lab combined elements coming from three sets of references:

1. A continuation of my immersion in design research, as I picked a subset of my concept ideas to be remixed and further developed through speculative prototyping.
2. The use of open-source methods such as shared and public

documentation and iterative online discussions happening in an open-ended way.

3. Participatory Action Research by engaging with a group of people interested and experienced in the field.

The study invited participants to help decide on its shape and purpose since early phases. That would include decisions on how to communicate and what the activities would be during the lab period. New questions were incorporated, such as how to adapt to diverse time zones due to the geographic dispersion of participants.

Chapter 5 describes in more detail how the study was conducted and what were its outputs and discoveries.

3.6.3. Third Cycle – Policy And The Commons

The final cycle of my doctoral investigation was one of grounded reflective practice. Following the insights generated in the two first cycles of the spiral, I was back to defining ways to address the objective of shaping alternatives to promote greater reuse of materials in cities and regions. In the first cycle, I conducted design research studies resulting in a better defined research focus and the creation of eight design concepts. The second cycle enabled me to prototype some of those concepts in dialogue with participants experienced in reuse initiatives, thus refining my understanding of the issues at stake and their potentialities. For the final cycle, it was time to expand my research back onto the city scale.

Following OpenDoTT's intention of discussing how to effect significant and positive change in the real world, I sought to explore possibilities of participatory policy-making related to waste prevention. I approached that purpose through parallel activities:

- Regarding literature, I focused on the fields of policy most relevant to my research. I was interested in critically exploring the possibilities for real-world impact that such fields entail, be it in legal and regulatory terms, or by opening space for public discussion on related topics.
- I recollected the engagement I had had with policy-making prior to starting the PhD. The participatory experiments I had been involved with while working in the fields of digital inclusion, cultural policy, electronic waste and others could have insightful contribution to the research.
- Instead of conducting a new round of research with participants, I explored my own experience of learning from the context of waste prevention in the urban context during the investigation. As an individual who had moved between cities in different countries, I was able to explore a sense of strangeness with the public administration, culture, language, and other elements. Such individual standpoint on the scenario, as well as a relatively distant observation of events, organisations and discussions, brought to the fore elements of auto-ethnography in this cycle.

- Finally, I returned to the concept idea of a Reuse Commons and developed it further as a toolkit to help facilitate conversations and negotiations about reuse systems at a local level. Even considering that it still deserves future improvements, Reuse Commons was a type of design-oriented embedded documentation of the insights, findings, and recommendations of my research aimed at fostering the commons-based governance of reuse systems.

The third cycle and its outcomes are described in Chapter 6.

3.7. Spiralling Methods

This chapter was the hardest part of writing my thesis. The fact that I did not affiliate in advance to an established and clearly defined field of knowledge or methodological framework made it particularly complex. It took me some time to understand that there was method in the studies, designing, conversations and reflections I was doing, only it was not following a linear route ahead – nor a completely elliptical one.

Reading my activities as turns of a spiral made it easier to cope with the changes in direction and redundancies. It also enabled me to naturalise the feeling of constantly returning to some questions that would be foundational in more strict methodologies: what is my research subject; what am I trying to accomplish and how; what disciplines does my research relate to.

Instead of a weakness, the spiral shape allows that constant return to be seen as reinforcement through openness. Each cycle of my research was conducted with a different combination of tools and methods to structure and design studies, to generate and collect data, and to make sense of discoveries. It was a gradual construction, but even that term must be read critically. One may, after all, think superficially of ‘construction’ as a process of laying bricks on top of other bricks, of progressing steadily but surely. The spiral of openness is not that predictable, being perhaps more adequately depicted as inspired by permaculture design.

The principles of permaculture combine observation, reuse, integration and responding to change, among others (Meyer, 2017). Interestingly, permaculture uses the shape of the spiral quite concretely as structures for intervention, such as in herb spirals (“Herb Spirals and Herb Circles,” 2014). Permaculture allows the dialogue between the real conditions for sustaining life in a particular environment, the intended goals of those using it – frequently regenerative –, and awareness about the time needed to at the same time effect desired transformations and adapt to external change. The spiral of openness provides a similar combination of flexibility and drive to my research.

By accommodating diverse methods and vocabularies – those coming from design

research, open-source software, STS and PAR –, the spiral of openness was crucial to push forward the objective of exploring convivial alternatives to reshape the way excess materials are handled in cities and towns. It simultaneously welcomes the individual exploration of cities and systems, the collective engagement with experienced actors, the reflection and experimentation on ways to act, and the navigation of the contemporary landscape of sustainability, waste and democratic participation. The central proposition of my investigation – the concept of generous cities – emerged as a new entity from the interplay between those diverse elements.

4. Smart Cities And Waste

This chapter describes the research studies conducted during the first year of my doctoral investigation – the Repair Journey and the Ecosystem Mapping. As described previously, these studies were based chiefly on methods of research through design to situate my research theme, acquire an overview of the issues involved, and design concept ideas in response. They were first developed to delineate a research focus that would bridge three main departure points:

- The topic of investigation that I was designated when I joined the OpenDoTT programme: ‘Smart Cities’. The programme was clear in its intentions on that, asking, ‘Can we create cities that are not just smarter, but kinder, fairer and more citizen-centred?’.
- The way OpenDoTT was structured to combine design research, open design, open-source software and hardware, with an emphasis on ethical technological development.
- My lived experience with other projects in the past, my current journey as a researcher and activities I would be involved in during my PhD.

Linking these elements through design research studies, I expected to acquire a first grasp of the fields I would be engaging with throughout my doctoral investigation. It was also the first iteration of my spiral-shaped research. At the end of this first cycle, I would return to my starting point to question and improve my research focus, consider the disciplinary affiliation of my research and plan subsequent phases. In Chapter 3 I differentiated between the ellipse-shaped circle and the spiral: even if I would return to a starting point of sorts to design new studies, such a point could not be exactly the same. Not only the world would have changed in the period, but I would have added elements to my baggage, and in result acquired a changed perspective. The studies performed in this first cycle would later be followed by other two cycles, in which I would frame and reflect on my Research Question in different ways.

Before going into the activities performed in the studies and the data collected through them, it is important to situate where I started. Expanding further on the analogy of the spiral-shaped knowledge generation, a look into the past suggests that the beginning of my doctoral investigation is not the absolute origin of my work in the field. Rather, it is yet another point of the ongoing spiral of my involvement with the reuse of materials in contemporary cities. In the next section, I describe what I already brought with me at that point.

4.1. Picking A Solid Topic

As discussed in Chapter 2, diverse authors interrogate smart city initiatives from a critical perspective, highlighting how they tend to focus on corporate efficiencies rather than the rights and needs of city-dwellers. Considering my background in community-based projects of eco-social innovation, open-source activism and movements for repair and reuse, I decided to centre my attention on waste – more specifically, on the reuse of excess materials in cities and towns.

At this point, critical scholarship about smart cities features very little about waste and handling excess materials. When something is said, it generally focuses on incremental improvements to customary waste management. In such accounts, there is no mention of sovereignty, no critique of global neoliberal capitalism and how valuable resources are appropriated by profit-oriented corporations, nor of how the 'recycling imaginary' makes people feel comfortable to consume (and discard) even more. Discussions about the working conditions of waste workers are all but absent.

A significant proportion of materials discarded every day still retain potential value (Western Australia Waste Authority, 2019). Realising that value generates more economic benefits than disposing of materials. There are estimates that repair creates over 200 times as many jobs as landfills and incinerators (Ribeiro-Broomhead and Tangri, 2021). Still, literature on how to identify and regenerate value from excess materials in a way that democratically benefits city inhabitants and communities is scarce and fragmented (for instance, criticism about the top-down imposition of circular economy (Gregson et al., 2015; Schröder et al., 2019) or so-called green transformation (Scoones et al., 2015)). On the rare occasion that it is even noticed, the potential value residing in excess materials is more often than not seen as another source of revenue for large industrial recycling and manufacturing corporations.

From the onset, I saw my research as an effort to reflect and experiment at the intersection of critical urban studies, concrete alternatives to waste management, open and participatory ways to engage with local populations, and the development of convivial alternatives facing the contradictions of global capitalism. It would also be informed by my background in projects related to the reuse of materials through repairs and modifications. From such projects, I already had a sense of the limits of waste policy when it comes to the reuse of materials beyond (or besides) the collection of recyclables.

In the past, I had also explored connections between repairs, craft, recent developments in digital fabrication technologies and internet-enabled maker cultures. I would then drive my doctoral investigation to understand some aspects of that scenario more deeply. To engage with excess materials in the context of smart cities, I knew it was important first to

understand the complex configuration of global capitalism, consumerist behaviour, unsustainable industrial practices and available infrastructure. Only acknowledging that context could any real solution be designed and implemented.

I started by conducting two studies almost simultaneously: a Repair Journey and an Ecosystem Mapping. Those two studies allowed me to organise ideas and obtain an overview of related fields. The Repair Journey investigated how individuals and households behaved with what I tentatively called ‘inadequate objects’ by then: things that were broken, obsolete, unfit, or worn out. The Ecosystem Mapping aimed at plotting organisations that dealt with discarded goods in cities and understanding how they related to each other and to society. Those two first studies offered me an overview of the field, allowing me to refine the research focus and create eight original design concepts in response. The following sections describe those activities in more detail and offer a glimpse into my findings along the way.

4.2. Designing Research Studies

As mentioned, the starting point of my research was the need to better understand the design research tools that would allow me to turn conversations and group interactions into objective findings and insights in an academic context. During a training module provided by two design studios that were part of the OpenDoTT Consortium – Quicksand and STBY – I had the chance to experiment with different design research methods. For training purposes, I developed two prototypical ad-hoc exercises: the first was a decision mapping, and the other was the geographical plotting of potential actors of material reuse in the vicinity of the University of Dundee, in Scotland. Two undergraduate students from the university volunteered as testing participants.

At the time, I was still refining the research focus for my PhD. One idea was of ‘post-consumption’. It was based on the perception that industrial production largely treats its products as potential waste – hence, emptied of value – from the moment they are shipped to retail. My interest was on the other end of the product use cycle: finding what happens to a product from the point when the consumer finds it inadequate. Such inadequacy could be, as I elaborated during that exercise, a result of one or more of the following conditions:

- Failing / Broken.
- Inadequate / Unfit / Wrong size.
- Obsolete.

To explore that space, the first brainstorming exercise I conducted during that training

module was what I called decision mapping. I wanted to learn when and how participants would consider an object inadequate and what kinds of actions would ensue. The resulting set of actions was useful in conceiving a map of possibilities and questions to help shape my research studies later on. The possible actions towards inadequate objects would be expressed along the following lines:

- Return / Warranty.
- Repair. Professional? Self, friend, relative? Community?
- Customization, change, adapting. Professional? Self, friend, relative? Community?
- Keep, decide later.
- Sell – Where?
- Donate – How?
- Discard – How?

Trial conversations with students and colleagues confirmed that different hypothetical inadequate objects – bikes, kitchen utilities, mobile phones, furniture – would trigger different actions in response. What was a relatively new perspective to me was realising that one's life situation also played a crucial role. A student sharing a flat with friends would adopt a very different behaviour than their retired parent or a young family furnishing their home.

Figure 3: Decision Mapping Exercise

My own life situation at that point also contributed to informing the research focus. My family and I had just moved from Brazil to Dundee, and we were interested in learning how to acquire second-hand goods for our household. We had found some second-hand stores, and discovered charity shops and websites to mediate the sale or donation of objects, such as eBay and Gumtree.

Nonetheless, I was somewhat disappointed that in Scotland – a rich country, from my perspective as a Brazilian –, a post-industrial city trying to adopt best practices on environmental issues like Dundee had no clear infrastructure through which city-dwellers could make redundant goods available to others. Ten years earlier, while spending some months in Barcelona, Spain, I had found that city's notable and useful habit of neighbours putting objects they didn't use anymore on curbsides so that others could collect them. On another occasion, I had the opportunity to work for some weeks in Nantes, France, where a group of organisations constituted a system that promotes the reuse of excess materials. It was in that period that I came across the image of *agents valoristes*, the professionals in charge of assessing the potential reuse value of materials available for reuse I mentioned in Chapter 2. Those experiences would also inform later research stages when pondering value, excess, and abundance.

Even though there were few spaces for freely donating or sharing second-hand objects, during the training I conducted another exploration to plot onto a map of Dundee different

types of organisations that could play a role in the reuse of materials. I decided to include in that map municipal waste facilities[3], repair shops, hardware stores, providers of services like sewing or key making, and selling parts and accessories. I even included shopping malls and Amazon's supply hub, for they can be seen as major sources of products brought into the city that will eventually become obsolete or inadequate.

That first contact with design research methods gave me more confidence in the choice to focus the research on waste and reuse. Those initial experiments were later reassembled to design the two studies conducted during my first year of PhD work: the Repair Journey and the Ecosystem Mapping. The outputs of such studies would provide the elements for the design of concept ideas to start addressing my Research Question.

4.3. Repair Journey

The Repair Journey was designed to engage people with interest and, if possible, diverse experience levels in manual repairs. Its main goal was understanding the conditions, limitations and possibilities impacting city-dwellers' ability to make broken objects valuable. It also explored what the participants thought should be different in cities to enable the repairing of things.

As described in Section 3.6.1.1, the study was inspired by the use of design probes to establish interaction with participants, focus their attention on particular topics and trigger conversations. Participants were asked to pick one object they considered to be in need of repair. They would then spend a period attempting to repair the object, or make it valuable in any other way. Meanwhile, they should keep a diary of their activities, reflections, and findings. During the journaling period, I would send them messages drawing attention to one or another aspect of repairs and reuse. In the end, we would have an online meeting to discuss the process collaboratively.

All the participants filled and signed a consent form agreeing to have their diaries made public with an open-source licence. Through the consent form they also agreed to have their participation in workshops and interviews recorded in audio, transcribed, anonymised and published in a repository as part of the study dataset.

The study had to be adapted almost on-the-fly due to the conditions and limitations of the COVID-19 pandemic. That impacted negatively on the plan to organise a face-to-face

3 That was symptomatically a complex task. It was not the first time I noticed that the typical citizen has no clue of what is made with their waste. I had a similar perception in Ubatuba, a small coastal town in Brazil, as much as in a large megalopolis like São Paulo. It was the same when I had discussed the theme with Master students in Doha and friends in different cities in Europe.

event in Dundee to recruit participants. On the other hand, it enabled people from localities in the UK other than the area around Dundee to sign up, which allowed for a more diverse composition.

4.3.1. Participants

The fieldwork took place during the early stages of the COVID-19 pandemic (April to May 2020). I organised an online event to present the broader research project and situate the Repair Journey as part of it. The event intended to establish a first layer of dialogue with individuals and communities interested in a culture of repair. I posted an open invitation to the presentation on specialised websites such as the *Restarter Project*'s online forum, the OpenDoTT programme's website and social media, my own social networks, and those of faculty members, colleagues and interested acquaintances.

Nearly twenty participants joined the online presentation. At the end of the session, I shared the link to the consent form, through which those interested could sign up to participate in the study. Due to particular limitations of how the study had gone through ethics approval at the University of Dundee, only participants based in the UK could sign up. Nevertheless, the diverse audience of the presentation was instrumental to recruitment. A webpage with a description of the study and the link to the consent form was also shared online later, using the same websites and social media as the presentation invite, as well as those of local partners such as the *Dundee Makerspace* and a social enterprise called *Scrapantics*.

A total of eight individuals volunteered to join the study. One of them gave up early on due to health reasons. The rest of the group was composed of:

- Three participants coming from repair events and networks. Two of them – one from Dundee, the other from London – were interested in computers and digital devices. The third person was a hobbyist repairer experienced in particular with home appliances, from Worthing, in the south of England;
- One person living near Dundee who works in the film industry, acquiring goods for film shootings;
- Two design researchers, one located in Dundee and the other in London;
- Finally, a participant who replied to emails only and did not attend any call nor shared any more details of their work or location, but sent a diary nonetheless.

4.3.2. Activities

The participants were asked to start a repair diary about at least one object they wanted to

repair. It could be something broken, malfunctioning, inadequate, or a combination of these three. Each participant got to choose the object their diary would focus on. It could be an object they were currently interested in exploring or some significant experience they had had in the past. Over a period of three weeks, they were constantly reminded via email to reflect upon the value of the object they each chose, in what ways it could be considered usable, and how easy it was to repair or repurpose it. I also encouraged them to share stories of failed attempts, arguably as relevant as successful attempts – or even more so.

There was a diversity of outcomes in terms of diaries. From participants who had an exciting start but did not follow through to others who had put extra effort into documenting and making things look good. There was a poem, a blog post, and technical notes. One participant documented extensively their process, including even images of attempted solutions, as seen in Figure 4. And in some cases, no diary was kept at all besides brief notes over email. Participants repair attempts were the following:

- A chair that one participant found in the street and tried to replace its missing seat;
- Cherished pants that had ripped;
- A series of garden objects in need of adjustments;
- A broken electric key fob and a failing powerbank;
- Home appliances brought by neighbours;
- A wooden box.

Figure 4: Chair Repair Diary

At the end of the journaling period, I met online with the participants to discuss their repair journeys. The idea was to discuss with them what should be different in cities to allow local society to reuse more of the materials they currently discard. Four participants and I met online for a collective workshop. Another two had to be interviewed individually due to an agenda conflict and connectivity issues. The remaining participant communicated via email only.

During the online conversations, participants were asked to report how their journeys went, and discuss what would need to be changed in their city or town to make the reuse and repair of materials more accessible, effective and enjoyable. The diaries were not discussed during the sessions, as my interest was more in the participants' perception during the period, not necessarily the outputs of their journals.

4.3.3. Research Data

During the weeks of the study, I sent the participants six emails with guidance, hints and reminders, and samples from my repair diary. In response, the participants sent me images of their diaries, or notes, about seven objects. The workshop and interviews resulted in 2h45 of recorded conversations with the seven participants. The recordings generated 79 pages of anonymised audio transcriptions. Those outputs, and those from

the Ecosystem Mapping, are analysed in Section 4.5.

4.4. Ecosystem Mapping

Systems mapping is a tool to visualise and understand complex configurations. Peter H. Jones discusses how systems mapping can be used in the context of design to understand and address complex social realities (Jones, 2014). Jones establishes several principles for systemic design, which include understanding that problems are part of larger systems, exploring issues in their full context, and embracing complexity and uncertainty. He emphasises that systemic design is not about simplifying problems, but rather understanding and representing them in their complexity to inform decision-making. In the context of my research, as mentioned in Chapter 3, the main goal of the Ecosystem Mapping was to acquire a system view encompassing:

- organisations operating on the urban scale that would be relevant when considering ways to promote greater reuse of goods and materials at the urban scale.
- how those organisations assessed the value of materials,
- how they handled and transformed goods and materials,
- how materials circulated – how they were acquired or collected, and what their destination was.

In adapting to the COVID-19 restrictions, I had to expand from mapping the region around Dundee to creating a more conceptual ecosystem map, summarising my conversations with participants in different parts of the UK. Similarly to the Repair Journey, participants were recruited using social media, and posting invitations to online environments such as the Restart Project's online forum. I also reached out to people I already had contact with before starting the PhD. Five participants signed up.

I created an interview guide exploring different aspects of reuse in organisations:

- characteristics of materials,
- how to assess their value,
- how they were processed,
- considerations about space, organisation, equipment and tools,
- outputs of the processes carried out.

All the participants filled and signed a consent form agreeing to have their voice recorded in audio, transcribed, anonymised and published in a repository as part of the study dataset.

4.4.1. Research Data

Among the five participants, there were:

- three business owners in different regions of the UK.
  - A custody shop in which unclaimed products are put for sale after a period;
  - A social enterprise acquiring industrial scraps to be resold or used in educational and artistic projects;
  - A boutique operation combining digital fabrication and second-hand shop.
- a data scientist working voluntarily to analyse waste data provided by local authorities in the UK.
- a leader of a nonprofit organisation dedicated to supporting 'zero waste' initiatives in Scotland.

Altogether, the interviews totalled 4h15 of audio recordings, which generated 139 pages of anonymised transcriptions.

Despite asking around in different cities and social circles, I was unable to identify anyone from a local council who would agree to be interviewed for the study. It may have been due to the pandemic, which exerted additional pressure over waste collection and many new issues regarding the health and safety of workers and city inhabitants. From my past experience in Brazil, I already had the impression that city officials are not that comfortable discussing waste policies. In Dundee, I tried to reach the responsible sector in various ways: directly via e-mail; through people from two different organisations; via one student who used to work for them; and even mediated by public servants one of my supervisors was acquainted with. The only reply I got – and a quite evasive one – came four months after the recruiting phase, already past the period of my fieldwork.

4.5. Emerging Topics From The First Cycle

Despite having designed the Repair Journey and the Ecosystem Mapping to observe different scales of the repair and reuse of materials, the fact is that the data collected through the studies converged in many ways. They were, after all, focused on matters profoundly interconnected, albeit from different perspectives. The fact that they were carried out almost simultaneously – and at a time when the world was facing and having to deal with an unprecedented health emergency – may have contributed to such convergence as well. Elements discussed in the participant workshop of the Repair Journey have contributed to my view of the ecosystem. At the same time, the interviews conducted for the Ecosystem Mapping would help interpret data coming from the Repair Journey. For this reason, and respecting the diverse while complementary nature of the

studies, the data are analysed in tandem in this section. The outputs are combined in a visualisation of the Ecosystem and a series of pointers and insights, composing a design briefing for the creation of concept ideas.

Constructivist Grounded Theory (CGT), as developed by Kathy Charmaz (Charmaz, 2006), is rooted in a constructivist epistemology. This means it assumes that reality is socially constructed and that multiple valid interpretations and ways of understanding can coexist. CGT is characterised by its flexible, iterative, and inductive approach, seeking to theorise phenomena within their context. CGT is particularly useful to generate a rich, contextualised qualitative understanding of complex processes or experiences, from the perspective of those experiencing them.

Qualitative participant data was the foundation of the Repair Journey and the Ecosystem Mapping. Both aimed at foregrounding the complex issues at stake when discussing community-based alternatives for convivial waste prevention. However, my take on the context started even before I engaged with participants, and my objectives went beyond the construction of theory from the data collected in such engagement. That is, I started my doctoral investigation being myself experienced in the field, and through the research cycles I expected to explore and create concrete ways to contribute significantly to its recognition and development. In that sense, my studies could not be strictly affiliated with CGT, as I had prior knowledge of the field.

Still, I borrowed some of the CGT tools and methods – true to the *cannibalist* influence mentioned in Chapter 3 – in order to circumscribe the scenario in which I would later intervene. In particular, Charmaz's practices of coding qualitative data, and 'memoing', or 'memo-writing'. The coding procedure is a crucial part of CGT. It is primarily divided into two stages: initial coding (going through the dataset to highlight common themes and construct an overview), and focused coding (identifying recurrent codes to synthesise larger amounts of data). The codes are then clustered into categories to compose an overview of the field and construct theoretical perspectives on it. Charmaz also suggests using memo-writing throughout the coding process. Memo-writing is the active capture of thoughts, interpretations, questions, or hypotheses that the researcher has while coding. These memos can then be used to help develop the emerging analysis.

Using *Qualcoder*, an open-source software designed for this purpose, I reviewed the transcriptions of my sessions and interviews. I identified recurrent topics and themes. In the 218 pages of combined anonymised transcriptions I identified 141 codes. The conversation topics more common in numeric terms were the following:

1. value (31)
2. city, state, government (29)

3. recycling (24)
4. reuse (14)
5. education (14)
6. hacker spaces and makerspaces (13)

A group of other codes followed, with 11 occurrences each: systems view and circularity, charity shops, community, bicycles, resell and recirculation, repair, equipment and tools, electronics. The COVID-19 pandemic was quantitatively part of this group, with 11 occurrences. I decided, however, to remove it from the analysis as the data collection happened in April and May 2020, the early months of the global pandemic, which arguably leads to overestimating its importance[4].

I eventually clustered the codes in categories to encapsulate the evolving understanding of the research topic and facilitate the next research steps. The 141 topics were organised into 4 categories and 15 subcategories, as follows:

- Contexts
  - Economic scenario
  - Ecosystem
  - Science, culture, behaviours
  - World
- Types of materials
- Processing stuff
  - Input
  - Analysis
  - Operations
  - Output
- Resources, conditions and solutions
  - Activities
  - Engagement
  - Governance and Administration

4 Perhaps a single element worth noting about COVID-19 is that, according to one interviewee for the Ecosystem Mapping, the forced migration of repair cafes to online environments made so that participants needed to get things repaired by themselves instead of just handing them over to someone more skilled, which was tempting on face-to-face events. The same person added that it also allowed repair events to explore bulkier objects that wouldn't be practical on physical events such as wash machines or refrigerators for logistical reasons.

- Physical space
- Public sector
- Stuff
- Technology

The clustered codes started providing elements of structure for my research, indicated additional themes I should cover in my literature review, and provided insight into how I should reflect on my individual behaviour and observations of the field. The dataset raises essential and profound questions, and offers insights into relevant themes for further exploration. In particular, regarding the topic with the highest number of occurrences, ‘value’. I categorised it as belonging to the subcategory Analysis. Nevertheless, the idea of value naturally cuts across many categories – such as Economic scenario, Science, culture and behaviour, World, Output, and Technology. This perception would orient decisions I made later on how to structure further research cycles.

4.5.1. Value And Access To Information

A recurrent reference throughout my research was the professional role of the *agent valoriste*, mentioned earlier in this thesis. In the conversations with participants, I would often ask them to help identify what kind of skills they thought were involved in the activities performed by the *valoristes*. For that reason, the dataset explores diverse perspectives on the concepts of value.

A telling example of relevant conversation on that topic happened during the Repair Journey final workshop. Two participants discussed the difficulty of repairing a power bank – which is a little more than a sealed rechargeable battery with USB plugs. One of them developed an interesting distinction based on value – between products like that one, almost designed intentionally to be disposed of with no possibility of repair or repurposing, and on the other extreme, products that were made to be easily serviceable such as high-end home appliances made in the 1970s: ‘big screws, big nuts, proper electronics that you can see, touch, feel and take off’. That participant performs amateur repairs for their neighbourhood and family, and is interested in the grade of products in between those extreme poles: not as expensive to be so clearly repairable and documented, nor so cheap as to be discarded from the moment it stops working. In the participant’s view, such intermediate products are objectively not as disposable as their manufacturers would want them to be. The participant considers that finding ways to overcome what one could call avoidable planned obsolescence brings joy in that it requires discovery, experimentation, and creativity. In the words of the same participant:

> Where I’m going with this is that you can kind of beat the system sometimes.

> So one extreme to the other, really. You've got a serviceable item, a non-serviceable item, but there are a lot of products that seem to fall into this vacuum, and this kind of perceived value.

These three scales of perceived value – high-end, intermediary, low-end – were recurrent in the discussion. Figure 5 shows some keywords and short descriptions extracted from the dataset that express the discussion about value.

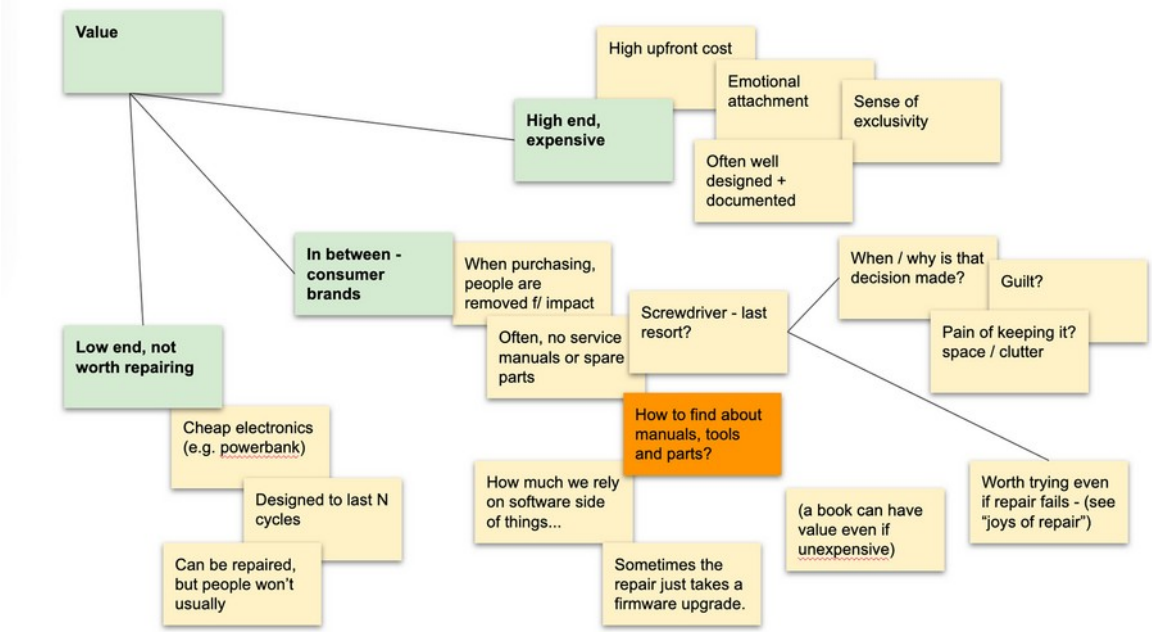

Figure 5: Value

More than one participant raised important questions about how to find information on repairing products – e.g. service manuals, tools, and replacement parts. As will be described in Section 4.6, some of my resulting design concepts would seek to address such a need, and how it impacts the potential value of reused goods and materials.

4.5.2. Human Aspects Of Repair And Reuse

An interesting element emerging from the conversations was how opening a product and attempting to repair it exposes not only material characteristics of product design and construction, but also the human labour involved in manufacturing. One participant said, 'a human being put it together, so a human being can put it [back] together'. While that may not be a fact for all goods due to the increasing mechanisation of manufacturing, a significant proportion of products are still manufactured manually, at least in some phases. According to participants, recognising this fact allows individuals to have a closer relation to the objects they own and use.

Another relevant point was made in the workshop, when discussing distinctions between

repairs in private spaces and seeking professional repairs in cities. One participant reported that in Asian cities, it is quite common to have local repair markets which are very informal but still ‘amazing’. The participant was not aware of similar markets in the UK. Another participant noted that public perception about repair and reuse was undergoing changes:

> I think what has really changed over the last ten or fifteen years has been social media’s response to repair. There are a lot of activists online, a lot of societies, groups, clubs, call it what you will, everything from repair cafes to specialists in their own fields, that have made themselves available. And that [earlier] it would have been really hard to track those experts down.

Repair cafés, community repair workshops, and other non-commercial repair and reuse possibilities were also discussed frequently. Participants perceive maker/hackerspaces as having the potential to contribute to repair and reuse. There are, however, questions about how open they are to the non-initiated in digital technologies. In their current form, such spaces are perceived by some as not easily approachable to the general public:

> And I’ve found, in both cases, it’s quite inaccessible. I would not have been able to access the hackspace at the university, obviously, unless I was a member.

Following value, the second most frequent code in the dataset was one I called ‘city, state, government’. It has to do with the role that the public sector should have in driving alternatives promoting the reuse of discarded materials instead of merely recycling, incinerating or sending them to landfills. This naturally affects the ability to repair things in the city or community. One participant reports having contacted local authorities, but:

> They seem to be focusing on education campaigns. (...) Whereas, when I look at data science area, they are all thinking about using robots to separate waste better, but it looks like it is not that much better than what is currently being done.

Another participant suggests how local governments could support the reuse of materials:

> Helping people to learn, pick up skills, and also offering spaces or giving a roof to events that could potentially help people learn and fix things.

The same participant also mentioned the need to find information on where and how to have access to tools, materials, and equipment:

> Even discovering the places that you can get scrap wood, or if you want to cut wood to certain dimensions, stuff like that – I am quite surprised by how many places there are around me that I had no sense of.

Still reflecting on the duality of reusing goods and materials in a private or public setting, there were discussions about digital alternatives. Online marketplaces or communities for selling and giving away unused goods – recirculation – were also recognised as relevant for the reuse of materials. According to a participant:

> I think that's changed the way society works. Certainly in my area around Sussex, there are lots of Free-Up, free to collector-type of thing, where no questions are asked, hand over the goods, as it were, and you can be on your way again. I've given away and received items like that.
>
> So I think that's only a good thing, people can extract more life from something, or take something that's broken and repair it, to inject a bit more life into it. That's the first thing, I guess. I think that's probably, being on social media, contacting more people, so I think more people do virtual jumble sales, as a result of that, which again is only a good thing.

Figure 6 establishes points of differentiation, convergence, and concern between repair in private and public/community settings. Here again, some elements – particularly how to find out about people, spaces, and events – would inform the creation of the design concepts I describe in Section 4.6.

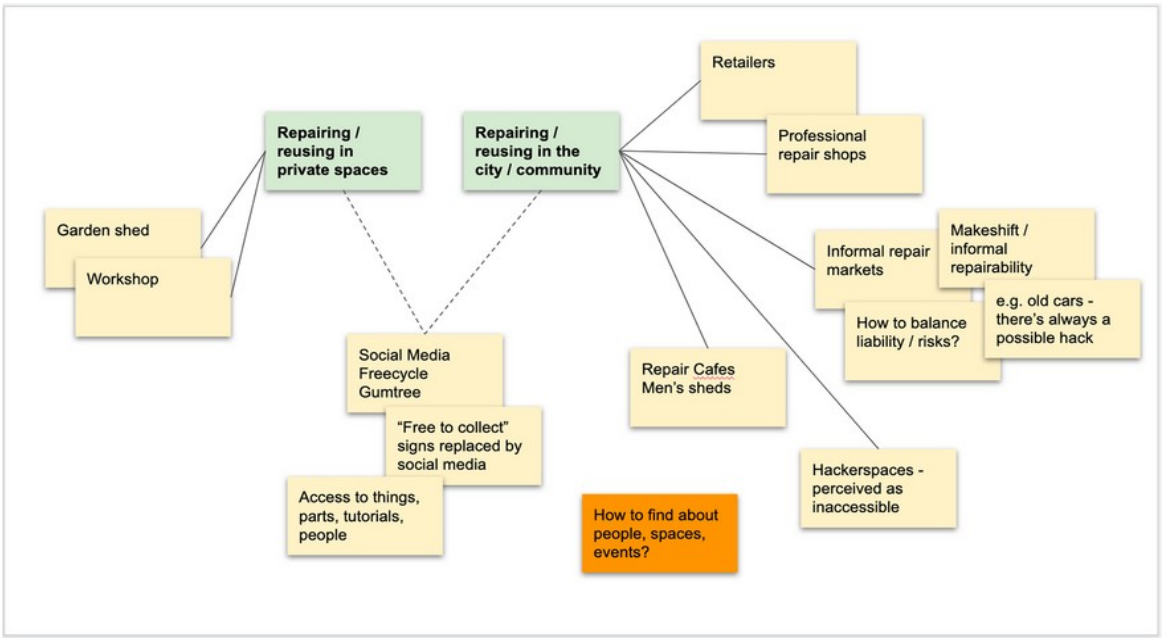

Figure 6: Private and Public Spaces

4.5.3. Stories Of Things

The story of individual objects plays a vital role in their reuse potential. A participant who repairs goods as a hobby said they always start by asking about the failure:

> Rather than starting with, 'it doesn't work' [I prefer to ask] 'what did it do before it stopped working? Were there any strange noises, funny smells? Was it hot? Any smoke?' These things are all bad, right? 'Was it making a noise for a long time? Was it slow? Was it fast?' To help me then try and maybe save some time, when you actually take the back off and unscrew things, that kind of stuff.

Another participant, who owns a shop selling repurposed and upcycled goods, says that sometimes uncovering the object's story can make it more valuable, whilst in other cases

hiding its origins has a similarly positive effect. In other words, the aesthetic value of a given object can change following the perception of its provenance:

> An example of that was... we were in Estonia and bought some wrestling awards. We were at a market and we saw these incredibly weird... They were like prizes, we think, for weightlifting and wrestling. Once you look past the kitsch nature of them and actually look at the objects themselves, they're really nicely made. We bought them, took them apart, made them into lamps and they're just beautiful things. Sometimes it's a question of, rather than being able to add accurate information to an object to increase its value, it can be about taking away information. Do you see what I mean? Origin information.

The same participant said that some of the most significant increases in perceived value could be achieved even without the need for proper repair or upcycling:

> There are some other things to think about here as well about the value of items, which is we found that cleaning items makes a huge difference. Some of the best value increases that we've had have been from cleaning things. That sounds absurd, but it's quite incredible how things look amazingly disappointing and then you clean them really thoroughly and suddenly realise they're great. Some things are easy to clean and some things are very difficult to clean. One would think that it would be advantageous for... This sounds kind of absurd in a way. It's possibly more sustainable to create objects that are easy to clean.

Another common question during the conversations was about how to identify the problems of objects that required repairing. Contributions from participants and interviewees allowed me to construct a general process as follows:

1. Investigate the story of the object.
2. Clean it externally.
3. Open it up.
4. Identify the problem, choosing a method or mixing different ones.
5. Repair or repurpose, also based on different approaches.

Participants also raised the issue of the social value of repairing things. Reflecting on value is of course central in exploring alternatives to promote a greater reuse of materials, as referred elsewhere in this thesis. Marxist theory can help illuminate some aspects of that, though for the purposes of this research I won't go too deep in that direction. To be as brief as possible, the concepts of exchange value and use value may be particularly useful.

The exchange value of used objects – simply put, their potential measurable price – tends to decrease once they age in most categories of products, except for antiques or objects of historical interest. In other words, things tend to be less valuable in economic terms even when their use value – the intrinsic worth of a good or service based on its utility (Marx, 1981) – hasn't changed. Those definitions help decompose how the notion of value

is constituted and the contradictions a market economy may pose. However, they are not in themselves sufficient to define social value in its entirety, as discussed by the participants of my studies. Reuse through repairs and recirculation arguably adds new dimensions to value. On a first layer, it extends the lifetime of goods, consequently maintaining or increasing their use value. It may also increase the exchange value of things once depreciated. Going deeper, it has also indirect impacts that may be interpreted as deeply convivial by:

- postponing the need for raw material extraction, thus reducing pressure over natural resources and negative externalities;
- regenerating bonds among local communities, in the case of community repair events, re-circulation of donations, or things libraries;
- enabling knowledge to be generated and shared in communities, as well as allowing people to express their creativity;
- reframing the relation of individuals with cherished objects. As in an example shared by a participant: a blender manufactured in the 1960s that ‘grandma gave it to the family and passed it down to make cakes and all that kind of stuff’ was restored – not only as an inert object but used by the family.

The idea of social value then points to positive impacts regarding sustainability, knowledge creation, the use of creativity and a sense of belonging. The complementarity of exchange value, use value, and social value points to the potentiality of creating systems to reward people and organisations who extend the lifetime of products through repairs, upcycling and re-circulation. That was another question I would bring to the ideation phase of my design concepts: how to translate the process of repairing I have sketched into speculative responses?

Figure 7 shows the repairing method inspired by participants’ contributions and other elements found in the conversations and interactions: an exploration of the joys of repairing and a note about the social value of repair and reuse.

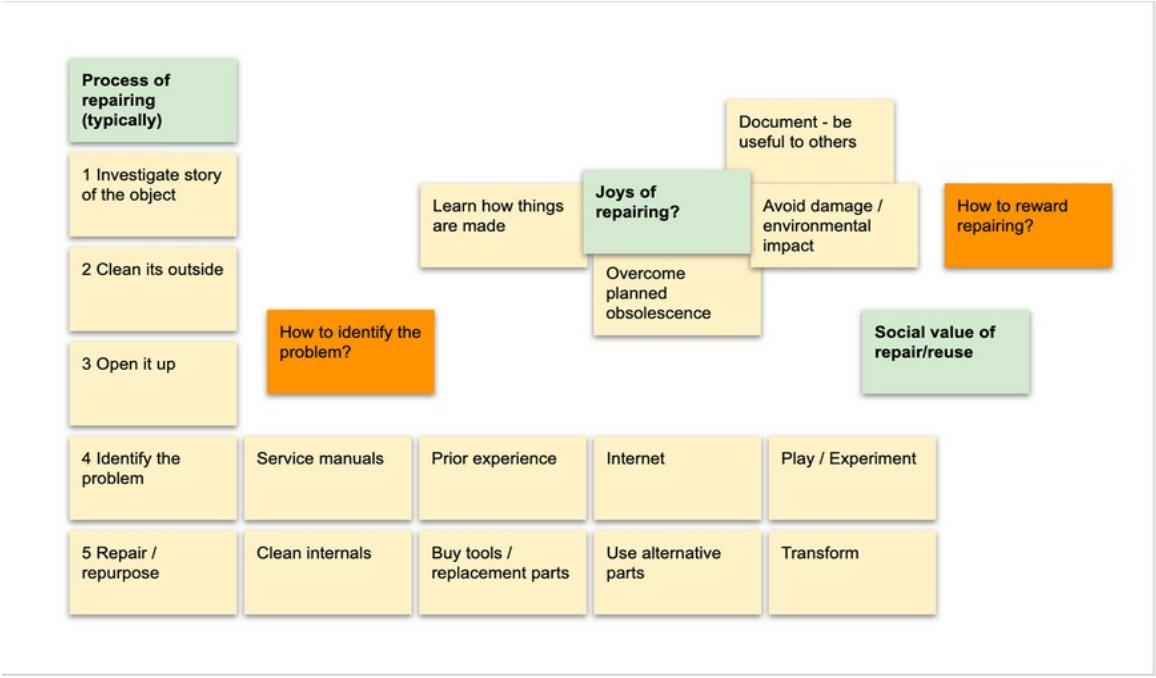

Figure 7: Processes

4.5.4. Visualising The Reuse Ecosystem

Based on the coded dataset, I created two visualisations, shown in Figure 8. They depict common materials sources and common materials types discussed with the studies' participants. Among the sources are industrial and manufacturing actors, retail and services, culture and entertainment, and the public sector. The types of materials are varied and could expand to numerous other areas. I have also added to this visualisation some elements that cut across different kinds of organisations, and play an important role in reusing materials: corporate responsibility programmes, government procurement, circular economy, and formalities such as trade waste receipts and insurance.

Figure 8: Sources and Producers

Figure 9 shows a different perspective of the Ecosystem Mapping. In this depiction, I focus on the kinds of organisations that already contribute to reusing materials in cities and regions through repairs, adaptations, and transformations. Here again, the private sector and public administration are present, but community-based projects start to appear, particularly connected to zero waste, the maker context, and handcraft sectors.

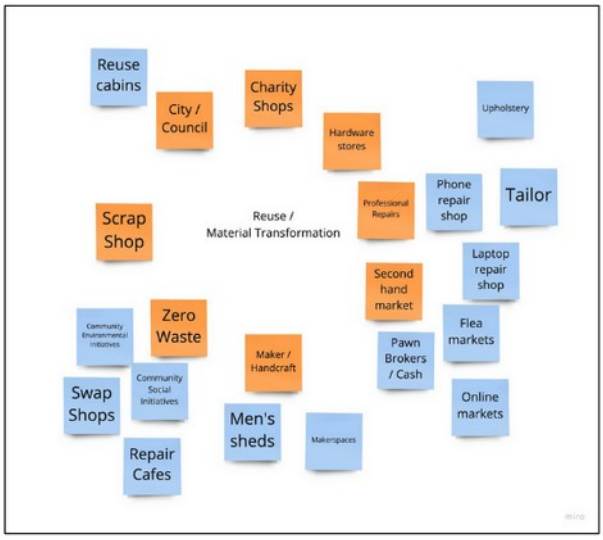

Figure 9: Reuse

These two visualisations would form the basis for my design concepts, with the horizon of creating ways to facilitate the reuse and circulation of materials in cities.

4.5.5. City-scale: Systems Approach For The Reuse Of Materials

As mentioned earlier, one of the effects of needing to adapt to the restrictions made necessary to face the COVID-19 pandemic was that the studies described in this chapter involved participants from several places in the UK instead of a single location. As a result, the Ecosystem Mapping was not a portrait of a specific city but rather a more conceptual map of types of organisations, some of their activities and the flow of materials between and beyond them. The interviews, workshops and other conversations with participants of both studies enabled me to acquire a systemic understanding of the reuse of materials in cities.

Returning to the point about social value, interviewees elaborated on companies and social projects adopting a *Zero Waaste* perspective. They articulate beneficial practices in terms of environmental effects and social inclusion. According to one participant, such initiatives don't make much use of technology or data, in contrast with municipal waste management that increasingly changes into generating data to aid decision-making:

> With zero waste people, I wasn't aware of any data-driven projects. [I joined meetups with] a community of people who talk about zero waste shops, or they run clothes swaps, or they talk about reusable bags out of their old clothes or whatever. You know, stuff like that. So, it wasn't very technical meetups. It was more just about household.

In addition to that characteristic that arguably results in a stark imbalance in the visibility and priority given to waste prevention in the public sector in comparison to waste management, there are constraints coming from how such initiatives are funded and structured. A participant who manages a regional 'zero waste' initiative sees a dilemma in prioritising funding for climate action educational campaigns:

> I work a lot with organisations funded by the Climate Challenge Fund. A lot of the projects seem to focus on poverty and poor areas, and it is about saving money and food waste and things like that. But, actually, maybe some more of the funding should be targeting the wealthy areas because actually when people have too much money, they can afford to go out and buy new stuff all the time and don't see the value in reusing or repairing. And maybe we should be targeting them a little bit more.

A concrete example of an initiative bridging social value and commercial operation came from one of the participants, the head of a scrap shop. It is a social enterprise that, in their words, 'aims to deal with excess'[5]. The shop collects donations of products and materials

5. That short sentence was crucial to reorient my research from the idea of 'post-consumption goods' and 'waste' to 'excess' and 'waste prevention', as discussed in earlier chapters.

chiefly from industrial manufacturers, to be resold at affordable prices or used in educational projects. According to that person, artists and designers should take centre stage in pushing forward innovative ideas to face the environmental impacts of massive industrial production. And even in the cases where that is already happening, it is not enough:

> There's a lot of top design out there, but it's not given the credibility by the manufacturers. [For instance, if] the companies providing the material actually said, ‘Look what they've done with our stuff,’ and actually backed and promoted it. Actually getting them to use it to validate the products that are being made [with discarded materials].

The same person feared that using second-hand materials risked being just a temporary trend and expects to create more permanent alternatives:

> At the moment, it is seen as a bit trendy. ‘Yes. Oh, this is great, isn't it? It's good.’ ‘Oh, look, it's gone.’ And so we're talking about something else. [But] it's part of lots of University courses now, how to create your own industry and all the art degrees are very much part of that. They all have to do a recycling module – to look at how they can reuse and the circular economy, which is great. As a whole ecosystem, we need to see what it really is. And maybe that's what's happening now.

4.6. Design Concepts For Reuse Of Materials

Combined, the Repair Journey and the Ecosystem Mapping produced considerable output in terms of data. The systematisation of the interviews allowed me to identify focal points that would structure my thinking about the research questions, and scope the kind of knowledge I was generating – or saw the need to generate. Based on those elements, I would create design concepts, incorporating self-reflection and exploring new boundaries. They would also become multi-faceted artifices, embedding diverse perspectives to be carried along to subsequent cycles of my investigation. Analysing the data collected in the Repair Journey and the Ecosystem Mapping, I was able to create a series of generative questions.

Generative questions in the philosophy of Paulo Freire are open-ended, thought-provoking inquiries that reflect critical issues within a community or society. They are intended to awaken critical consciousness, promote dialogue, and foster social change. According to Freire, these questions or themes should be rooted in the lived experiences of individuals, resonate with their socio-cultural realities, and stimulate a deep exploration of their world to promote collective learning and action (Freire, 2017).

I created the generative questions around the Repair Journey and the Ecosystem Mapping based on reflection upon analysing the research data, my personal experience, and literature exploration. The generative questions are the following:

- How to offer inclusive spaces for reusing goods and objects?
- How to reward people for repairing and reusing objects instead of discarding them?
- How to find people, spaces, and events that are relevant to reuse things?
- How to store and move broken objects that can still be repaired?
- How to find manuals, tools, and parts?
- How to identify the problem of one specific broken object?
- How to encourage repurposing by modularity?
- How to treat more objects as we do a cherished book?
- How to connect the practical skills of craft, repair, and making?
- How to undo and re-do a robot's work?
- How to make Local Authorities and Councils more active in promoting the reuse of materials?
- How to make materials and services known to interested parties?
- How to use prop shops as models for a local circular economy?
- How to welcome people who struggle with mental issues into reuse initiatives?

In addition to the initial design research studies, my perspective on the reuse of materials in cities was also influenced by other activities I conducted around the same time:

- Observing my own behaviour as I learnt how to handle waste, broken objects and unused materials in a new city and country. The gradual discovery of services that most city inhabitants take for granted offered insight into how they are interwoven in local cultures and assumptions.
- Two online courses I attended at the time. The first one was about *Waste Management in Developing Countries,* offered by the École Polytechnique Fédérale de Lausanne in Switzerland (Coursera, n.d.). The course articulated a systemic view about waste management, particularly in low-income countries with precarious infrastructure. The second was about *Platform Cooperativism*, offered by The New School in New York and the Mondragon Corporation in the Basque Country (Platform Cooperativism Consortium, 2020). Each n a different form advanced alternative, unconventional thinking about creatively structuring public services and collective organisation even under suboptimal conditions.
- Hands-on experimentation with repairs and the reuse of materials. As I shifted more of my purchases to online retailers due to the COVID-19 lockdown, I started using parcel packaging as reusable materials. In exploring possibilities with my own hands, I made sculptures and improvised furniture add-ons, and reflected upon the materiality of reuse (Figure 10).

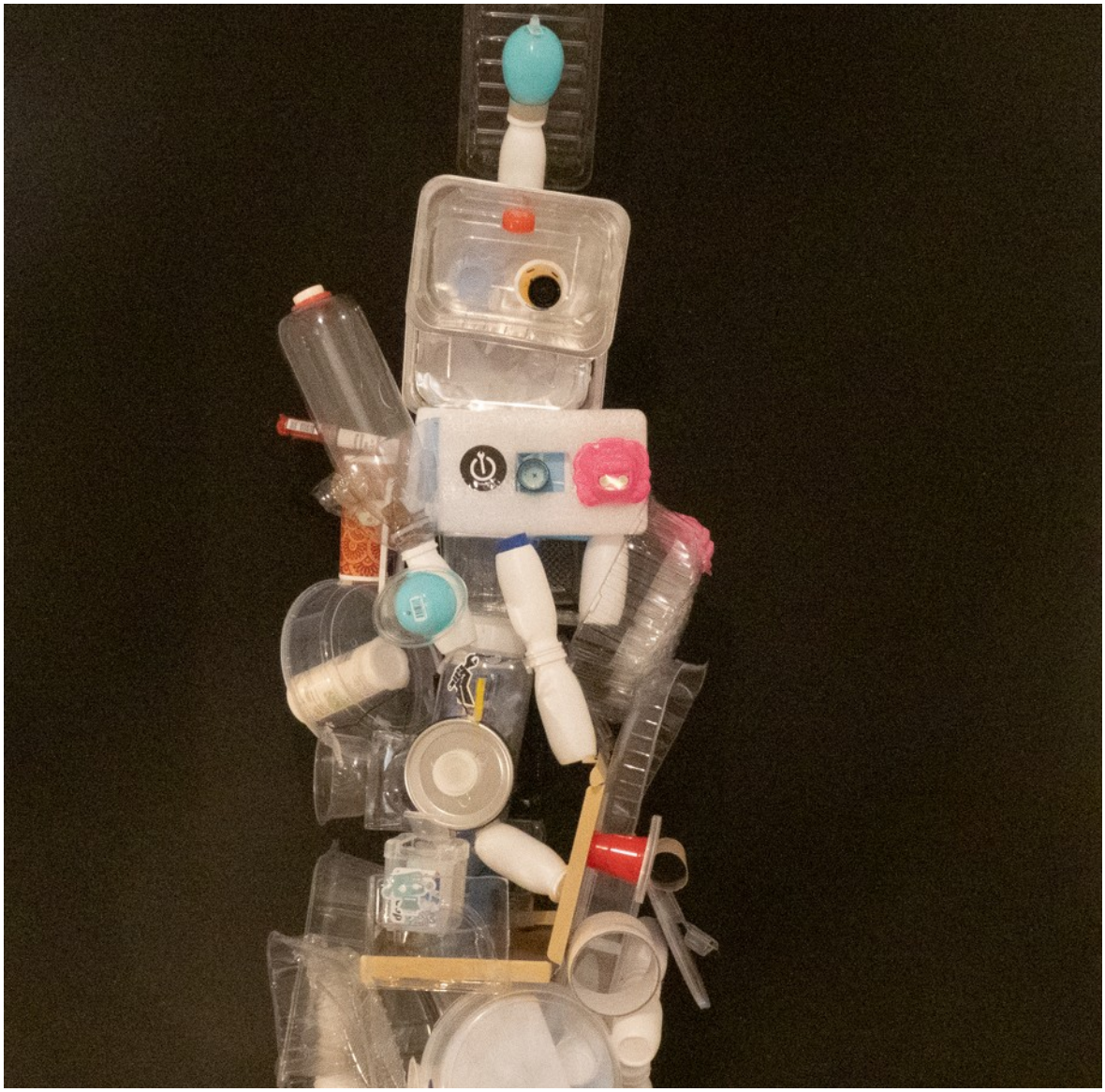

Figure 10: Hands-on experimentation

A combination of takeaways from the studies, reflections on the generative questions, and these additional sources of insights allowed me to start seeing the field in a systemic way. This helped me to reflect on my research exploration on the urban scale. Figure 11 positions the generative questions in three circles, with sometimes overlapping groups: citizen/household, city/community, and education/behaviour.

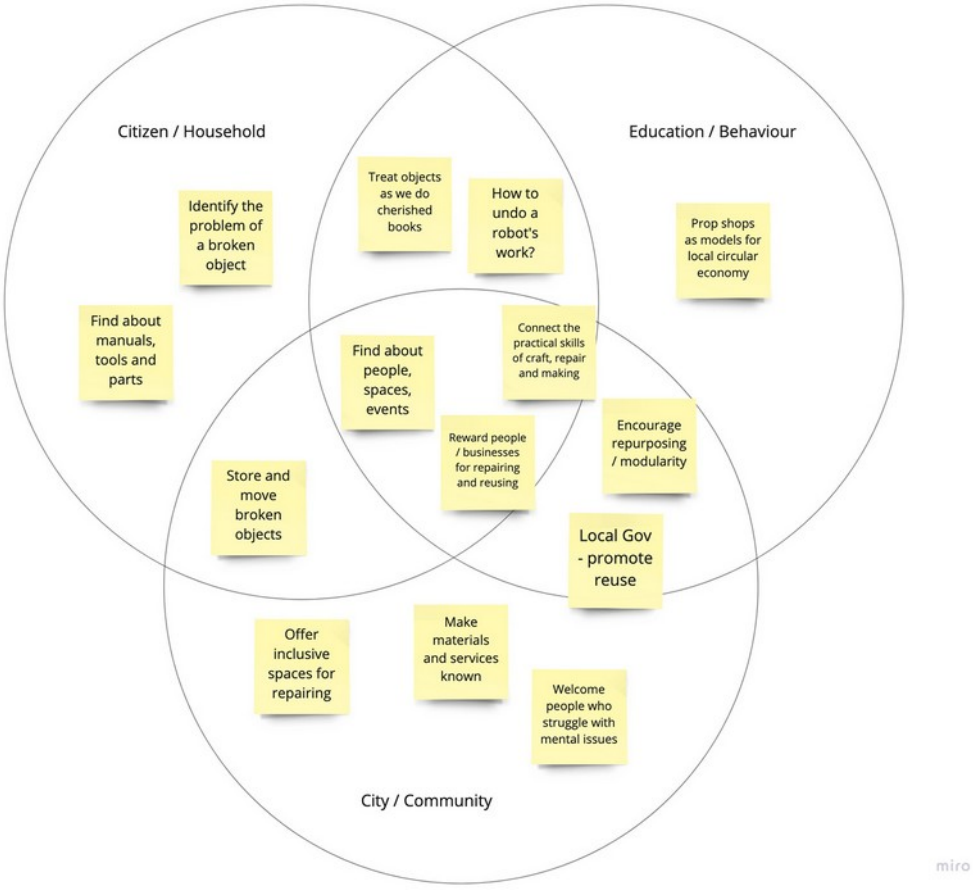

Figure 11: Generative Questions

Even though the boundaries between these three groups are arguably blurred, the diagram helped ground the creation of design concepts. My reading of the generative questions suggested four different target groups and areas of intervention for design. There is some overlap between them, but each can arguably be understood as a perspective that emphasises how materials should be handled and circulated on the urban scale: city-dweller, community, professional reuse, and public sector.

- City-dweller
    - Individual/household who has things that are broken, wrongly sized, inadequate or unwanted.
    - Individual/household interested in acquiring trusted and affordable second-hand goods.
- Community
    - Group or organisation willing to offer second-hand goods to local communities or to use second-hand goods to generate income for community members.
    - Volunteer group or not-for-profit organisation organising repair cafes, clothes swaps and other zero-waste projects.
- Professional Reuse

    - Social enterprises working on the selection, transformation and redistribution of second-hand goods.
    - Professional workshops dedicated to repairing, maintaining, customising and upcycling used objects.
- Public Sector
    - City council or similar official government body, looking into social, environmental and economic benefits of encouraging the reuse of materials locally.
    - Regional or inter-municipal public organisations tackling environmental issues.

4.6.1. Ideation

As mentioned at the beginning of this chapter, the first cycle of my research spiral started with the decision to conduct two research studies. They were designed to provide an overview of the intersection of fields my investigation would lead to, and help validate the relevance of that particular configuration. Along the way, I collected data through interactions with people interested in reusing materials and who have varied levels of experience with it. I also reflected on my own observations during that period. Finally, I could systematise generative questions and target groups to orient the creation of design concepts. The groups were: city-dweller, community, professional reuse, and public sector.

Adding to constitute a design brief, I also created a list of elements to be articulated in generating novel ways to address the excess of materials in cities. I sorted those elements into six main groups of context and operations:

- Connecting
    - Sources of materials
    - Transformation
    - Destination – customers, communities, recycling
- Urban presence
    - Workshops / Local manufacturing
    - Donate / Sell
    - Repair
    - Buy / Receive
- Systems approach
    - Business models for different actors
    - Commons governance

    - Social need – Opportunities
- Change
    - ‘Trending’ vs. ‘Ethical decision’
    - Behaviour / Education / ‘Niceness’
    - Concrete incentives – Policy / Taxing
    - Autonomy / Sovereignty
    - Islands / Rural areas – being resourceful
- Data on Zero Waste / Repair / Reuse
    - Generate / Integrate
    - Manage
    - Publish
- Stories / Curation / Presentation
    - Find information
    - Remove information

Those elements were then articulated along the four groups of stakeholders as I started brainstorming ideas for the design concepts. Figure 12 shows an early exploration of such ideas. They are situated in a system view of the field and respond to perceived absences in information access, public infrastructure or technological applications.

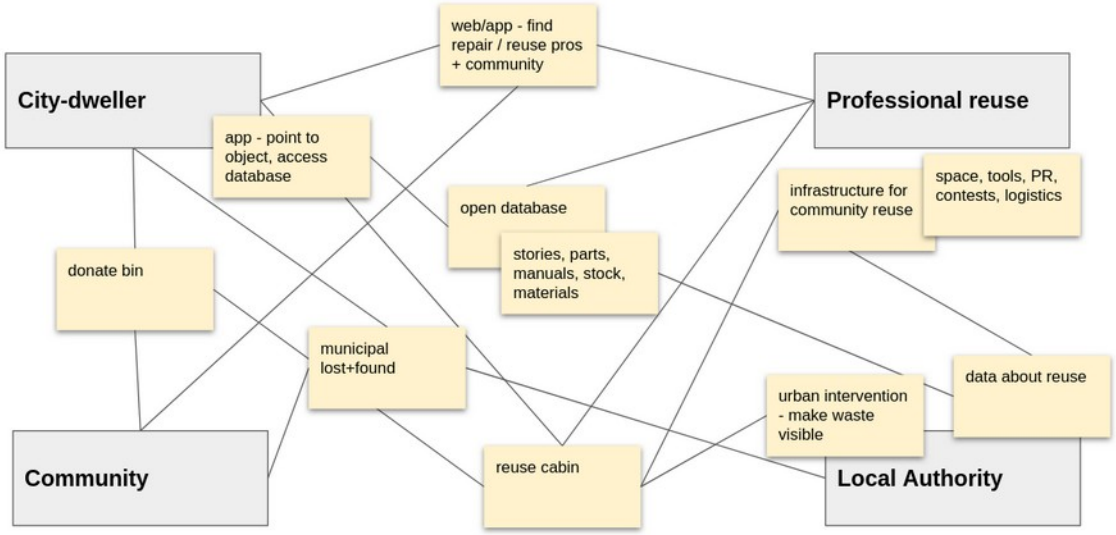

Figure 12: Brainstorming concepts

As I shaped and discussed such ideas with colleagues and members of the OpenDoTT Consortium, I developed eight design concepts. In general, they were not created as

blueprints for implementing objective solutions for the problems raised by my research studies. Rather, the concepts were designed as boundary objects (Star and Griesemer, 1989) that can be used to trigger and focus deeper conversations about the many layers of context, assumptions, affordances, and possibilities regarding the reuse of materials in urban contexts.

The concept ideas described below explore crucial points identified in the research studies, such as the visibility of waste, how to find information and how to create local convivial systems to better reuse goods and materials. Each concept idea connects differently to at least one of the four target groups identified above – city-dweller, community, professional reuse, and public sector.

These resulting concepts were not meant to be radically new. Rather, the intention was to contribute with elements that help build systemic approaches enabling local communities and society to benefit from the potential value that can be generated by reusing goods and materials. Some of the concepts are more abstract in nature, pointing at a desirable direction for open discussion or public policy. Others are more concrete, shaped as potential or speculative products to be incorporated to further research and development phases.

The eight concepts were grouped alongside three categories: Data and Things, Transparency and Visibility, and Reuse in the City:

- Data and Things.
  - Universal Registry of Things.
  - Point and Reuse.
  - Save this Thing.
- Transparency and Visibility.
  - Make Waste Visible.
  - Reuse Dataset.
- Reuse in the City.
  - Reuse Commons.
  - Transformation Lab.
  - Reuse Bin.

4.6.2. Data And Things

The concepts grouped under this category were created in response to a perceived absence, or lack of organisation, of information and data that could help increase material reuse in cities and regions. The data types would range from characteristics of discrete

objects and materials – which could help assess their potential reuse value – to information and stories about providers of services such as repair and transformations. All three concepts were designed to be based on open-source software and open data.

4.6.2.1. Universal Registry Of Things

The Universal Registry of Things is a trusted source of information about how to reuse objects and materials. It contains information relevant to repairs, customisations, repurposing, and the re-circulation of things. The Universal Registry of Things combines data from diverse sources:

- Manufacturers – specifications, breakdown of materials and toxicity, replacement and parts and add-ons, service manuals,
- User-contributed information – stories, testimonials, suggestions about transformations, upcycling, adaptations,
- Third parties like community initiatives and repair shops – data about repairability, second-hand market value and other potentially relevant information generated by businesses, nonprofits, and community organisations.

The goal of the Universal Registry of Things is to serve as the conceptual groundwork for creating online resources providing updated data to aid the reuse potential of objects and materials. It is inspired by a trove of initiatives advancing the effort to collect and offer data about goods and materials. Examples are the *IFIXIT Repair Guide* (iFixit, n.d.), consumer-maintained websites such as *ThinkWiki* (ThinkWiki, n.d.), and also *Thingiverse* (Thingiverse.com, n.d.), *Persistent Things* (Climate KIC, n.d.), *Open Repair Alliance* (Open Repair Alliance, n.d.), *Provenance* (Provenance, n.d.), and *WasteNet* (Wastenet, n.d.), among others. However, instead of being yet another data source in a very fragmented, impermanent and non-standardised scenario, the Universal Registry of Things aims at integrating diverse data sources through principles of open data.

By its open and collaborative nature, the Universal Registry of Things can be implemented and replicated onto a number of applications, including technologies that augment the work of *agents valoristes* or that allow less experienced agents to replicate the skillset of those professionals.

Supporting research data, excerpted from an interview:

> To be honest, eBay has been probably the main way of valuing stock. You can type in the specs of a laptop into eBay, you can click on sold listings, and you can see what a similar type product has sold for over the last week or month.

4.6.2.2. Point And Reuse

Point and Reuse is an app for mobile devices that allows its users to take a picture of any

object, identify it, and instantly evaluate or learn about its potential for reuse. The app allows city-dwellers, members of 'zero waste' initiatives, repair professionals or anyone interested to quickly assess the potential value of an object and find information on how to reuse it. It is an example of the potential uses for the Universal Registry of Things.

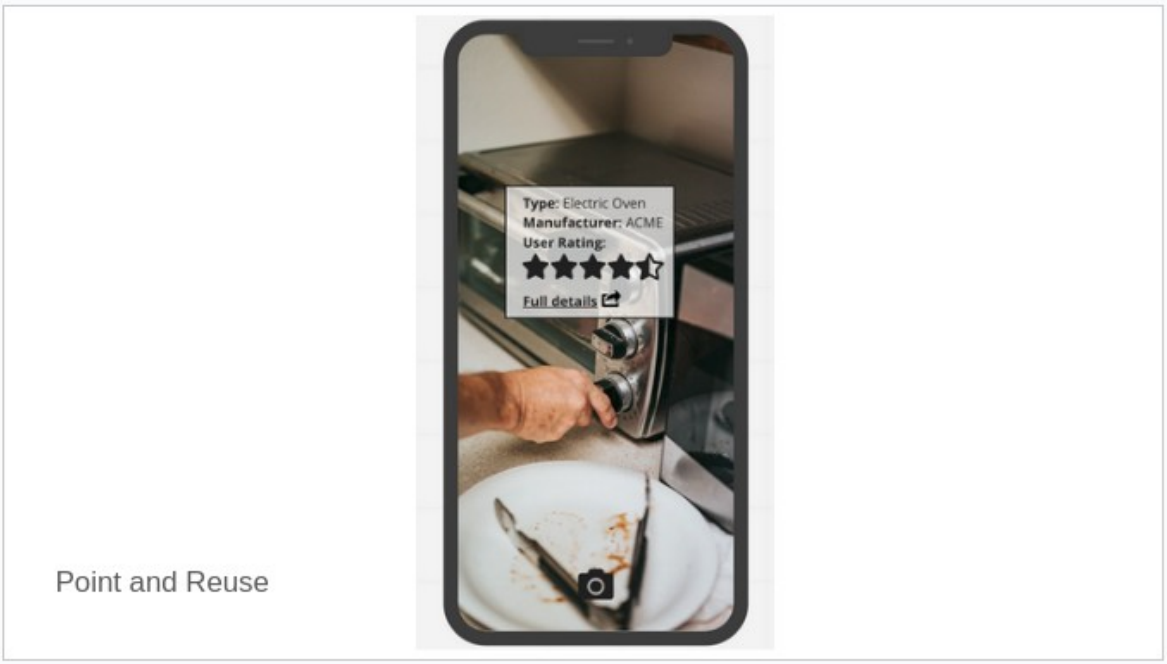

Figure 13: Point and Reuse

Inspired by initiatives such as *Google Lens* (Google, n.d.), the *Object Detection Kit* (ODK, n.d.), *Pi Trash Classifier* (Fox, 2020), as well as apps used for plant identification (Edwards, 2022), Point and Reuse can help promote the use of data from the Universal Registry of Things instantly and conveniently. It can also be incorporated into local strategies for education and sensitisation. Being open-source software, the app can be adapted by local organisations to create custom versions.

Supporting research data, from the Repair Journey final workshop:

> So I guess- I don't know about you guys really, but what I've noticed, there is a- For example, the food mixers I work on, these Kenwood Chefs, a lot of them, different variants. To replace those with the modern equivalent would be between £200 and £400. But the repair would be a tenth, roughly, to me, of that purchase. So the old item, it doesn't matter how old it is, still has value.

4.6.2.3. Save This Thing

Save this Thing is a geo-referenced and user-evaluated website featuring an open directory of repair professionals, 'zero waste' initiatives (community repair, upcycling, swap shops, etc.), craftspeople, hardware stores, maker spaces, charity shops, recycling points, and others. Its goal is to address the difficulties of finding trustable information on

where to seek help for reusing materials in cities through repairs, transformation, upcycling and re-circulation.

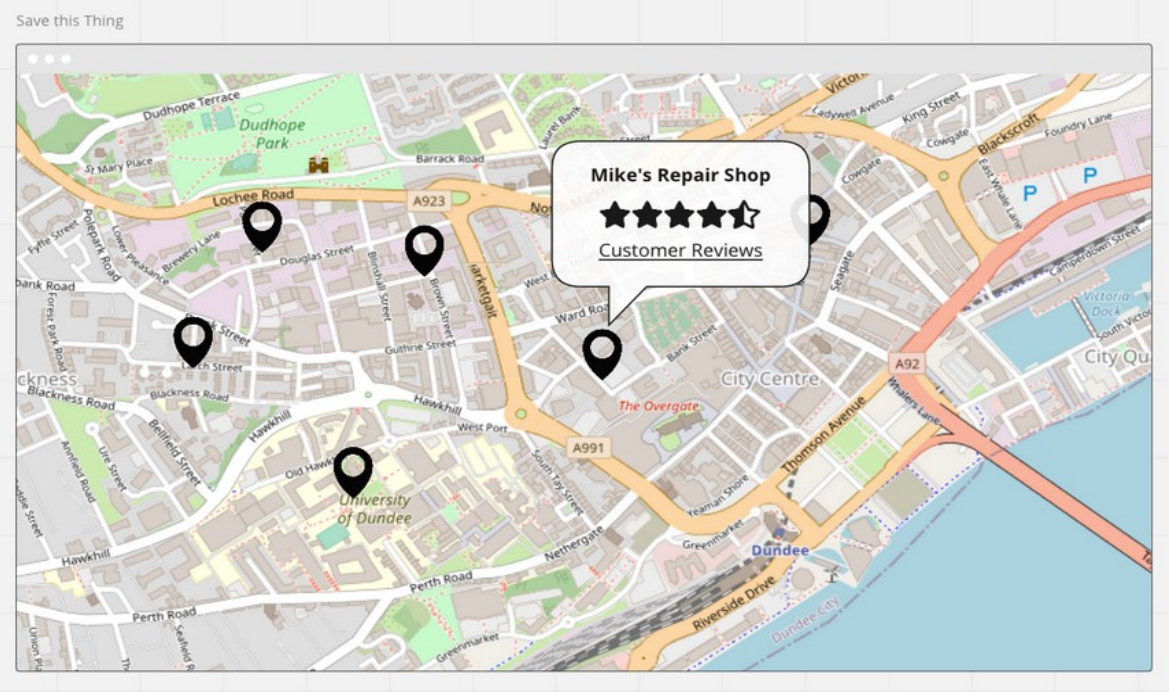

Figure 14: Save this Thing

As a collective and collaborative online resource, Save this Thing can help foster the transition to a circular economy on a local level. Expanding on ideas already implemented by initiatives such as The Restart Project's *Repair Directory* (The Restart Project, n.d.), and initiatives like *Remap Berlin* (ReMap, n.d.), *Verbund Offener Werkstätten* (Verbund Öffener Werkstätten, n.d.), *Dsposal* (Dsposal, n.d.), and *Make.Works* (Make Works, n.d.), Save this Thing can also be incorporated by local authorities and alliances interested in promoting material reuse.

Supporting research data, from the Repair Journey final workshop:

> It's knowing where to look for people that you can in some way trust with your device or item.

4.6.3. Transparency And Visibility

The second category groups concepts addressing the relative invisibility of waste and particularly the reuse of materials. They address two challenging conditions. Firstly, the common expectation that waste management should be about making waste disappear from the public eye as quickly as possible. As a result, there is generally little awareness about the volume and composition of materials that are sent for recycling, incineration or to landfills. Secondly, there is no clear data about the reuse of materials. That is related to

the fact that waste policy is usually created from a top-down perspective based on ideas of objective efficiency – and focusing merely on collecting materials that are already considered unusable.

4.6.3.1. Make Waste Visible

Make Waste Visible is a conceptual perspective proposing to support projects that expose the waste produced in localities – and by extension, the costs and socio-environmental impacts of managing it. Instead of a specific project, it is a broader strategy to influence the development of cultural programmes, such as artist residencies, commissions, and hackathons focused on waste awareness. They would invite artists, designers, and activists to inform local populations in varied forms about the volume and composition of waste the generated, collected, reused and recycled. Initiatives that may serve as inspiration are the work of Mierle Laderman Ukeles with sanitation workers in New York and her manifesto for maintenance in art (Ukeles, 1969), as well as *Recology's Artist in Residence Program* (Recology, n.d.), the artist collectives *Gambiologia* (Gambiologia, 2014) and *Basurama* (Basurama, n.d.). Documentaries and movies on similar topics such as *Waste Land* (Walker et al., 2011), *Estamira* (Prado, 2006), *Isle of Flowers* ("Isle of Flowers," 2023), and *Trash* (Daldry and Duurvoort, 2014). Finally, the work of Cuban designer Ernesto Oroza (Oroza, n.d., n.d.), and initiatives like the *European Week for Waste Reduction* (EWWR, 2023).

Figure 15: Make Waste Visible

4.6.3.2. Reuse Dataset

Reuse Dataset collects, consolidates and publishes open data about different kinds of reuse of materials in urban environments. Literature shows that recycling should not be the only measure of successful waste policy. Whenever there are still potential uses for discarded materials, reuse should be the norm. However, compared to recycling, little data is available to inform society and guide decision-making about the volume of materials being diverted from the waste stream by reuse initiatives and in what forms that happens. The Reuse Dataset was created to draw attention to the social, economic and environmental outcomes of reuse as compared to recycling.

Initiatives adopting a similar perspective are the Open Repair Alliance's *Repair Dataset* (Open Repair Alliance, n.d.) and OpenDataManchester's *KnoWaste* (Open Data Manchester, 2022).

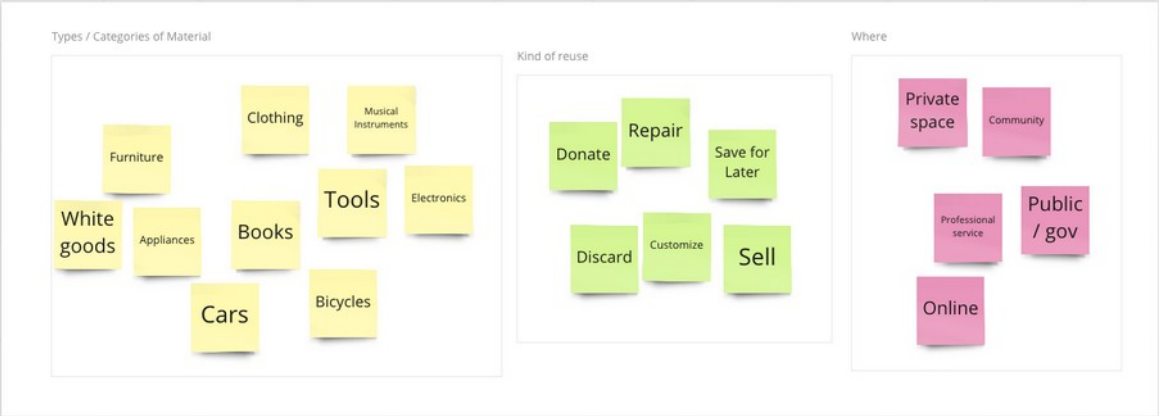

Figure 16: Reuse Dataset

Supporting research data from an interview with a data scientist who analyses data on waste collection in the UK:

> Yes, I think with this data that currently exists, you can measure the value of materials after they have been through a material processing facility. So, you would know that this much aluminium was recovered. This much textile was recovered, which is normally carpet, which is normally made of polyester. So, you would know how much it would cost, but you don't know before it goes in because it is all mixed up. In the UK, it is collected together. So, it is called commingled recycled because it is all together mostly. Apart from that, okay, carpet is separated. It is not a good example, but your standard rubbish is typically separated. In this dataset, there is also a reuse element. So, for things like books or some white goods, like fridges and things, they measure how many were reused because the council, they do this scheme where they repair it, then they give it to people who don't have much money or, the council tenant, they can offer them this reused product. I think books were also part of that. I think the materials, they can be quite detailed.

4.6.4. Reuse In The City

The two previous categories focus on objective characteristics of things, existing contextual conditions, and how to learn and engage with either or both. The third and last group of design concepts advances on speculative and systems-based approaches, expecting to allow cities to encourage greater reuse of goods and materials.

4.6.4.1. Reuse Commons

The Reuse Commons was conceived as an ecosystem for the collective stewardship of goods and materials. It is a model for a multi-stakeholder system governing the reuse of discarded materials in a city or region. Ideally, the Reuse Commons articulates different kinds of organisations, infrastructure, communities, data and material flows[6]. One of the main motivations behind the Reuse Commons is creating ways for people and organisations to be rewarded for reusing materials or helping others to reuse – instead of discarding things that would, at best, be subsequently downcycled. Initiatives like the Waste Banks in Indonesia (Salim, 2013) and Plastic Bank (Plastic Bank, 2022) inform the development of the Reuse Commons.

Supporting research data from the Repair Journey final workshop:

> I found two chairs, wooden chairs. They look as if they are mid-century, but one is missing the seat. That's the diary I made and shared with you. We moved into this place a year ago, and we've slowly been putting things in it. And we tend not to have too many things because my work sometimes takes me to other countries and I move for a bit of time. So we try not to have too many things. But we knew we needed chairs, so I took it in as a necessity/opportunity to do something creative with it. Especially since I was looking for excuses to use my printer, that was kind of the idea. What else was there? What else has broken recently? Quite a few things.

4.6.4.2. Transformation Labs

Transformation Labs is a blueprint of physical facilities dedicated to the reuse of materials in urban contexts by means of repair and upcycling. The idea is to set up workshops akin to FabLabs, makerspaces and shared workshops like the Atelier Partagé du Breil, in Nantes (PING, 2019). But they have a particular focus on the transformation of goods by repairs and reuse, and special attention to inclusion. The blueprint features recommendations in terms of equipment, data sources and governance. Transformation Labs are oriented toward social and environmental outcomes and administered collectively. There may be different types of Transformation Labs that carry out diverse activities according to the potentialities, skills, and interests of the surrounding

6. The Reuse Commons would be picked up again during the third cycle and redesigned as a toolkit, as described in Chapter 6.

communities.

Figure 17: Transformation Labs

Supporting research data from an interview with the owner of a maker shop:

> One of the common factors I've seen about maker spaces is often maker spaces will be guilty of making things that are tremendously ingenious, but essentially valueless. They're interesting, but interesting is not the same as want. How many maker spaces have you been to where you've seen another plastic bust of Albert Einstein? The 3D printed bust of Albert Einstein or the marble run that's made from laser cut pieces of plywood. How fascinating it is, for four minutes. That doesn't mean you're actually going to have it in your house. (...)
>
> What I've seen is that there's a real question with these volunteer spaces that are often based on a membership model, is all the people who are involved in them look very self-similar. They're male, they're well educated, they're usually educated in computer science or engineering. They appear to be very similar types of people. (...)
>
> I always find them [maker spaces] – It feels like a little bit- I'm not sure if there are enough. I can think of two or three, that wouldn't be in my area but I know where to find them. At the same time, it feels like there is a certain level of effort that would require for me to go there or get introduced, to participate. I guess there is an accessibility thing. For me, it's not as straightforward. And I would imagine, for somebody that hasn't even heard of the notion of such a space, it would be even a few steps further of saying, 'I can actually go down there and somebody can help me drill a couple of holes in this thing that I need to fix'. So I think they are still, in my mind, more for makers and people that are already in that mindset. And that doesn't make them approachable to people in the general public.

4.6.4.3. Reuse Bin

The Reuse Bin concept is a container to receive donated goods. Inspired by projects that add sensors to regular garbage bins like *SmartBin* (Smartbin, 2020), the Reuse Bin allows city-dwellers to track what is made of the materials they donate. Each unit generates a tracking code which allows donors to learn where the objects are taken to, what is made of them and their social/economic impacts along the way.

Supporting research data, from interview with a member of a 'zero waste' nonprofit:

> There are a few projects at council recycling centres where they will have what they tend to call a reuse cabin. So when you take your things in, they will say – have big banners up saying – ‘could this actually be reused? Put it in this cabin’. And such-and-such community group will come and collect those things. So, like, a couple of really good ones, there's one called Moray Waste Busters, up near Inverness and they have a big site at the council recycling centre. So you go in, and the first bit you come to is Moray Waste Busters. So if you've got anything that you think could be reused, you give it to them, and then they have an onsite shop as well. So they will put stuff in the shop. So while you're there getting rid of stuff, you can also park up and go in and do your shopping. And they've got a Section for books and a Section for electrical items and a Section for bikes and all different things. So, they’re really trying to push reuse. So it's only if they can't reuse it, then you move on to the recycling or the landfill bin.

4.7. Looking Back On The First Cycle

As the spiral completes a first turn, a few critical elements have emerged that will guide the subsequent cycles of my research journey. As described in this chapter, I could engage with participants through two complementary research studies that enabled me to scope my investigation better. In the Repair Journey, I asked them to attempt to perform a repair or other physical intervention to make used objects increase their value. And to compose the Ecosystem Mapping, I interviewed people with diverse perspectives on the field. As a result, I was able to assemble a design brief and create concept ideas that would be part of other phases of research.

Besides the concrete outputs in the form of an interview dataset and codes/keywords, diagrams and design concepts, my perspective on the context in which the research takes place was also refined. Chiefly, an essential shift has occurred in my perspective. I transitioned from an interest in 'waste management' to a focus on waste prevention and avoidance. This evolution, fuelled by the complex interplay of waste, reuse, and the urban scenario, suggests a path to escape the traps of an efficiency-biased mindset on a local scale. If we transform the end goal of waste policy from ‘increasing the level of discarded materials sent to recycling’ to ‘reducing the volume of waste to be handled’, there are new avenues of thought to explore.

Secondly, the design concepts I created emerge as valuable resources for further stages of the investigation. My goal in creating the concepts was never to simply create ideas to be automatically turned into viable products. Rather, I wanted to use them as conversational devices that embed some of the profound issues I have encountered in my literature review and field observation. Those range from the interests of global capitalist actors, the pervasiveness of consumerist behaviour, discussions about material preservation and resource sufficiency, and the need to root the development of new technologies in wider sociopolitical considerations. In that sense, rather than ideas ready to be prototyped and tested, my concept ideas take the shape of *boundary objects* for stimulating discussion and building bridges across different perspectives (Star and Griesemer, 1989). They may offer fragments of insight that, when assembled, can contribute to a richer and more nuanced understanding of convivial alternatives for waste prevention in the context of urban environments.

As I move forward – to a new cycle of the spiral that involves an online co-design lab and some prototyping –, these initial findings will serve as a foundation. The insights offered in this chapter inform and shape my exploration of how design can effectively intervene in and navigate the complex territory of waste prevention, the circular economy and policy in urban settings.

5. An Online Co-design Lab: Reuse.city

As indicated in Chapter 3 of this thesis, my doctoral investigation took place along consecutive spiral-shaped cycles. The first one, described in Chapter 4, was composed of two research studies leading to the creation of a set of concept ideas. The second one will be described in this chapter. It was a co-design lab combining open-source methods and reflective prototyping, borrowing elements from participatory action research to expand the understanding of how materials are reused in different localities. The goal was to incorporate the point of view of people with lived experience in the field, while I prototyped a subset of my concept ideas. It preceded a third research cycle, described in Chapter 6, in which I would return to think of the city scale and participatory policy-making.

The second research cycle featured in this chapter enabled a deeper immersion into combining my current activities as a PhD researcher in a Design School, my previous experience in diverse capacities outside academic settings, and my ongoing relationship with networks and groups active in fields related to waste prevention. It was also a phase of coming to terms with my personal journey of moving from Brazil to Europe in particularly challenging times, and recognising my positionality as an expatriate Latin-American researcher.

The central activity during this second cycle was an online co-design lab called reuse.city. As mentioned above, it focused on engaging with people with lived experience in activities related to the reuse of materials, repair communities, circular economy and related topics. Instead of merely observing and interviewing participants, I would also position myself as a peer in a proto-community in the making, as will be described in this chapter. While naturally taking on a position of individual protagonism for creating, organising and steering the co-design lab, I was also observed by the participants and asked about my current research and past projects. That was not only a strategic choice to collect relevant data, but fundamentally a recognition of the participants' importance as co-authors of the lab.

Alongside the workshops and co-designing with participants, I was also prototyping a subset of the concept ideas created in the first cycle. I documented those processes in an open and constructive way, as will be described in Section 5.4.11. At the end of this cycle, I had worked on three speculative prototypes. Interacting with participants along the way enabled a more profound understanding of crucial aspects of my research. Additionally, the community-building aspect of this cycle was at least as important as – if not more than – any concrete research outputs I was able to produce. It was itself an exercise in conviviality, as discussed in Section 5.5.

5.1. The Second Cycle

The reuse.city co-design lab was created to explore in more depth the point of view of people with real-world involvement with repair and reuse initiatives. The initial research studies described in Chapter 4 had already enabled me to obtain an overview of the field, define the research focus on waste prevention, and create eight design concepts through design research methods. As I planned a new research cycle, I expected to present those findings and concept ideas to participants, and reflect on the conditions of developing constructive approaches to waste prevention in cities and regions. I would pursue such objectives from some starting points:

- Expanding on a subset of the original concept ideas developed in the first year of research. I initially selected two of them that aligned with the goals of the study and provided a good balance between a speculative nature, potential technical feasibility, and ease of understanding by skilled participants:
    - The Universal Registry of Things as informational groundwork – a multi-layered database of objects and materials and their reusability and repairability.
    - A combination of hardware and software that expanded on the original concept called Point and Reuse and aligned with the Universal Registry of Things as well.
- Developing speculative prototypes based on the concepts above, aligned with OpenDoTT training on open leadership, open-source hardware, and privacy by design.
- Conducting meetings and workshops with participants interested in or engaged with the reuse of second-hand goods and materials. Such meetings and ongoing communication would contribute to updating my concept ideas and prototypes, and expand the research in other directions.

Through the co-design lab, I intended to build bridges between those elements through public documentation and constant communication with the participants. It would also be complemented by my ongoing auto-ethnographic exploration of the reuse of materials in Berlin, where I had moved to at the end of the first research cycle. From that perspective, I focused on how cultural and infrastructural differences manifested in the reuse of materials in different cities. Notes and reflections from that exploration informed the lab sessions and my prototypes, and were discussed with the participants.

Of course, reuse.city was situated in a particular institutional context that generated the expectation of producing outputs to be incorporated into project deliverables. That would inevitably lead to an asymmetry between my expectations and those of the participants. On the other hand, in interacting with them, it soon became clear that the potential for collaboration could extend beyond the timeline of my PhD research. So instead of framing

the recruitment and contact with participants only on what was being planned for the estimated four weeks of the lab, I was intentionally opening an invitation for an ongoing spiralled conversation that would not have started only then, nor would it need to be closed at a predefined point. The participation in limited research activities such as online meetings, conversations and co-design would naturally be subject to conditions expressed in the consent form, and the collection of research data would follow the ethics procedure approved by Northumbria University.

5.2. Borders And Difference

Collaborations between academia and industry can yield significant benefits, such as knowledge co-creation and the practical application of theories (D'Este and Patel, 2007). However, several obstacles can hinder successful collaboration: diverging objectives regarding theoretical advancement and practical relevance, time constraints, intellectual property and confidentiality conflicts, and differences in communication and language. In the case of OpenDoTT, the contradictions were even more pronounced. The fact that the leading industry partner was the Mozilla Foundation in Berlin added some more elements to this mix for some reasons, as follows.

First, as referred to in Chapter 3, Mozilla has roots in the remarkably fast-paced world of software development. That setting is influenced by agile methodologies (Highsmith, 2010) and lean innovation methods (Ries, 2011) – based on quick cycles of experimentation, learning, and course corrections. Conflict is to be expected at the points of contact between that context and an academic environment. Technology sometimes evolves through unexpected leaps, while doing science requires longer-term planning, commitment, ethical considerations, and assurances that need to follow a different pace.

Secondly, but still crucial, Mozilla is a mission-oriented nonprofit foundation whose work centres on a grounded critique of the very industry it is part of. The foundation is among the most well-respected voices pushing for open-source software, ethical artificial intelligence and internet health. This means it has social value considerations at its core. Mozilla then does not fit easily into the usual formats of cooperation between industry and university that focus on generating restrictive intellectual property to compete in clearly defined profit-oriented commercial markets.

Besides recognising those differences as potential points of tension – as well as creative opportunities – during this cycle, I often returned to reflecting on my positionality as a researcher and activist. As indicated in previous sections, I was conscious that my non-linear past career puts me in a different position than the stereotypical industrial designer starting to adopt participatory research methods to learn about the opinion of potential

users or stakeholders of their products. At the same time, I diverged from the typical image of humanities academics adopting design methods to experiment with technologies and connect to the world outside the university walls. Finally, my take on technology-oriented open methods was explicitly critical of common assumptions of high-tech entrepreneurship and its *WEIRD* foundations, as described in Chapter 3. The condition of not easily accommodating to either environment was always present as my research progressed onto this new phase, as will be discussed.

5.3. Re-spiral

My research focuses on imagining, discussing and designing convivial alternatives to handle excess materials to benefit local communities and societies. More than managing waste to make it disappear efficiently – as discussed critically in Chapter 3 and more practically in Chapter 4 –, a central running theme of my investigation is understanding what are the skills, processes and forms of knowledge involved in assessing the potential value of things discarded or unused, and how to act on that potential. I am conscious and intent that whatever solutions emerge from my studies, they must always recognise and aid the hard work carried out by people and organisations involved with waste prevention at a local level. In other words, if I contribute to developing technologies that help evaluate and act on excess materials, such technologies should strive not to replace those people who already organically perform that work. Instead, I want to learn with them how to augment their work capability in convivial ways and, when possible, help new generations access the information necessary to become skilled to help their communities thrive.

With these considerations in mind, I planned a new research cycle. In addition to further exploring the aspects of waste prevention through material reuse identified in initial studies and design concepts, I sought to experiment with an open and spiralled approach to participatory research. Rather than employing participants to test or validate my authorial prototypes for future industrial production, the collective experiment would ultimately treat the community as something in the making, a prototype itself. This meant I would initiate an open-ended process with flexible goals, accommodating diverse interpretations and inviting ongoing revision. The study goals were never to become rigid or fixed. Furthermore, I was keen to involve participants with practical experience and relevant skills in material reuse through repair, upcycling, and reuse practices. I aimed for the study to incorporate their perspectives at its core, and was successful in recruiting people who contributed with significantly diverse points of view.

Beyond the particular outputs generated by the participant interaction, I wanted reuse.city to point to ideas for convivial interventions potentially applicable at an urban scale. By

proposing that cities are open systems where commonalities and differences coexist dynamically, an open-ended collective experiment could provide clues for navigating such conditions. The reuse.city lab explored just that by forming a particular proto-community – people with multiple commonalities, among which experience with repair and reuse was a central one – and intentionally opening up the decisions on what kind of knowledge to generate, and how.

5.4. An Online Co-design Lab

To advance the understanding of waste prevention and material reuse, I designed reuse.city to explore the potential augmentation and replicating of the skills and experiences needed to assess the potential value of materials, and how to make such skills available to individuals, communities, and organisations. Drawn from diverse practices, the reuse.city lab sought to identify types of data, skills, and experiences relevant to promoting greater reuse of materials in cities. It was chiefly inspired by the professional role of the *agents valoristes* in France, mentioned in earlier chapters. One way to put it is that the lab experimented with ways to facilitate the work of *valoristes*, by exploring the kinds of skills necessary in their work of assessing and transforming things, involving material knowledge, experience with local context and culture, creativity and access to parts and equipment.

The co-design lab was planned as an open-ended process to take place via online workshops. Through them, participants with diverse levels of involvement with repair, reuse, and waste would be asked to describe their experiences, prompted by ideas emerging from my research studies. They would also follow the progress of my prototyping of a subset of the design concepts. I expected to discuss with them the implications of using those concepts in real-world scenarios. Reflecting on the participatory community-driven research framing I adopted for this cycle – described in Chapter 3 –, I kept the concrete plans intentionally as open-ended as possible. With that, I sought to involve the participants in contributing to shaping the study since its inception.

From the onset, there was a range of potential outcomes I knew to expect. For instance, co-designing updated versions of the concepts, or generating novel ways of using technologies to augment society's ability to reuse a larger volume of materials. Owing to the COVID-19 times, the workshops were to be held online via videoconferencing. Additional interaction would occur through other means, to be decided with the participants.

Before starting reuse.city, I hosted a workshop about the Universal Registry of Things design concept during the 2021 edition of the Mozilla Festival. In preparation, I expanded

on the original concept, and started to model it as an open repository for collecting and organising data such as product specifications, service manuals, spare parts descriptions, authorised repair shops, and possibilities for reuse, upcycling and recycling. The virtual session at Mozfest allowed me to test ways of presenting the design concepts and organising discussions with a diverse audience. It was also the starting point to recruit participants to reuse.city. Next, a call for participants was sent out via my social media, and those of the OpenDoTT programme, colleagues and supervisors. I have also personally invited people I thought relevant, and took on suggestions from colleagues and other participants about whom to invite.

At the end of the recruiting period, 29 persons from ten countries on four continents signed up for the study by filling out the consent form. Ultimately, not all the individuals who signed up have engaged with the lab's activities. There was considerable attendance, nonetheless – 10 of them actively engaged, some others watching the sessions as an audience or reacting only through email. An early look at the list of participants indicated that they had diverse levels of familiarity with the research topics and, in some cases, with my previous studies. All the participants who joined the sessions had opted in through the consent form to have their names publicly visible in the transcriptions and other research outputs. For that reason, their names are occasionally explicit in the following sections.

As a way to document the process, I experimented with the analogy of open-source Release Notes to collect and synthesise significant contributions made by the participants. It is described in Section 5.4.3.

5.4.1. Running An Online Co-design Lab

The study was planned to happen for four weeks, though, in the end, it was slightly extended. The shape of reuse.city was left open to be debated and agreed upon with the participants. As hinted above, even if I was steering the study in the explicit and clear role of a PhD researcher, the idea was to allow plenty of room for genuinely collective peer construction. We started with an elementary set of definitions, on top of which I expected to build:

1. We would have online meetings throughout the four weeks. All participants were invited to join any session, according to their interest and availability. We'd also have continuous communication through means collaboratively defined with the participants.
2. I would provide context and trigger conversations on focal points, but the participants were free to propose other perspectives and dynamics.
3. In parallel with the sessions, I would also document and share with the participants the ongoing process of developing prototypes based on my design concepts.

Even the practical meaning of the definition I chose for the study – an ‘online co-design lab’ – was subject to discussion early on. I sent an email and a video introducing the general format and posing the question ‘what a co-design lab should be’ to the participants, and sent out an online questionnaire about their preferences for interacting alongside the video calls.

Nine participants replied to the survey about communication. They all agreed to participate in communications in parallel with the live calls. The modes of interaction that got more votes were an email discussion group (5 votes), and a group on the messenger application Telegram (4 votes). Both groups were created right away, and all the participants received invitations.

Given the positive response to the introductory video, I decided to keep creating and sending what I called ‘video fragments’ about my research in the following weeks. Breaking down different parts of the investigation into smaller-sized videos proved to be an efficient way to offer context while not taking up the time of the online meetings. The participants could watch them at their own pace, leading to the meetings. During the co-design lab, I sent a total of five video fragments. Five emails with guidance, organisation, and contents were also sent to the participants.

We had seven video calls during the lab, summarised in session 5.4.1.2. Nine participants attended actively, presenting their projects and engaging in conversations during the sessions. Another two attended occasionally, but had connectivity problems. One other participant was scheduled to present his initiative and had to cancel due to health issues. In agreement with all participants, I would also record the sessions and send the files to all other group members so that those who did not attend could watch them. Two participants who could not attend any call reported having watched at least one recorded session, and engaged in conversations via group messaging. After the period of collective activities was finished, I sent a final message to the participants to wrap up and indicate my plans following the lab.

Those who didn’t make it to the final call were offered alternative ways to provide feedback afterwards. They received the video fragments describing the prototypes and could add comments to a collaborative online whiteboard, kept open for two more weeks. A survey was also sent out and answered by two other participants.

Figure 18 shows the timeline of activities performed during the weeks of the co-design lab in three layers: communication (e-mails and videos sent to participants), meetings, and prototyping.

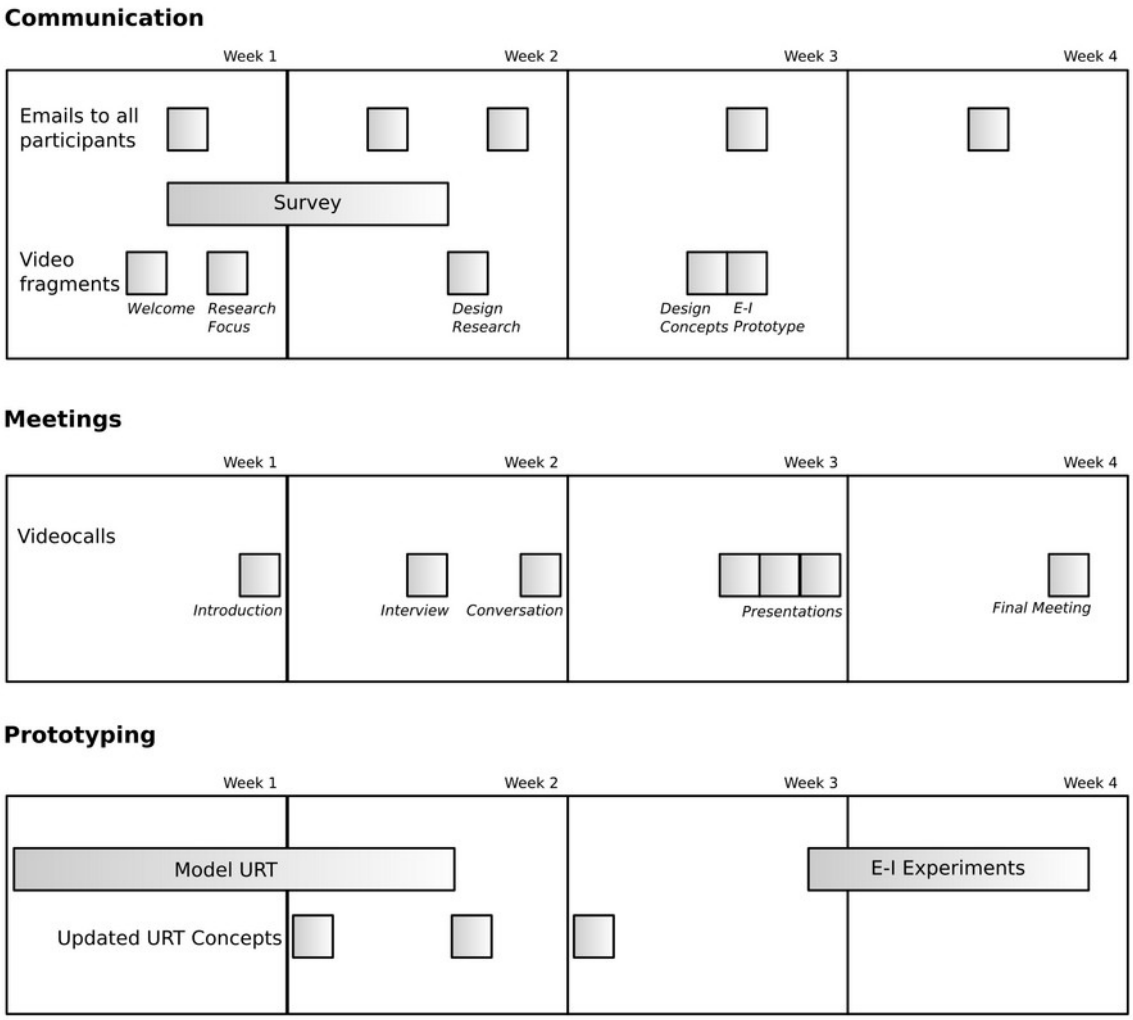

Figure 18: reuse.city activities

5.4.1.1. Open Documentation

During the calls, I took notes on an interactive whiteboard using the Miro platform. For the final meeting, I created another collaborative board on Miro, and invited participants to collaborate and post content. I documented the calls, my reflections, and auto-ethnography in text, notes, photos, and sketches. In line with best practices of open-source projects, I published all the contents generated during the lab on a GitHub repository: text notes, images, code for the prototypes, snapshots of the Miro boards, and video fragments (Schmidt Fonseca, 2022). The recorded sessions were only shared with the participants. The transcriptions of the meetings generated 240 pages of text, only accessed by me. Notes and folders in the repository are connected through hyperlinks, as seen in Figure 19.

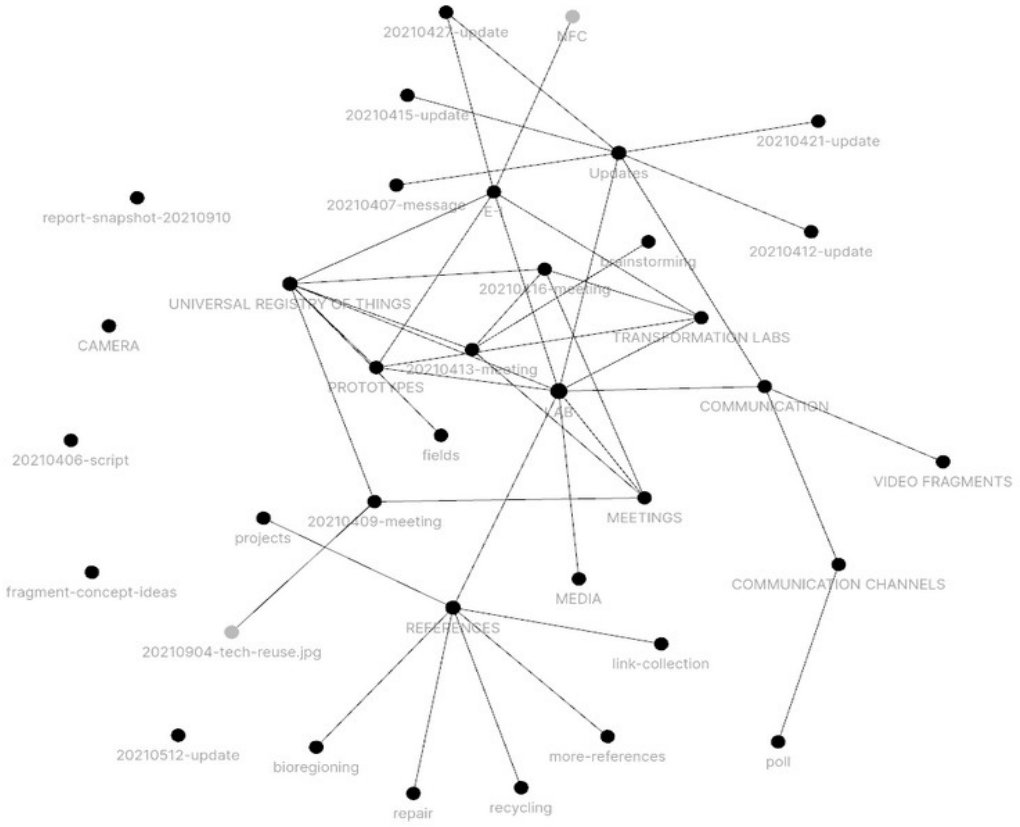

Figure 19: Lab documentation

5.4.1.2. Meetings

The seven video calls were organised collaboratively with the participants, and covered diverse perspectives on the research topics. They happened in tandem with the development of my prototypes, described in Section 5.4.2.

The first meeting happened on April 9th 2021, coinciding with the international *IoT Day* organised by the Internet of Things Council. Three participants attended the videoconference on that day to introduce themselves: Mark Phillips, a British photographer involved with repair movements; Mathew Lubari, a member of a community-based electronic repair project in a refugee camp in Uganda; and Kamie Robinson, a software engineer from California. I presented an overview of the research topic and the motivations of reuse.city. We discussed the reuse of materials in quite diverse local contexts – from advanced reuse centres in Finland visited by a participant, to community workshops in the refugee camp. Furthermore, we discussed the limits of technology to provide solutions for the reuse of materials and handling of waste.

The group decided that from the second week on we would hold calls in diverse time

slots, to accommodate the participants' wide range of time zones (from India to the west of the USA). I sent beforehand a video fragment about design research and my initial research studies. The participants were also invited to prepare presentations of their work, and ideas about reuse and repair to be discussed in the following weeks.

During the second week, we had two calls. The first had one participant only. John Hopkins is an engineer with a diverse background in geophysics, the oil industry, and teaching at art schools. The call was more of a direct interview, allowing for deeper immersion in discussing particularities, tools, and considerations of a systemic take on the reuse of materials. The second call had three other participants. One of them was Mark Phillips, who had attended the session the week before. The others were Mary Fox, a social entrepreneur in the USA, and a French service designer based in the Netherlands, called Hugo Pilate. We discussed how used goods were re-circulated and reused in different world contexts, looking at structures and social/cultural practices. The focus was to learn about the kind of material selection that these structures and practices implied, and whether digital technologies could improve such selection.

In the third week, I sent participants a video fragment about the eight concept ideas I created earlier. It was a way to prepare them to discuss the prototypes I was working on more intensively towards the end of the lab. Following the earlier invitation, participants also presented their projects on two calls. It was a telling demonstration of different whilst complimentary perspectives on reuse. Hugo showed his experiments with the speculative design of reused virtual objects. Mark Phillips reported on his long-term documentary photography project covering repair cafés, reuse centres, and other contexts on four continents. Rhea Muthane shared her experience with a project called ‘100 ways of mending’ and the *Makeflix* collective. Fred Paulino presented his work with the *Gambiologia* collective in Brazil, exploring the aesthetics of *gambiarra* to express improvisation and reuse. Finally, Tom Passmore presented *Dsposal*, a software solution to ease waste compliance. A sixth presentation was cancelled due to health impediments. Other participants attended the presentations as well.

5.4.2. Prototyping Design Concepts During The Lab

In parallel with the calls and other interactions with participants, I was also prototyping reassembled versions of a subset of the concept ideas. As mentioned earlier, I chose the ones that could act as boundary objects, by embedding and expanding the discussion on how to understand, augment and replicate the skills, data, and knowledge involved in assessing the potential reuse of materials. When the planned period of the lab was coming to an end, I set out to promote discussions and collect participant feedback on

how my prototypes were evolving. A wrap-up meeting was scheduled for the fourth week, and was mostly attended by participants who had been to previous sessions. The group was introduced to updated versions of three of my design concepts:

- The Universal Registry of Things. I also asked whether my prototype should be called ‘valudata’;
- E-I (evaluation interface), inspired by Point and Reuse but taking the form of a workbench machine that could also be ported to a mobile app or adopt a larger kiosk form factor;
- Transformation Labs, a blueprint for creating reuse centres, in some aspects resembling community repair events, but also in dialogue with formats more common to FabLabs and makerspaces.

Through the activities of reuse.city, I was able to discuss with participants the prototypes and collect their insights and ideas, described in Section 5.4.3. After the four weeks of collective activities, I collected my notes and focused further on prototyping, as will be described in Section 5.4.6.

5.4.3. Collective Construction

As indicated earlier, the reuse.city co-design lab was an exercise combining open-source methods, speculative prototyping and participatory action research. It consisted of open-ended online interactions with participants, hands-on experimentation with hardware and software, in parallel with my personal observation and reflection of my surroundings in Berlin. I was able to review my earlier findings and design concepts, and compose a deeper and more nuanced perspective on the reuse of materials in cities. Section 5.4.3.1 has a selected collection of the conversations with participants. I also made notes during the meetings using collaborative boards on Miro. I later used those notes to shape the analysis of the transcriptions of recorded sessions, and to bring insights to my prototyping. Section 5.4.5 shows my prototyping process.

The following section is a narrative experiment collecting excerpts of the sessions in which participants contributed to add significant depth and density to my understanding of the field, its potentialities and challenges. It is not a linear account of the activities. To expand on the use of open-source software analogies, I call it reuse.city’s *Release Notes*. In the context of software development, ‘Release Notes’ are text documents usually published when a software version is released. Unlike ‘User Documentation’, which is typically focused on explaining all the functionality or features of one particular software version, Release Notes are published as a meta-commentary about the changes in the most recent development cycle. They may explain the motivation for decisions made about adding or removing functionalities, report on achievements or failed experiments, and even offer conversations about factors outside of software development *per se*.

Release Notes are fundamentally an instrument of accountability within communities interested in better software. Sometimes – as is the case in my experiment here – they assume that the reader has prior knowledge of the previous state of the software, and focus on recent additions and contributions. They can thus also be seen as a description, explicitly marking the differences between versions – reinforcing the argument in my spiral method that nothing returns to the exact point of origin. The way I do it here, my Release Notes are also inspired by the manner of *griots*, the wandering storytellers mentioned in Chapter 3. By retelling stories and incorporating new elements as time passes, the *griots* help create the sense of commonality, belonging, and constant communication essential to even call a group of people a community. The individual excerpts are anonymised so as to focus on the substance of their contribution.

5.4.3.1. Reuse.city – Release Notes

The interactions with participants during reuse.city enabled me to deepen the understanding of crucial aspects of my investigation, inform and provide feedback on my speculative prototyping, and provide contributions to be carried along as I planned my next research cycle. What follows is a curated selection of excerpts from transcriptions of the online meetings. They cover a wide range of topics, reflecting the diversity of perspectives in the composition of reuse.city. The excerpts are interwoven with my comments to provide context, or to draw attention to specific points they focus on.

The reuse.city lab started as an open-ended exercise in understanding the reuse of materials in cities through community-oriented initiatives of repair, upcycling and re-circulation. I recruited a group of people to discuss, in ways decided collaboratively. At the same time, I'd be working on prototypes based on my design concepts created earlier. Central to my selection of which concepts deserved further development in this phase was a focus on ways to generate data about how to reuse goods and materials in convivial ways. Ignited by the presentation of these starting ideas, one participant indicated the need to aggregate data that already exists:

> So I have a box of broken gear down here but this thing has got a barcode on it that gives me its serial number, its model number, etc. This stuff exists all over the place now on almost any product you choose. Behind that, someone, someone has got all the information. In theory, you could probably get most of the supply chain information. In other words, what materials, and where they came from, you should be able to get things like the repair manual etc.

A similar point was also raised by a participant in another session:

> Even just within the data, suppliers and manufacturers know what these materials are, they know the volume and the weight of these materials and these products. We know on a global market what the value of a tonne of aluminium is, therefore we can start making educated guesses at the actual

> raw material costs of these products.

Later into the discussion, the same participant formulated:

> If we can either use the barcodes and the product codes or if we haven't got those available, we look at the object and maybe there's some image recognition type of software that allows us to do that. What you can do, we talked about how do we circumvent the system if the system doesn't want to do it.

When focusing on digital systems to offer data about things, the conversations reinforced the need to integrate information systems already in place. As one participant put it:

> The first thing that comes to my mind is quite simple, a collective database. That's an initial concept. Clearly some type of machine learning. Because essentially, a human knowledge base that is rooted in, say, long-term experience, you have the challenge of capturing that long-term experience.

One participant sees the potential to use data currently out of the radar of waste services:

> Some of the good places to find information about reuse is from the charity sector actually because it's seen as a commodity in that, they have good data and because it's a commodity, so they know what they get in. They class it as a stock, they then add a value to it and then they sell it. That data is not the best data in the world by any means. But it's not regarded in any recycling stats. Why? Basically if it didn't go to that charity, if it didn't go to that furniture reuse facility then it would have ended up as waste. So it is a form of recycling but it's not taken into account.

The same participant, however, sees authorities getting interested in that:

> There is a massive ask by the local authorities to actually take this to the next level, to start mapping out all of the charity shops in the UK, all of the reuse networks, all of the repair cafes. So that this whole idea in the UK of reduce, reuse, recycle actually becomes a data set that anyone can use.

However, the design of technologies to promote the reuse of materials should be more than simply managing material resources, as suggested by another participant:

> Clearly, a technologic situation, in my view, is always heavily embedded in the human social techno. I always called it the techno social. In that one and had to be very aware of what the technology was doing to the human connection.

Interoperability was also seen as key, not only between large actors but also communities and individuals:

> You could have your own inventory that's then indexed and shared or linked to others.

Naturally, integrating data from different sources and very diverse kinds of agents raises concerns about trust:

> Whether or not it's machine mediated, it's got to have a degree of trust. Where, if I'm coming to a database or some kind of machine mediated knowledge, I have to trust it. Trust, I don't know where the word trust and machine mediation fits.

One participant suggests:

> A Wikipedia of things – you just get a community of people who have all got a common interest adding to it. There are risks associated with that. People will add to it without necessarily the knowledge, and therefore there'll be errors but in the same way that Wikipedia, whilst it's built sufficient momentum, there are people in there who fix it, so errors don't stay for very long.

There are ideas as well regarding how to scale up the use of data:

> It's two tacts for scaling up, one of them is very much federated/franchise model of open data releasing in and having a community around it that all kind of wants the same thing and have a bit a loose governance structure just to make sure that it all works together. The other one is just pure having a software service, technology platform that waste companies and waste producers use and then hopefully interlinking again – federate or franchise that model around the world, so that we can see that waste chain everywhere.

In parallel to that global integrated take, participants recognised the need to act locally as well. From the perspective of waste management services, one participant suggests the need to interrupt the usual habit city-dwellers have of simply throwing in the garbage the things they don't want anymore. The participant brings an example grounded in the British context:

> Then also all of the furniture reuse networks we have in the UK to basically go, 'Right, you've got an item, you want to take it to the dump. There is a better step here and we need to interrupt that journey'. Because a lot of people when they've gone online just go, 'I just want to get shot of this, I want to get rid of it'. They instantly want to just take it to their household waste recycling centre in their car and get rid of it.

Though seen as helpful to raise awareness to the general public, the way the circular economy is often pictured is considered problematic by a participant:

> The representations of circular economy, they underplay the repair component. They show this make, use and then they have this recycle bit and you go like, 'no, you missed the point'. So actually there's a potential dilemma in the way that people are portraying the circular economy.
>
> The visuals that people use and the imagery and the way they show it has the potential to undermine the repair component because. You see these models with a make, then there's the use, and then more often than not, the repair bit is a little tiny loop here and the big part of the doughnut or the circle is the recycle bit. It's like now you missed the point. The diagram should go round here and show this repair and reuse big, and then only a small bit comes out as recycle.

On the other hand, there might be room to borrow terms that gain attention in the public discourse and use them tactically. One participant talks about the city of Amsterdam's adopting the discourse of a doughnut economy (Raworth, 2020). According to him, some local organisations would point out that:

> Yes, that was part of actually Amsterdam's existing circular city agenda and it

> has now been rebranded but now there's much more renewed international interest thanks to the rebrand and thanks to the new message' which I thought was really interesting and why I think repair should definitely be tied to this circular logic. I mean it is by definition but also in the language and the branding it has a lot to gain.

Participants suggested incorporating stories of particular objects alongside technical descriptions. Those stories would allow people to replicate and take inspiration from transformations performed by others. One participant sees potential in that to allow for situated adaptations on ways to use tools, for instance:

> It's like, what do they say in open-source where you have a solid software platform that's been developed over time. The idea of forking it. You suddenly fork this thing over. That same thing, that same process, I think is the idea of when someone hands you a tool. Oh, this is the normal use, what this thing was designed for over a 100 years. But can you use it this way? Yes, the idea of forking, that's interesting.

As can be seen, participants would frequently recognise the potential of using digital technologies to help foster the reuse of materials. However, as one of them put it, 'Technologies enable but don't solve the problem alone'. That remark is aligned with and conversely reinforces my focus on the human scale of material reuse. In particular, it highlights the importance and the embodied skills of those already active in the field. Instead of replacing those people, my objective is to expand their reach and increase their work capacity.

An example brought by a participant is Precious Plastic, a project created in the Netherlands that designed low-cost machines for recycling simple plastics, and published the schematics of the machines as open-source. That allows initiatives worldwide to manufacture their own local-scale plastic recycling machines. The validity and efficiency of the machines can be debated, but the point the participant was making had more to do with the way Precious Plastic adopts open-source licences and documentation, but is also open to adapting its business models to different contexts:

> And how they have gone from refining their machines to making them buildable in different contexts, to now documenting the business models that are developed around them. So, I agree with you, that sometimes it feels a little limited, but they have put an extensive amount of work in, in open-sourcing their machines. And the way they had designed them in The Netherlands wasn't really easy to make, for example in the US, then they made a few versions. And now they have started documenting their business models. So, when they assumed that everybody would have all five of their machines, they are realising that now it works much better if you only have a sheet press and an industrial granule maker, for instance. So, there has been a really nice amount of fine-tuning of the blueprint, is why I was bringing it up.

To that point, many participants referenced the importance of supporting local community initiatives, including for educational reasons. One participant used terms such as 'tactile'

or ‘hands-on’ as the most effective way for people to learn about repairing. The same participant, who has been documenting repair events and reuse centres for years in places as diverse as Ghana, Helsinki and Cuba, suggests there is an aspect of traditional apprenticeship to repair education:

> It's not so much about having all these repair manuals. It's about having somebody who's got experience, almost acting as the classical – that used to be called the master and the apprentice type of thing. Somebody who can guide the other person to build their confidence and skills, somebody they can go to and say, ‘Hang on. What do I do here? I'm a bit stuck. I don't understand’.

Insisting on the essentially personal aspect of such learning, the participant exemplified:

> Havana it’s an oral culture that used to actually train people to repair. It was exactly the same when I was in Accra in Ghana and when I went to Kierrätyskeskus in Helsinki, again, it’s more of a hands on oral culture.

And adding to the idea of going beyond mere access to technical data, another participant puts:

> I feel like we’re still missing a connection with popular culture and narratives and myths and mythologies around this. Recently, for the past five, ten years, I've been trying to keep track of when maker themes show up in movies, whether it’s in The Founder, the movie on McDonald’s, where they prototype the fast food environment, or when it’s Spiderman making- I think Andrew Garfield makes their own Spiderman suit, at first.

In addition to such appearances of individual makers in pop culture, participants also pointed to the importance of local repair initiatives. They can function as a means of social inclusion, as one participant has seen in an initiative that hires immigrants and ex-convicts.

> It provides local mechanisms, social mechanisms to, one, to educate people but also to re-engage people back into society.

Another participant pointed to the concept of *DWAM*, which expands on the well-known DIY, or do-it-yourself. Uncertain whether the term was coined by a friend or borrowed from someone else, he says it stands for ‘doing with available materials’. It relates to the idea of *DIWO* (do it with others) (Catlow and Garrett, 2008), which the participant describes as:

> Being around people who I could learn from. Who were empathetic, sympathetic, who had a good vibe around them, who were willing to share. Then absorbing their knowledge and then going on to share that same knowledge.

Education was also mentioned regarding city-dwellers and the broader society, besides repairers. One participant said, ‘We need to educate the community about reuse’. Another suggested that ‘people should be educated’ on where to get the spare parts to perform repairs. A participant said about the general public:

> People are beginning to accept that it's okay to take something from a neighbour. It's not dirty. It's useable. So there is a shift happening now. I think the mind is shifting on what's acceptable, what isn't.

On the other hand, a group member indicated that such a shift in public awareness and attention to reuse is not global. In Uganda, according to him,

> The media tend not to look into bringing this up. It's just neglected. They keep on taking shots on waste. But on the side of the electronics, they haven't got into these repair centres or repair houses, to capture or to take stories from these repair houses, and bring them up.

Adding non-western perspectives to repair and reuse was also part of the discussion. For instance, one participant talks about the 'puja' rituals through which people in India worship their tools of trade. She says that the practice influences the way they relate to objects:

> It also happens on more mundane, everyday events, like whenever you buy a new car, you would worship the new car. Or whenever you get a new object, you place it in front of the god, and, kind of, ask for you to treat it well, and for it to serve you well. Every object is treated like it has a life of its own. It's treated like it is an equal, it has respect.

Such highly local and culturally rooted characteristics could be articulated with global information infrastructure to open possibilities. On the other hand, one participant thinks also of local information systems:

> A directory of sorts, like, 'Oh, my bike's broken, can I do something? I need to build this furniture; can I do something out of it? I need this done; can I do something?' Or, 'I have so much trash, or so much office stationery just leftover; can I build something out of it?' Stuff like that.

One participant pointed at systemic challenges on a macro level deriving from a globalised capitalist economy. For instance, local shops for electronic components are 'all gone'. As a result, 'the only way to buy capacitors now is you have to buy a pack of 20 in bulk on eBay'. Another suggested that:

> The idea of employment through repair is something that needs to be subsidised or at least that the entrepreneurship in those spaces has to be supported.

Another participant points to Sweden, where the government removed the VAT (value-added tax) for repair services. The same person suggests the macro-scale elements of reuse and repair would need to be addressed in a systemic and 'multifaceted way':

> You do need policy change. You need something that says the rules are going to be that anything new that comes into this ecosystem… goods need to be made with a right to repair becoming more prevalent. (...) If you do something in education, you've got to do something around enabling a community of repairers to thrive. (...) An individual person needs to be able to repair if they want to but then I think there needs to be solutions that sit at a municipal level.

Moreover, adopting an ecosystem perspective:

> You get a combination of expert repairers who may have specialisms, you may have some municipal stuff or the stuff that the experts, it's not economically viable for them to repair it. You have Wiki solution information, knowledge based solution that means you can do all those things that you say. You can go on your phone, you can scan the device or you can look at it and it'll tell you and it may even give you a repairability or view of repairability. I could almost envisage seeing at the end of the day I've got my device, 'Can you identify at very top level what's wrong with it?' You go, 'I think it's either this or this,' and it'll give you a view as to how repairable it is.

Expanding on the necessity of having novel infrastructure for repair and reuse in cities and local communities, one participant suggested something similar to FabLabs, 'but with more focus on reuse, maybe like the reuse centres' in Finland or the examples of everyday repairs presented by other group members. Another member raises issues about the way young people learn in FabLabs in comparison to hands-on experimentation with repairs and upcycling:

> It's completely different if you get children into a FabLab and then they get into a computer and start to learn one or more softwares and to model 3D. and then that machine which is far away from them just magically happens to laser cut something or to 3D print something. It doesn't differ, it definitely doesn't differ of the traditional relationship with objects, with technology and so on. If you are bringing [to workshops] packs of products that they are used to consume in their everyday life, besides the fact that we are recycling or reusing, this is something that they are familiar with. So it's a path for them to get interested about learning technology. You should start from basic technology. You can't start from Arduinos, for example. The first exercise in any technology workshop should be using scissors.

That opinion obviously hints at the concept idea of Transformation Labs I had created during the first research cycle. Such places should have tools but also room to store materials and parts, as exemplified by a participant:

> Imagine a repair guy parking a huge amount of broken devices, ok. But what next, when his room gets filled up? That becomes a big question to me. I am still thinking of now bringing this idea of the warehouses, or stores, that can collect such kinds of materials from these people doing the repairs.

Even if I was already interested in formats like these reuse centres, acknowledging the crucial need for storage was a discovery in my way of seeing the field. It is not only about having space to keep equipment or goods to be repaired, but also for spare parts and broken objects to be disassembled. Describing what happens with materials collected by publicly funded reuse centres in Finland called *Kyerrätuskeskus*, one participant raised their habit of scraping for parts the things that could not get repaired:

> The idea is that these reuse centres will either try and repair it, in which case it's then sold, or if they can't, they'll scavenge it for parts or they may upcycle it. They'll try and do whatever they can with it. The idea is that the absolute least possible goes down the recycling route.

Such reuse centres in Finland collect a wide range of material types. According to the participant, there are few exceptions – automobiles being a type nominally mentioned. The participant argued that 75% of materials coming to the reuse centres are effectively put to use, and the rest is sent for appropriate recycling. In these spaces, the skillset of the *valoristes* I have been trying to experiment with is particularly useful. The participant says that an object arriving at a reuse centre in Finland could have different destinations depending on its potential value:

> What they'll do with something like that is – so they have a store that they'll sell it all in but actually they're smart. What they said was, they know something like that has got much higher retail value because it's a collectable than just putting it in the shop. So they'll sell that on eBay or they'll sell that online because they know they can make more money for it.

In addition to repairing things to restore their original use, there are also possibilities for repurposing and upcycling. In this context, it is crucial to have a point of view that sees the many possibilities in any materials and tools.

> I know the spectrum of tools that I have. I also know the spectrum of tools that I don't have. So, when I look at an object, I can say, 'Okay. I know that in 10 ways I can change that object'. Obviously, something as simple as a piece of wood – with a variety of tools you can do a shitload of different things with a piece of wood.

A slightly different take is adopted by a participant talking about the artistic possibilities of second-hand materials:

> In our case somehow it's the opposite because it's like, 'I have this, what can I do with this? What can I create with what we have?' So it comes more randomly in the opposite of the traditional design direction. It can't be replicated, it's not serialised. It's always unique objects but it's the opposite of idea of the traditional way of creating, at least in the romantic viewpoint of the artist as this creator, if you can name it.

On another path of the conversations, a limitation of reuse initiatives noted by participants is their isolation on local and global levels. First, for lack of class identity between different kinds of reuse professionals and hobbyists. Secondly, for the often ultralocal nature of small repair businesses and community projects. To face those conditions, participants suggest the need for inter-local connections:

> We need to find these, what I would call, islands of solutions and things we can tangibly do and then work out how do we join them up? Ultimately it's got to work as an ecosystem.

Another participant replied:

> I'd be interested in doing some of that, and seeing how things that work somewhere else, how do you test their suitability or their relevance in their context? I'm sure that can take many forms. But being able to say, 'Okay, we have this solution over there. It took this long. Or it is situated in this kind of neighbourhood, or in this proximity to other parts of the city'. Trying to almost

> unpack the magical recipe. And seeing what needs to be addressed differently, what needs to be tweaked. Or if altogether it might not be able to work.

Or, as put by a third participant:

> It's so interesting, because I think different people, without having spoken to each other, we would all have these kinds of problems. And if each of us solved one problem, and then made it open-source, and made it open to a community, together, we would have so many solutions, and we would already have an ecosystem. And then if we each did it in each of our cities…

A similar thinking goes towards intersectional cooperation between repair agents:

> Then the other big gap I think is that there is just no, you know if you like to think of a trade union or if you think of the General Medical Council as an association of professionals there's nothing analogous for repairers. Every repairer, commercial repairer I'm thinking about now is almost working as an independent in isolation. That I think is a challenge. I think there needs to be some sort of collective that helps repairers, particularly commercial repairers build community, because if they don't it's very difficult to do.

At the final session, two participants said they felt the need to discuss further the relationship between repairs and cities – focusing not only on the conditions to repair things but also on the immediate environment. Along with all the contributions captured in this section, I already planned to shift my attention back to the city scale in the final research cycle. Some of the conversations brought insights particularly relevant to that:

> The other thing that we're looking into and this is a bit crazier idea – is this idea that waste is a commons. So like on a small scale it should be free and it should be accessible and people should be able to basically retain value from it at a small individual level.

Naturally, that view connects smoothly with another of my design concepts, the Reuse Commons. The fact that a participant that had not been introduced to it earlier reached a similar conclusion made me realise there was room to return to it later. The idea of commons naturally touches on a topic another participant mentioned when talking about a project of second-hand clothing she had been involved with:

> It was more about the actual object itself, what they were buying and selling. We felt the ownership cycle was really, really important. So it was more about what was being owned.

I replied to that discussion, already seeing the link between ownership, commons and incentives.

> Having a multi-stakeholder approach even to the ownership of the things that you share. You have this model of individual ownership of stuff. You give stuff away, you donate things to other people and they are not yours anymore. Sometimes you are concerned that you are donating something and that thing may end up being recycled or incinerated or in a junkyard. You may want to get that thing back when you need it later on, so this kind of commons governance would be interesting for material objects in the cities.

5.4.4. Emerging Themes

The conversations excerpted in the release notes above cover multiple and complementary human experiences in planning and conducting activities of reuse in diverse contexts. They point to a series of recurrent topics, listed below. Those topics were organically incorporated in my prototyping activities, and would also inform the design of further research activities for the next cycle.

- social inclusion and education,
- advocacy for repair and reuse culture,
- influence of cultural practices and non-western perspectives,
- need for systemic changes,
- public awareness and the role of artistic possibilities,
- impact of global capitalism,
- infrastructural support,
- inter-local and intersectional connections,
- relationship between repairs and cities,
- commons and cooperation,
- implications of ownership and governance,
- importance of tools and spaces.

5.4.5. Back To The Workbench

Initially, I expected the lab to focus only on two of my original design concepts. The first one, the Universal Registry of Things, had already been slightly refined in an online workshop during the Mozilla Festival in March 2021, and I expected to prototype it further. The second was based on Point and Reuse – an app for mobile devices –, but during the lab and experimental prototyping, it was articulated in more general terms as ‘Evaluation Interface’, or E-I. It could still be thought of as a mobile app. But a physical piece would add other perspectives to debate access to information, and potential expansions to the urban scale.

As well as experimenting with technologies that allowed interested parties to assess the potential value of discarded materials, the online sessions brought forth the discussion about what kind of urban facilities are needed to promote the reuse of materials, what were its precedents and relevant references, as well as main desirable characteristics. Therefore, I returned to a third design concept I had not initially envisioned working on during this research cycle: the Transformation Labs. It would enable my research to reconnect with the scale of local communities, and the city-based ecosystems of reuse. At

that point, the concept seemed to offer a good segue to progress towards my third research cycle, where I expected to explore policy and public services.

Through reuse.city, I could design updated concepts based on conversations and participant interactions. Two were turned into prototypes following the period of the online activities: an experimental implementation of the Universal Registry of Things called ThingWiki, and a demonstration of technologies that would enact E-I in the form of a workbench machine. I also developed a blueprint for creating Transformation Labs as a third prototype.

Importantly, my prototyping never intended to generate implementation-ready models for manufacturing or deployment. Instead, I positioned my concepts as speculative prototypes through an iterative movement – between hands-on experimentation with the support of OpenDoTT consortium members, and conversations with lab participants from diverse global localities. They were functional design concepts, based on open-source software and hardware. And that enabled me to unpack the issues associated with the reuse of materials in terms of incentive systems, culture and behaviour, and access to data, information and experiences.

5.4.6. Speculative Prototypes

As referred to earlier, alongside the conversations, presentations and meetings I had with participants during the reuse.city lab, I was also exploring ways to prototype my design concepts. In connection with mentorship and training offered by members of the OpenDoTT consortium on open leadership, open-source hardware and privacy by design, I worked on three prototypes: ThingWiki, E-I and the Transformation Labs blueprint.

5.4.6.1. ThingWiki

ThingWiki is a prototypical implementation of the design concept Universal Registry of Things. It is an example of a collaboratively governed online service to gather and publish data on how to reuse objects and materials through repairs, transformations, re-circulation, repurposing and other means.

Before the lab started, I had already sketched a tentative data structure model for a workshop during MozFest 2021. It is shown in figure 20.

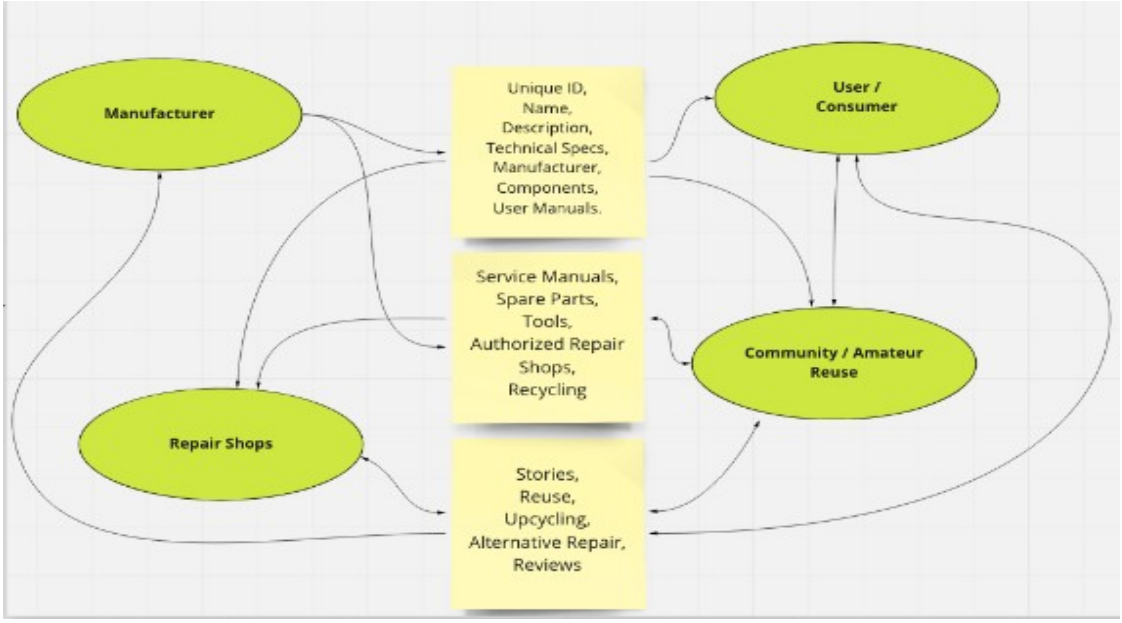

Figure 20: Universal Registry of Things

During the participatory activities of the reuse.city lab, it was still referred to by the tentative name ‘valudata’. Following one participant’s suggestion that we should have ‘a Wikipedia of things’, I later named the prototype ThingWiki.

The prototype included as part of the OpenDoTT project deliverables was a website with information about a sample of different objects. The website was based on Wiki.js. This wiki engine was chosen based on its ease of use, clean user interface, and ability to configure text-based folders as a means of storage. That allows for easy replication and exchange of data.

ThingWiki was planned to be easy to navigate and access by users, enabling raw data and its structure to be exchanged and reused by other information systems. I designed a data template for the entries that allowed descriptions of things in objective (physical characteristics and manufacturing) and subjective terms (stories), as shown in Figure 21.

```
# 0001: Title

## Basic data

### Name

### Description

### Manufacturer

### Manufacturer website

### Color

### Identifiers

### More information

### Images

## Stories

### Author
```

Figure 21: ThingWiki structure

As the contents were stored and backed up as plaintext markdown files via a git repository, any online system can access and use the data. Even though the website was discontinued at a later stage, its sample data can still be accessed on the git repository[8].

5.4.6.2. E-I

E-I, short for Evaluation Interface, was a prototype created to experiment with ways of accessing data from sources aligned with the Universal Registry of Things. It was, in that sense, complementary to ThingWiki. E-I recombined two design concepts: the Universal Registry of Things, and Point and Reuse. It also connected indirectly to concepts such as the Transformation Labs, and the Reuse Dataset.

8. https://github.com/reuse-city/thingwiki

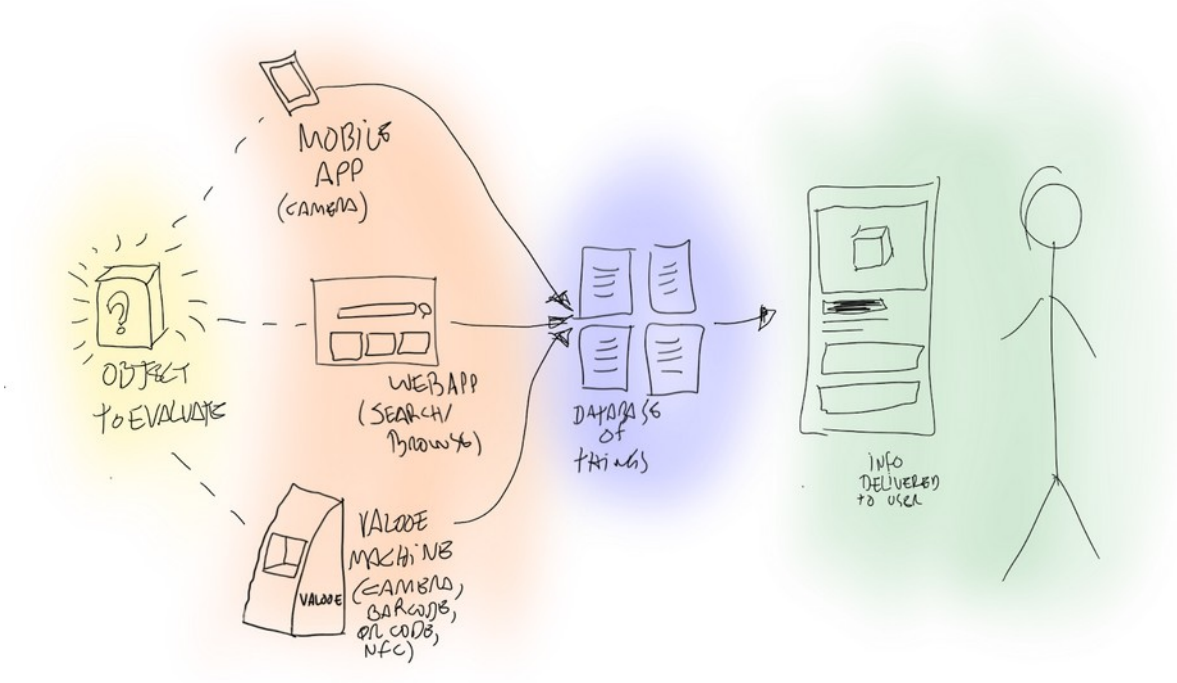

Figure 22: Sketching, still using the name Valooe

The format of E-I would vary according to the intention. It could be a kiosk installed in public areas, a portable device, or a desktop machine. For the prototype, I decided on the desktop form factor, considering it a workbench piece of equipment to assist in repairing and reusing. After giving up on the tentative name ‘Valooe’ and playing briefly with the word ‘e-valudata’ to name the machine, a new name was decided: Evaluation Interface, or E-I.

The workflow of the machine would be as shown in Figure 23.

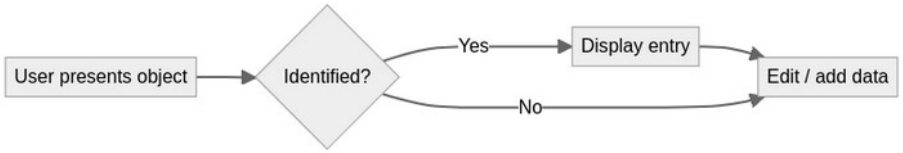

Figure 23: E-I Flowchart

Conceptually, E-I could use a combination of characteristics to identify objects. For instance: size, shape, colour, weight, barcode, QR code, description label and/or other

identifiers. For prototyping purposes, I assembled a machine that had an NFC sensor. It only worked with pre-selected objects that I had prepared with NFC tags. When one such object was put before the machine, it would show the respective page on ThingWiki with data about the object.

The prototype was assembled with a camera and a screen displaying a live image of the presented object and put on top of a cutting mat. A magnifying glass with LED light was also included, reinforcing the identity of E-I as a data-driven repair assistant. Still, voice recognition capabilities could be added so that the user could interact with it through voice commands. Figure 24 shows E-I's structure.

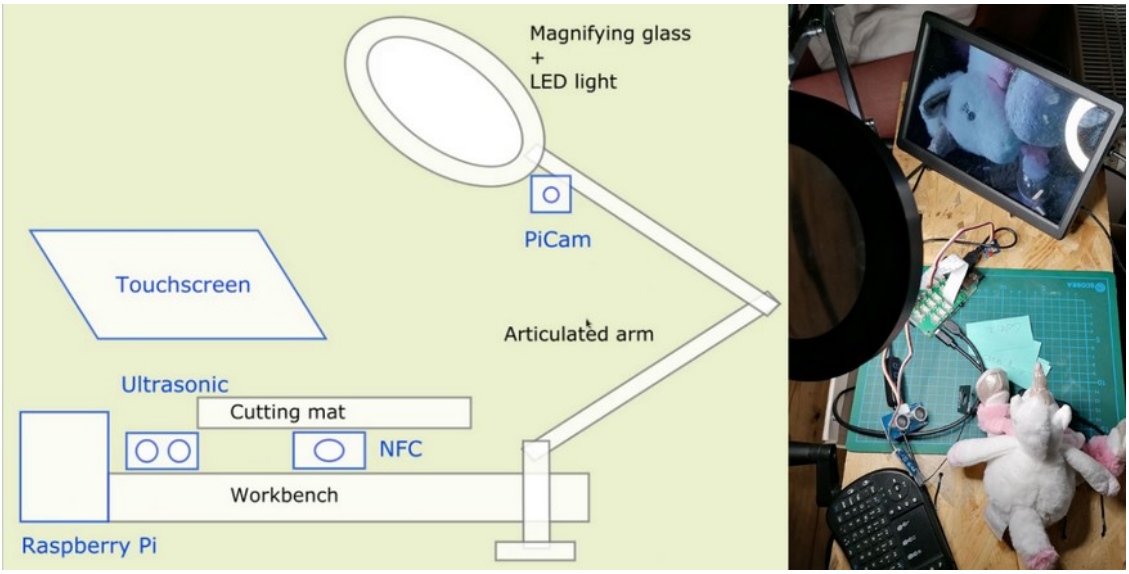

Figure 24: E-I

5.4.6.3. Transformation Labs

The prototype of a blueprint to create Transformation Labs emerged as a response to the discussions during reuse.city about the local access to tools and equipment in cities. The design concept of Transformation Labs proposed a type of place where the residents (and visitors) of a city or region can use tools and equipment to transform goods and materials. It can be seen as a hybrid of makerspace, tool library, technical school, reuse centre, and community hub.

In conversations with participants, Transformation Labs came to be understood as public urban facilities that enable the local population to repair, upcycle and repurpose goods and materials. They would be hotspots for hands-on and technical education and creative experimentation. Transformation Labs could partner up with – or be located inside – scrap shops, second-hand warehouses and reuse centres.

A blueprint for creating Transformation Labs would include specifications of technology, space requirements and management principles. Such specifications ought to be open and freely accessible to municipalities, businesses, and nonprofits to use – and improve upon – them.

The prototype took the form of a list of space requirements, equipment and tools, pointers about decisions on governance and suggestions for activities. It also has references to relevant initiatives. The prototype was rather lightweight, since at that point I expected to work further on Transformation Labs in the following research cycle. The blueprint was published on GitHub (Schmidt Fonseca, 2021).

5.5. A Proto-community

Whilst the reuse.city lab focused on providing additional depth and new insights that would feed the prototyping of design concepts, the conversations with participants raised essential points for my investigation in conceptual terms as well. As indicated by the participants, no single intervention will ensure success in diverting potentially valuable materials from the waste stream. In other words, effective transformation can only be achieved by thinking of ecosystems of reuse in cities. That crucial insight would inspire the following research cycle, to be presented in Chapter 6. For now, however, I want to focus on a particular aspect emerging from interactions with participants: the need to weave communities and improve cooperation between sectors and localities.

My perspective is significantly influenced by the work of John Thackara, who sees great potential in building alliances between initiatives on all continents that are, in his words, building tomorrow's world today (Thackara, 2017). A good part of the projects I was involved in for decades followed that intention of connecting sectors, respecting their idiosyncrasies. In other words, I have always been engaged in building ongoing and open-ended conversations between people in different localities and coming from different backgrounds. It was only during my doctoral studies that I realised the importance of that adjective, though: 'different'.

Diversity has long been recognised as essential in creative and innovative processes, including design and technology development (Page, 2008). With an array of different perspectives, ideas, and approaches, a diverse team can significantly enhance problem-solving capabilities and innovation (Phillips, 2014). On the other hand, a superficial understanding of diversity may result in significant pitfalls, including 'tokenism' and stereotyping, to the extent that organisations might occasionally seek only to appear diverse without truly incorporating diverse perspectives in their decision-making processes (Kulik, 2014).

The term ‘difference’ is then crucial to understand community-making. It can be seen as the range of attributes an individual possesses that makes them unique or distinct from others in a group, which can contribute to identity and diversity (Page, 2008). If there is no community without commonalities, it is also true that without difference there is no real need for a community. After all, if everyone thinks and knows the same (an impossibility in itself in a Freirean perspective, but let’s entertain the idea), there is no room for exchanging information, perspectives or opinions.

Difference can, on the other hand, lead to conflict and stall cooperation when not properly channelled. Once again, the notion of conviviality comes at hand. As discussed in more detail in Chapter 2, Ivan Illich pointed to the need to restructure society in terms of conviviality to counter the negative consequences of submitting mankind to a solely productivist, industry-oriented mode of organisation (Illich, 1990). That view is not exclusive to manufacturing, political representation and the global economy. My first contact with the concept of conviviality, in fact, happened in 2016, when I was a designer in residence in the *(S)lowtech* programme in Nantes, hosted by the PiNG Association. The organisation was responsible for two contrasting, while complimentary, projects: a community repair workshop in the Breil neighbourhood (PING, 2019), and a FabLab called Plateforme C, in a renovated central area at the Île de Nantes. Thomas Bernardi, one of the coordinators of PiNG, suggested me to read two books. The first was Illich’s *Tools for Conviviality*, which he claimed to be the basis for their community repair workshop.

The other book recommended by Thomas was Richard Sennet’s *The Craftsman*, also referenced in Chapter 2 (Sennett, 2008). I reconnected with it at the start of my doctoral investigation. Only later, however, came to my attention that the French version of the book had a different title: *Ce que sait la main: la culture de l’artisanat* (‘That which the hand knows: the culture of craft’). This sense of the embodied, sometimes implicit and hard to express, combination of knowledge, skill and sensibility was in part what I was trying to articulate with the reuse.city lab.

Those reflections emerged as I experimented with ways to organise and communicate with the participants of reuse.city. As indicated earlier, I wanted to run the study as an exercise of spiralled openness. My intentional take on making decisions collaboratively and not following predefined methods was central. It allowed the group to form in a way that didn’t follow a clear agenda. For that reason, the conversations were organic, occasionally incurring in repetition, or drifting to topics not previously expected. Regardless of the specific outcomes in terms of research outputs, there was a sense of relationship growing between peers from different parts of the world, and with relatively

diverse perspectives on the research topics and other themes.

I use the term proto-community to describe this emerging configuration. By that, I mean that reuse.city has the potential of becoming a community in its own right. As if it was in a latent state, with the possibility of gaining even more depth and eventually scaling up. In other words, the same group of participants who allowed me to understand better and elaborate my research topic to create speculative prototypes in response can, on a meta-level, be seen itself as another prototype. A prototypical community interested in the convivial reuse of materials in cities. One that composed of people from different localities and sectors, as the participants proposed themselves. It is useful to refer back to the understanding of *autopoiesis* in the work of Arturo Escobar (Escobar, 2018): communities continuously designing themselves into existence.

My place in the proto-community resulting from reuse.city was a matter of constant personal reflection during the lab. As mentioned earlier, I did acknowledge my transient role of steering the activities, but always tried to question and mitigate its potential implications regarding the position of author and leader. Again, I borrow from non-*WEIRD* references to insist on two images mentioned in Chapter 3, the *griot* and the *tuxáua*.

The *tuxáua* is a role of leadership based on generosity in Amerindian communities (Instituto Socioambiental, n.d.). It is a position of temporary leadership, organically assigned to the individual that can demonstrate a caring and generous way of managing the needs of their people. My aspiration during reuse.city was just that – to use the relative privilege of assembling a group of people and exerting an initial authority to turn it into a proto-community. I tried to do that by serving my individual need to fulfil research plans in an academic institution, while making the lab useful and relevant for the participants. Ideally, other community members could take on a leadership position at a later stage.

I also saw my habit of documenting in open ways (which I already did for years) as reminiscent of the social position of the *griots*. As much as helping create and establish a community's collective memory, the spiralled retelling of stories can also make explicit the community’s evolution over time.

5.6. From Lab To The City

As mentioned throughout this thesis, the starting point of my research was to explore smart cities from a bottom-up perspective. I began aligning with the critique of the disconnection of smart city rhetoric and contemporary discussion about cities, technologies, and society. I then decided to reflect on waste management, and eventually

focused on waste prevention through convivial and community-based practices of reuse in the form of repair, upcycling and re-circulation.

My first research cycle allowed me to focus on individual and sectorial perspectives. The second research cycle, described in this chapter, was a deep dive into the lived experience of people involved with the sector. As I moved to the third cycle, it was time to return to the city scale.

Some conversations during the reuse.city lab were particularly relevant in that context. A central point was the importance of physical infrastructure providing access to tools and equipment. That was incorporated in the blueprint for Transformation Labs. The blueprint had real-world references of projects and insight. Even their composition in terms of equipment was improved with suggestions gathered from participants. Projects such as the reuse centres in Finland and how they accept virtually every type of material were also acknowledged.

A central part of the discussion about physical spaces for reuse is that storage is crucial. It is not rare that one unused object of today will be needed tomorrow. Or conversely, a broken product requires time to be worked on, by receiving spare parts or new parts being tailored to it. Storage for works-in-progress and things that can become useful in the future could be understood as a reserve of potential uses – a resource in itself.

As pointed out by the participants, reuse logistics depends on more than just space to keeping materials waiting to be reused. Transporting them is another challenge. Also indicated by participants, repair shops are disappearing, with few exceptions. As a result, taking things to be repaired is increasingly more cumbersome, as one needs to travel longer distances to achieve it. While that is already problematic with small items, it becomes impractical for larger objects.

Another theme of reflection from the meetings with participants is the governance of solutions inspired by the Universal Registry of Things. Instead of creating (yet another) centralised database, the conversations suggested adopting a distributed approach. Wikipedia was mentioned as a reference of a data platform maintained, edited and curated by diverse collaborators. While that is an important benchmark – which would afterwards inspire the naming of the prototype as ThingWiki – some remarks must be made.

Wikipedia is inspired by – indeed, its name uses as an explicit reference – the encyclopaedic ideals. Such an analogy implies a defined body of knowledge about the world, things, beings, and ideas. However, that knowledge is typically selected and encoded into the encyclopaedia by human individuals, who must adhere to a particular

method to do so. On Wikipedia, the solution to conflicting opinions is always performed at the human level: individuals exposing conflictive views and using reason and objective references to ground their claims. Content is usually added by individuals who are ultimately held accountable for whatever they post. That is clearly a feature defined by design, completely aligned with Wikipedia's understanding of knowledge.

In the case of a Universal Registry of Things, however, the goal would be something other than only generating and maintaining an overarching body of knowledge about everything. Instead, the main concern would be accessing and validating fragmented and constantly changing information. Its structure should then welcome alternative methods of validation and maintenance of data, be it through automation (AI, crawlers, bots) or via institutional bodies. As hinted at earlier in this thesis, legislation on the *right to repair* has recently been gaining ground. That could be an excellent opportunity to attribute to new or existing regulatory bodies the responsibility for making corporations and other organisations adhere to a hypothetical distributed protocol for data on how to reuse things. Policy inspired by such legislation can enable the creation of regulatory mechanisms and conflict-resolution methods.

In addition to such data infrastructure and applications, it's interesting to return to the image of the *agent valoriste*. The capacity to sustain the work of professionals exclusively dedicated to that kind of activity is highly contingent on local conditions. Not every location has enough demand, or an appropriate economic configuration to enable it. On the other hand, assessing the potential value of reusing excess materials is arguably an ordinary practice in diverse contexts, albeit often fragmented or inconsistent. Some of the people interviewed for my Ecosystem Mapping described in Chapter 4 are doing just that. They may resort to prior experience, to online resources, perhaps to intuition and hunches. But indeed, the role of the *valoriste* can potentially be performed in a networked way. In other words, it is perfectly possible that the *agent valoriste* doesn't need to be an individual, but a collective that assesses materials in coordinated forms.

The questions that emerge are then how to organise social systems to promote convivial forms of evaluating and acting on available excess materials. Additionally, what could be the incentives in terms of regulations and legislation, and how to influence culture and the public opinion to promote reuse prior to waste management. Chapter 6 will explore the space of participatory policy-making, and how can that contribute to the purposes of my research.

6. Generosity And The Commons

As described in the previous chapters, my doctoral investigation was part of an international cooperation programme called OpenDoTT. The programme was designed around a progressive and predetermined structure. In general terms, it would have three phases common to all the five research fellows recruited through an open call. The first stage would be an immersion through design research into each fellow's topic – in my case, smart cities. The second stage would be one of designing and prototyping, advised by a consortium of expert organisations, and with special attention to openness, privacy, and ethics. Finally, the researchers were expected to engage with policy-making from the perspective of each of the research topics.

As described in Chapter 3, I responded to such predefined structure through a spiralled research approach. In the first year, I defined waste prevention through conviviality as my central subject of investigation, and identified typical actors of material reuse in urban contexts. For that first cycle of the spiral, described in Chapter 4, I conducted two research studies and created eight original design concepts based on them. During the second cycle, I led an online co-design lab with active participants from diverse countries and worked on prototypes based on my concept ideas. Two of the prototypes focused on recognising and augmenting the skills and knowledge involved in the reuse of goods and materials.

A third prototype that emerged during that phase was a version of the design concept I called Transformation Labs. It was a response to a perceived absence of available infrastructure for city-dwellers to access tools, equipment, and knowledge to reuse materials through repairs, upcycling, adaptations, and exchange of information. I saw potential to deploy Transformation Labs as public infrastructure in cities, and to design policy around their social, environmental and economic benefits.

At that point, my expectation for the following stage of research – focused on policy, in line with the OpenDoTT plans – was to work further on the Transformation Labs concept and how they could become local hubs to leveraging waste prevention through practices of reuse. However, my approach to this last research cycle would lead me through a significantly different route. It was based on my direct observation of reuse initiatives in Berlin and various parts of the world, while considering their contexts in terms of policy and legislation. I also participated in a series of events on related topics both online and in person, and established ongoing interaction with peers working in the field. Additionally, my growing interest in discussions about coloniality and the politics incorporated in industrial and managerial practices was ultimately present in this final stretch.

To this last point, and looking back on my previous experience in international cooperation, I can now identify in retrospect aspects of colonial imposition both in cultural and economic terms. I remember, for instance, having often to adapt the shape of my previous projects to match the expectations of international funders from Europe or other wealthy contexts. As a result, such projects had to adapt to foreign assumptions, at times drifting away from core work needed in our context in Brazil. On occasions, we had to dedicate considerable energy to produce outputs that were not at all relevant. Such a situation likely stems from assuming that best practices from one locality will probably work when replicated elsewhere. And that is not always the case.

Of course, through the years of my PhD I was first based in the UK, and later in Germany. My everyday observation of practices of material reuse was that of a doctoral researcher living in urban contexts of wealthy countries. I kept, however, my attention on similar practices in international contexts, through literature and networked exchange. Even if based in a series of very particular and relatively privileged conditions, my research intends to be useful for waste prevention, conviviality, and material urban generosity beyond the context of central cities in Europe. It is precisely for those ambitions that I understood that it doesn't make sense to focus on the Transformation Lab concept as a prescriptive blueprint – a list of equipment, spaces and methodologies to be copied and pasted elsewhere. Instead, I prefer to help leverage existing initiatives in all parts of the world focused on balancing scarcity and excess. Instead of creating, growing or building a new type of urban facility, my take was to concentrate on weaving possibilities between active contexts and new framings.

During my research, I had, for instance, the chance to learn from initiatives such as #ASKNET (#ASKnet, n.d.), which helps organise repair cafés, set up physical workshops and promote knowledge exchange in different localities of Africa. I also had another layer of understanding when participating in *CEHotspot*, a conference on circular economy in Barcelona. The organisers took participants to visit a series of circular economy initiatives, including reuse centres, social stores, community-based repair workshops and a FabLab integrated with a natural park. I made similar visits and observations to reuse initiatives in Berlin. I have attended other events on 'zero waste', circular economy, and innovative approaches to policy and public administration. Furthermore, I also presented my work in seminars associated with contexts such as the COP-26, the international conference on environmental policy held in Glasgow, in 2021. Meanwhile, conversations with OpenDoTT colleagues and supervisors were also part of fine-tuning my work. This chapter discusses how these multiple contexts and activities converged in my research.

6.1. Designing For Conviviality

As mentioned, during the second research cycle, I had worked further on the Transformation Labs design concept. I imagined it would play a role in the third and final turn of the spiral, as I shifted my focus back to the city scale. Transformation Labs would have similarities with spaces such as makerspaces and FabLabs (Fab Foundation, n.d.). It is essential to reference scholarship exploring connections between grassroots innovation, makerspaces and social issues (Maxigas et al., n.d.; Smith, 2015; Smith et al., 2013; Troxler, 2014; Troxler and Maxigas, 2014). In connection with that perspective, I started seeing any contemporary city as a large-scale situated makerspace. Under that framing, materials are already circulating and being transformed by various actors: commercial repair services, community networks, charity shops, material exchange projects, civil society collectives, second-hand shops and many others. Equipment and knowledge are already in place, and in use. To promote systemic change, we should look into ways of enabling them to be connected, so as to produce social and environmental transformation on a local scale.

Those were the foundational elements for my PhD investigation's third and final research cycle, described in this chapter. At this stage, I would not conduct a new participatory study. Instead, I reflected on policy-making by interpolating the context of my research topic, revisiting my past experience with the public sector and advocacy, and analysing how the findings of my first two research cycles could inspire novel ways of approaching waste prevention in contemporary cities. My indirect observation and occasional engagement with organisations and projects in Berlin would also be part of the composition.

Having been through the first two cycles of research detailed in Chapters 4 and 5, it was now time to create concrete ways to promote transformation at the urban scale. Such transformation would be based on systems to recognise, make visible, celebrate, reward and fund practices that contribute to resource conservation through reuse. In the process, I returned to another of my design concepts, the Reuse Commons.

Similar to the Transformation Labs, the Reuse Commons proposes a way to approach the reuse of materials in cities. However, instead of a prescriptive blueprint for infrastructure like the former, in the third cycle the Reuse Commons would be designed as a toolkit to promote conversations in local contexts, with a focus on conviviality and community weaving. The toolkit embeds and mirrors my research findings and proposes a straightforward approach to identify elements for building cooperation and local policy.

The timeframe of the PhD investigation did not allow me to test the toolkit with participants. It is nevertheless an early version of a service design method inspired by and

resulting from my research. At this stage, it is not exactly a prototype, but rather a design-oriented annotation device for my research findings.

6.2. Generous Cities

My research focuses on ways to cope with material excess in cities and regions. I recognise the importance and validity of those striving to promote ambitious system change in which excess will be mitigated through better designs, rationalising industrial production or distribution mechanisms more appropriate and fair than the commercial market. This is how the future should look. My eyes, however, are set on the present, and on the vast quantity of objects being manufactured every day.

Raw materials – both renewable and non-renewable – are extracted and transformed through complex large-scale global systems. That process leaves traces on the planet. Even when things are done right – decent labour conditions, industrial practices as sustainable as possible, fair pricing and mitigation of environmental impact -, there are effects on nature, on human populations, and on populations of other living species. It is only logical that, if that colossal machine cannot be stopped abruptly, the least a global society should do is ensure that those materials that have been extracted stay in use for as long as possible.

It is essential also to accept the inevitability of excess. By that, as described in Chapter 2, I mean material excess: things – transformed matter – out of use for various reasons. Any and arguably every contemporary city and town possesses goods that are not being used. Moreover, a culture of easy consumption promotes intentional ‘blindness’ to negative externalities. Global capitalism reproduces unsustainable behaviour through public relations, cultural imposition, and irresponsible practices. Those in power say they only deliver what people want. I call that ‘industrial populism’.

The opposition between scarcity and abundance is present in some visions for better futures. For example, William McDonough and Peter Braungart propose designing for abundance (McDonough and Braungart, 2013). Luiza Prado explored the tension between excess and the production of scarcity as population control under neo-liberal capitalism (Martins, 2020). Ken Webster and Kate Raworth question economic theories centred on managing scarcity, sometimes artificially created (Raworth, 2017; Webster, 2017). I have in the past espoused that dichotomy while exploring the Brazilian culture of *gambiarra*, the presence of improvised solutions to everyday material problems described in Chapter 2. I would position *gambiarra* as a way to change lenses and see the world as abundant in possibilities, owing to tactical and disobedient creativity (Schmidt Fonseca, 2015).

It was only some years into my doctoral research that I started questioning whether abundance was the best framing to counter the unbalanced distribution of usable materials in cities. I had the elements at hand, but still needed to reassemble them in true *gambiarra* style. As referred to in Chapter 4, I moved countries twice with my family during my PhD. The choice of focusing my research on the reuse of things made me always attentive to the material practices and cultures in each different locality.

My research process was in part one of auto-ethnography, as discussed in Chapters 3 and 5. I constantly observed my perception in relation to different contexts, while reflecting on local infrastructure, cultures, assumptions, and incentive systems for the reuse of excess materials. It was also an exercise of reviewing my past experience with reuse initiatives, including my non-academic experience. My arrival in Berlin brought new elements to that. It added another layer of estrangement, as I had to cope with living in yet another country, culture, and language amid the restrictions imposed by the COVID-19 pandemic. Influenced by the path my research had taken until then, my attention was in excess and generosity, and how those elements were expressed in the city.

In his seminal work Arcades Project, Walter Benjamin explored ways of engaging with contemporary urban culture (Benjamin, 2002). He was interested in people's everyday lives and experiences. Benjamin wrote about the ragpicker – the urban character collecting excess materials – as someone who embodied the writing of history by organising 'superfluous waste material produced by a society obsessed with the cult of the new' (Le Roy, 2017, p. 130). My engaging with examples of excess and generosity in the city was, in that sense, an exercise in experiencing and organising excess, much like Benjamin's ragpicker.

My exploration of the streets of Berlin was an attempt to make sense of urban phenomena that are not exclusive to that particular context, and yet reverberate life in other cities under contemporary capitalist societies. In many neighbourhoods of the German capital, it is common to find boxes with goods for donation outside residential buildings. I had experienced that in the past in Barcelona, where residents put their donations out on a different weekday in each neighbourhood, usually the evening before the collection of large items happens. The difference in Berlin was seeing that happening on any day, at least in some neighbourhoods.

That setting of a perceived abundance was influential on my research and design processes. I experienced a permanent flow of goods available to be taken and reused. Many objects found in the streets were incorporated into my home, either used for their original purpose (a drawer cabinet, plants, shelves) or transformed (a small room divider repurposed as a tabletop and, curiously, a large tabletop used as a divider). In addition to

the availability of things for the taking on the streets, my exploration of reuse cultures in Berlin was also observing and experiencing flea markets and second-hand shops in neighbourhoods, as well as online communities for exchanging or selling used goods. With eyes on that, for some time I described my research as one of creating abundant systems to reuse and redistribute unused goods and materials.

During a seminar in the context of COP-26 (Dillon, 2022) organised by artist and professor Teresa Dillon, however, I was prompted to question the appropriateness of abundance as the best way to frame my investigation. During the Q&A after my presentation, co-panellist Julia Corwin from LSE pointed to a crucial distinction between two terms I used almost interchangeably in my session: abundance and generosity. The conversation then moved towards a perspective where abundance is seen as passively receiving, whilst generosity would be based on intentionality and arguably some effort. Recognising the validity of such distinction to my investigation of conviviality, I incorporated that change instantly.

6.2.1. Unicorn In The Generous City

In the first year of the PhD, I documented a material finding in Dundee. Cycling through the city, quite empty due to the COVID-19 lockdown, I found a small plush Unicorn doll on the street, pictured in Figure 25. I observed it for some time to see whether a child or family would show up to collect it. It was, however, being pushed by the Scottish wind and if left alone would certainly fall amid the seals of the Tay River.

Figure 25: A dancing unicorn - sign of generous cities?

I eventually picked it up and looked for any signs of identification. To my surprise, the Unicorn had a tag with a telephone number (in France) to report, a sort of lost and found service. I took it home and tried to call. The manufacturer had no information about the owner, unfortunately. Still, looking retrospectively, that Unicorn was likely one of the influences for creating my design concept of a Universal Registry of Things. Sitting by the Tay with a plush Unicorn, I wrote ‘Generous city’ on my journal, for the first time:

> Generous city. A dancing unicorn on the sidewalk. Bike. Barcelona. Train station. Where will it end up?

By that time, I wrote a blog post documenting the find (Schmidt Fonseca, 2020). By then, I thought of generosity on a city scale. As if an impersonal city was being generous to me. Nowadays, I would possibly rephrase it as ‘abundant city’. After all, I was offered an object without effort, merit, or need. At the same time, it was likely that the previous owner of that

object would miss it. This unacknowledged externality was invisible to me at that point. As seems to be the reality of industrial populism, through which consumers are offered goods so affordable that it is easier to replace than to reuse them. I explored that topic in the discussion of value with participants during my first research cycle.

Throughout the previous chapters, there are some mentions of generosity. I observe local reuse initiatives that link socially aware generosity and gratitude. Generosity is also constitutive of the worldview present in open licensing schemes such as the Creative Commons ('CC'). Back when I worked with the Brazilian Ministry of Culture organising activities in grassroots cultural centres, we would call our CC classes 'intellectual generosity'. I also use the image of the *tuxáua* in Amerindian communities to describe a position of rotating leadership based on generosity and care for the community.

The COP-26 seminar where I was confronted with the distinction between generosity and abundance was called *Tales of Care and Repair*. The notion of care is naturally associated with generosity. Earlier in this thesis, I mentioned how authors relate care to material repairs (Jackson, 2014; Nemer, 2022). Crucially, care is also depicted by Joan Tronto as a central element of democracy (Tronto, 1993). As I returned in my final research cycle to the city scale and the idea of participatory policy-making, the idea of generous cities became central. Not, as noted above, in the sense of the city itself being generous with its residents and organisations. Instead, the concept of generous cities is my contribution to reimagining how cities handle excess materials by weaving local systems to foster concrete and intentional generosity between people. And the Reuse Commons is my proposal for bringing generous cities into being, as will be described in this chapter.

6.3. Waste And Recycling In The Public View

As detailed in previous chapters, over the last decades there have been significant improvements in waste management in contemporary cities – notably technology, methods, and policies to improve the collection and recycling of materials. However, as described elsewhere in this thesis, the industrial practice of recycling – transforming objects back into material for manufacturing – equates at least partly to shortening the lifetime of things that may still have value (Syberg, 2022). In addition, it requires significant investment and has environmental impacts that should be factored in (Esmaeilian et al., 2018). Therefore, keeping materials away from the waste stream as much as possible is of utmost importance. Done correctly, it can also create local opportunities for social inclusion and economic development (Coffey and Coad, 2010).

My research focuses not on waste management but instead on waste prevention through

convivial practices of material reuse in cities and regions. Rather than increasing the speed of collecting discarded material to be sent out to recycling, incineration or landfill disposal, I want to leverage initiatives addressing the potential value of said material to generate social and environmental benefits for local populations. To promote system change, my investigation contributes to a shift in narrative, refocusing the use of technologies and methods to address the excess of discarded materials in a time of global climate emergency and fragmented social bonds.

To ensure that waste prevention strategies are effectively implemented within cities and regions, they must be incorporated into public policies. I describe in this chapter some lessons from my past experience in collaborative policy-making. That context informs the way I conducted my research on waste prevention. I am particularly interested in adopting a commons-based perspective (Ostrom, 1990) to identify, shape and facilitate the governance of material resources in cities and regions.

In addition to centralised practices of waste management usually structured around the collection of solid waste to be recycled, incinerated or sent to landfills, there is room for innovative approaches that focus on waste prevention through reuse. In particular, by inviting local agents to create systems for the commons-based governance of materials, tools, equipment, space and other shared resources. I also propose, as mentioned above, the image of generous cities – simultaneously, a conceptual setting and an alternative narrative. I do not intend to replace the idea of smart cities as a whole, but rather to promote a dialogue in which environmental and social issues take centre stage. Instead of getting rid of excess materials through engineering and logistics, generous cities would be those promoting practices of care that intentionally transform excess into generosity.

Reshaping the narrative towards critical yet constructive generosity-based waste prevention systems is a crucial first step for my research to reach the public sector, nonprofits, and wider society. The global climate emergency requires from all fields of knowledge a deeper reflection on the materiality of contemporary society and its future conditions of objective sustenance. By setting my research on designing commons-based systems for material reuse, I expect to help set the foundation over which new approaches can be created with increased awareness of our delicate situation – not around largely abstract and arguably obsolete goals of waste collection envisioned decades ago.

The next sections explore possibilities of participatory policy-making to promote system change towards a mindset of waste prevention. I describe a design concept developed with that goal in mind: Reuse Commons, a toolkit to help create commons-based local systems for the reuse of excess materials.

6.4. Designing Services For Waste Prevention

When it comes to the topic of waste, there is often a unidimensional understanding that the only goal to be pursued by using technologies in cities would be to increase the volume of recyclables collection.

At that confluence, my research experiments with an alternative narrative around what to do with excess materials. It starts from acknowledging that contemporary cities frequently produce or import a volume of goods and materials that exceeds the local society's ability to use them. The reasons may vary from city to city, from country to country, and from one season to the next. Excess can result from overconsumption, changing economic conditions, product obsolescence, and the availability or absence of maintenance services, among other factors. In any case, I propose that developing solutions for excess materials should always involve local stakeholders actively.

Under a global climate emergency, it is paramount to strive for the conservation of natural resources. In other words: to understand that raw materials were already extracted from nature and generated an environmental footprint as they were transformed into goods and objects. In that situation, it is logical that those goods should stay in use for as long as possible – both delaying the need to extract more raw materials and conserving the value added to them by manufacturing and logistics. It is then vital to challenge the cities' aforementioned mandate to recycle as much as possible of discarded materials. Premature recycling of objects equates to cutting short the value those objects could still possess. Furthermore, recycling is an industrial practice with its own economic and environmental impacts – deriving from logistics, use of energy and the inevitable devaluing of materials that results from transforming a manufactured good back into raw materials, as comprehensively explained by McDonough and Braungart (McDonough and Braungart, 2013, 2002).

The practices of reuse I investigate are frequently identified within the field of waste management. As discussed earlier, however, such framing is not entirely appropriate and often leads to distortion. Instead of merely trying to make waste management more efficient with new technologies and methods, I adopt a perspective of socially inclusive waste prevention. I am not naive to suppose we can completely eliminate the production of waste in the foreseeable future. Nonetheless, framing the discussion into making the most out of materials already extracted from nature and transformed into objects helps us see the situation differently. It creates new possibilities with positive impacts both in environmental and socio-economic terms. That should be the backdrop to any attempt at developing solutions, in line with the hierarchy of waste handling referenced in Chapter 2: reduce, then reuse, and only then recycle. I will return to that point in Section 6.4.3.

My work is related to systemic proposals willing to impact policy-making, such as the circular economy (Ellen MacArthur Foundation, 2019, 2015; Webster, 2017) and doughnut economy (Raworth, 2017), albeit from a critical perspective. By extension, it also relates to emerging fields such as 'zero waste', situated climate action and movements exploring concepts of resource sufficiency and degrowth. Additionally, interactions with policy are expressed in the growth of terms such as the Green New Deal or similar formulations, as well as ‘Net Zero’ commitments on an international level.

Even if well-intentioned and driven by scientific evidence, however, most of these approaches risk replicating a top-down nature in wealthier nations and a colonial position over developing countries (Schröder et al., 2019). My intention to always bring local stakeholders to the discussion and decision-making is a response to that perception. Based on my experience before and alongside the PhD, I wanted to include those with embodied experience in the reuse of materials. The horizon was to replace unidimensional solutions based on the perspectives of corporations and government with alternatives centred on people – city-dwellers, consumers and those engaged with reuse initiatives.

6.4.1. Smart Cities And Participation

As noted earlier in this thesis, critical literature about smart cities (Cardullo and Kitchin, 2018; Engelbert, 2019; Greenfield, 2013; Morozov and Bria, 2018) problematises such projects vis-à-vis references to a right to the city (Harvey, 2003; Lefebvre, 2017; Sassen, 2010). Sidewalk Labs' attempt (Ahmed et al., 2019) to force into Toronto the company's understanding of what a smart city should be is a significant – and by far not the only – example of authoritarian behaviour.

Smart city initiatives usually offer little to no agency for most local stakeholders. They adopt a top-down approach in which the interests of corporate actors and local authorities align—typically, expanding profits of the former and societal control by the latter. The collusion of political and economic powers and the resulting unequal dynamics are relatively easy to grasp in topics such as street surveillance with cameras. But it is often unaddressed regarding other target areas of smart city development.

Public services are redesigned under a questionable measure of efficiency (Greenfield, 2013) based on costs and frictionlessness. The meaning of such efficiency is seldom discussed with local populations, and even less so is whether city dwellers even desire to have services redesigned along these lines. Societal trust in solutions – particularly technological ones – is taken for granted.

When expanded internationally, the smart city rhetoric acquires even more unbalanced

characteristics (Datta, 2015; Datta and Odendaal, 2019). Not only do leaders allow little room for criticism, but their discourse is also charged with coloniality. Typically, the discussion about smart cities in developing countries implies that the solution for problems any municipality faces already exists. It has been created and tested in rich nations and should be imported wholesale, sometimes attached to earmarked development funds. Arguably, even in societies with relatively advanced democratic institutions, participation is lacking in smart city initiatives (Willis, 2019).

Initiatives worldwide are proposing increased democratic participation in policy-making, sometimes with the help of digital technologies – on topics such as online deliberation and voting, collective decision-making, open data and others. Participation is, however, a term with widely variable meanings. Some bodies see participation only as a matter of transparency, while others seek increased accountability. On the other hand, there are more profound democratic practices to reflect on and incorporate into the discussion, particularly when the intention is to increase multi-stakeholder trust in new developments.

Participatory democracy is not a novelty in the long history of political ideas. To mention only one among uncountable experiences, my birthplace Porto Alegre in southern Brazil was home to experiments with participatory budgeting around the early 1990s. Even though the mechanism was later emptied due to changes in the local political context, inviting the population to deliberate on how resources were to be applied was influential for a long time (de SOUSA SANTOS, 1998). A couple of decades later, also in Brazil, the public sector set up official participatory channels for ‘transparency and social control’, as they were called then. Many other cities like Barcelona (de Hoop et al., 2019; Hernández-Morales, 2022) have invested in creating free/open-source software for online deliberation and public decision-making.

Coming from a different perspective, the growing presence of design-inspired practices in policy-making also carries a vocabulary of participatory methods. The emerging field around civic innovation laboratories (Pascale, 2018) helps to articulate collaboration between the public sector, educational institutions, private actors and the organised civil society, often using design research methods. Formal recognition of the value of Design in public administration can be seen in the creation of roles such as the Scottish Government’s Chief Design Officer and the Policy Labs by the European Commission and the UK Government. International events like the Creative Bureaucracy Festival (The Creative Bureaucracy Festival, n.d.) also engender collaboration spaces in that realm.

The world needs new policies to address various pressing issues. However, creating such policies from an objectively isolated standpoint and expecting societies to adopt them uncritically is an illusion. In a time of growing scepticism, sustained and consequential

change will only be possible by building trust with stakeholders in a participatory mode. That should be the groundwork for any attempt to plan relevant uses for digital technologies in future smart cities.

6.4.2. Common And Ordinary Policy-making

When shifting the focus of my research towards policy, I was conscious that only proposing a different narrative is not enough to transform common assumptions about waste management towards a perspective of conviviality. My investigation adopts, as described in Chapter 3, a spiralled approach. Instead of sitting in a studio looking for a bright idea to present to potential users, I set out to engage with people interested and active in the issues I was exploring. I discussed, shaped ideas, presented and tested them, and then discussed again, not in a perfectly circular way, but rather through a sometimes bumpy and irregular spiral that never returned precisely to the point of departure.

Spanish scholar Antonio Lafuente (Lafuente and Alonso, 2011) describes how people affected by rare diseases organise themselves collectively to demand that science be developed. This particular form of open science can be an excellent reference for truly relevant participatory policy-making and echo the calls for intersectional and inter-local cooperation from participants of my research studies. As a city's inhabitants and organisations are directly impacted by decisions made at a municipal level, they can be similarly seen as a 'community of the affected'. Lafuente goes one step further, which is useful for my research also: more than public and open science, he proposes the idea of common science (Lafuente and Estalella, 2015), already referenced in Chapter 3. In the sense of commons as a shared resource, of course. But also common in the meaning of 'taken for granted', ordinary. In this sense, David Nemer's approach to *mundane technologies*, referred to in Chapter 2, is also helpful. Echoing that, my research proposes the concept of common policy-making: as a socially-governed commons, at the same time that it is mundane, belonging to the common people.

I come from a background in grassroots activism on themes such as digital rights and ICT for development. My involvement with policy-making happened about two decades ago, as some collaborative projects I co-founded scaled up and became recognised in Brazil. After some time, it became clear to the people involved that there were more effective ways to promote sustained change in the real world than ad-hoc activism. If initiatives were to achieve systemic change, they had also to acquire institutional legitimacy. We found that this can happen by influencing those political actors involved in making, discussing and approving policy and deciding on budget allocation (Foina et al., 2005).

Policy-making is a process by which governments, organisations, or individuals establish rules, guidelines, and procedures to address and manage public issues or organisational goals (John, 2012). It can then be interpreted as the creation of clear and rational governance over collective – and often diverging – interests. Policy-making is also related to enforcing and monitoring legislation, regulations and their concrete use.

My past experience in Brazil made me conscious of well-written policies and legislation that simply don't work in practice. It is then essential to reflect also on the limits of institutional policies. Sometimes creating policy requires stakeholders to reduce the complexity of issues to seek consensus – as boundary objects allowing different vocabularies to find common ground (Star and Griesemer, 1989). When interests diverge significantly, the result may be that none of the parts involved is satisfied. The most appropriate way to address such a condition would be to engage with the affected parties as much as possible in the process from the beginning. Methods from design research can aid on this matter, as I have been exploring in previous chapters.

In my research, I focus chiefly on waste prevention through community-based reuse practices, usually found in projects of repair, upcycling and re-circulation. A central question follows: how can participatory policy-making be developed to reflect the concerns of different stakeholders involved with such initiatives?

6.4.3. Policy Areas

In recent years, concerns about the effects of climate change have made their way into the public sphere. Certainly far behind the necessary urgency, but still significant. Kim Stanley Robinson wrote an interesting novel called Ministry for the Future (Robinson, 2020). Considered a referential piece on *cli-fi* ('climate fiction'), it tells the story of an international environment agency created after a deadly heatwave hits India. The author weaves the narrative around the possibilities and challenges of building international cooperation to address a situation that risks making life unsustainable for the whole humankind. Robinson, an experienced science fiction writer, inserts in this near-future novel topics of contemporary discussion in technology circles. The book features an open-source social network, owned by its users, and the use of technologies to mediate economic compensation for environmental services. It also raises important insights about the limits of traditional policy based on the same old market-based mechanisms.

Reframing the way society handles excess materials requires policy changes across fields. I stress here a distinction between incremental transition and more radical transformation, as proposed by Stirling (Stirling, 2015). Instead of promoting the democratic confrontation of visions and seeking open accountability, institutions would

focus excessively on nudging ordinary people to change their behaviour incrementally. Doing that would leave little room for a situated critique of neoliberal capitalism and the need to address such issues at an ecosystem level. He calls ‘environmental authoritarianism’ the trend of imposing universal objective goals for sustainability policy (Stirling, 2015, p. 56).

Stirling sees democracy not as a ‘procedural end-state’ but rather as a constant struggle through which the least powerful can challenge power. He counters the notion of transition – the consensual albeit relatively emptied construction of controlled responses – with that of transformation – the result of conflict, struggle and negotiation. He adds that in the climate change context, the idea of control would be a fallacy, created not to ensure future prosperity for humanity and the planet, but rather to give the impression that organisations are achieving progress by some arbitrary measure.

In that sense, the author sees transformation not only resulting from occupying the few democratic spaces made possible by those in power but, crucially, in ‘culturing change and welcoming unruly political contention against power’ (Stirling, 2015, p. 66). Finally, he suggests that transformation can be better achieved under a framing of mutual care instead of control.

Regarding waste policy, it is easy to notice the dynamics of control via arbitrary measures as a sort of institutional virtue signalling. As referred to in Chapter 2, the well-established formula of the ‘Rs’ of waste was gradually assimilated by public opinion and has influenced policy-making worldwide. The simplest version of the formula says that society should ‘Reduce’ consumption, ‘Reuse’ products and materials, and ‘Recycle’ what can be recycled. There are alternative versions of that formula with additional steps. In any case, there is a strong emphasis on the individual responsibility of common people (Cooper, 2017). Additionally, a fundamental fact often ignored is that there is an expected hierarchy of such operations. Recycling should be a last measure, only resorted to when reducing and reusing materials is not feasible anymore. As a growing number of accounts phrase it, recycling is not enough (European Environmental Agency, n.d.). Waste prevention practices are considered more effective and with a lower cost than their alternatives (Cherrier et al., 2018; Esmaeilian et al., 2018; Western Australia Waste Authority, 2019).

Some of the policy areas described in the following subsections may offer solid foundations for the reuse of materials in cities and regions, under a perspective of mutual care. Others are more general in scope but could help compose a scenario enabling political buy-in for waste prevention. All in all, their elements could form the basis for discussing local and regional sovereignty over excess materials and structuring commons-based systems to address the situation. Further, they provide guidelines to be

followed by any deployment of trusted technologies within smart city initiatives seriously committed to addressing the climate emergency and other critical issues of contemporary life.

6.4.3.1. Green Deals

The growing dissemination and acceptance of climate science – chiefly, the IPCC reports (IPCC, n.d.) – into mainstream media and politics creates new opportunities. For instance, discussions about a ‘Green Deal’ (European Commission, 2019) or ‘Green New Deal’ (Búrca, 2019). The world needs to limit the emission of greenhouse gases as much as possible. Such plans promise to invest sizeable resources into heat insulation for households and businesses, expand the capacity to generate renewable energy, and promote the electrification of machinery and transportation, among other axes of work.

It is not by chance that they borrow the image of the ‘New Deal’ in the USA, which brought forth heavy public investment to overcome the great economic depression of the early 1930s. At this point, it seems already clear that the world will not reach a net-zero economy (one in which all the carbon emitted is balanced by carbon-capturing methods or technologies) based on private investment only. Quite the contrary. To mitigate the effects of the climate crisis, the public sector must weigh in.

These discussions are a crucial setting to advance notions such as Mariana Mazzucato’s Entrepreneurial State (Mazzucato, 2018b) and make even more explicit that the responsibility of funding for long-term lies chiefly in the public sector, particularly regarding basic research to drive scientific innovation. However, green deal mechanisms are typically off the mark from the perspective of reuse of materials. They tend to focus on upgrading infrastructure – transportation, home insulation, electrification. And fail to discuss its concrete impacts regarding the higher demand for raw materials – minerals required to manufacture batteries being a significant point of contention –, the need to increase the production of electricity in a short timeframe, and what to do with the discarded materials being replaced. Granted, green deals often tout the demand for industrial players to adopt circular economy principles. But even that is usually depicted as a utopian view of the future – more innovation than maintenance, to paraphrase Vinsel and Russell (Russell and Vinsel, 2016) – and little is said about handling the immense volume of materials being discarded every day.

In response to the urgent challenges of climate change, pollution and the destruction of natural environments, the European Commission created in 2019 the European Green Deal (European Commission, 2019). It is composed of recommendations for a series of policies to be developed or reformed, in different areas. Even though policies adopting the

form of a green deal are more frequently formulated and implemented on a national or regional level, they are also influential on the local scale. As climate emergency concerns make their way into the public debate, local initiatives are urged to respond. Herein lies an opportunity to transform current waste management practices into waste prevention strategies. It may be possible to engage with the formulators of a green deal type of policy, pointing out the negative economic and environmental impacts of premature recycling. Any plans of using technologies and other data-driven solutions must commit to information-healthy and ethical practices, aligning with privacy and security regulations.

The traction provided by the adoption of such policies by major institutional players – governments of globally powerful nations, for instance – can help channel investments for technological development and draw public attention to ideas around the reuse of materials. Even if deserving criticism and increased scrutiny for their frequent top-down nature. To that point, establishing participatory channels in green deal policies can also earn trust from societies that such policies will impact. Participatory policy-making for waste prevention that incorporates multiple local stakeholders in the whole process and adopts mechanisms for generating open data and its collective stewardship through digitally enabled distributed decision-making by default can increase collective trust in green deals.

Specifically to the focus of waste prevention, the European Green Deal makes explicit the directive to prioritise the reduction and reuse of materials over recycling. However, it remains on a higher level and does not offer much detailing on how to get there besides pointing to the EU's Circular Economy Action Plan (European Commission, 2020) that will be mentioned in the following section.

6.4.3.2. Circles And Doughnuts

The concept of a circular economy has been around for decades. Still, its adoption by the Ellen Macarthur Foundation (CE100, 2016; Ellen MacArthur Foundation, 2019, 2015) over the last decade made the term well-known in a relatively coherent form. The Foundation bases its argument on its Butterfly Diagram (Ellen Macarthur Foundation, n.d.), depicting distinct compositions of the 'biologic cycle' and the 'technical cycle'.

Whilst, as mentioned in Chapter 2, relevant criticism of that flavour of a circular economy points to it being chiefly centred on urban contexts and rich nations (Schröder et al., 2019), it still offers the advantage of being relatively easy to grasp by city-dwellers, civil servants and corporations. It can also be seen as a boundary object (Star and Griesemer, 1989), useful as a narrative device if not a concrete plan. Based on the dissemination of a circular economy narrative, committees are created in the public sector, knowledge

exchange between cities is promoted, and actors who were usually invisible to the industrial sector, such as informal waste pickers, start to be taken into account, even if superficially. One of the European Green Deal principles mentioned in the previous section is its Circular Economy Action Plan (European Commission, 2020). Important interaction between urban and environmental issues is also happening around the idea of circular cities (Huang and Villari, 2021) and the circular recommendations embedded in the Fab City commitment (The Fab City, 2022).

As mentioned above, the green deal perspective is often about setting the guidelines to invest – massively in scale whilst incrementally in form – into reducing carbon emissions. Little attention is put into how the agents of such change are structured at an economic level – that is, profit-driven and not truly accounting for externalities. There is important critique to be made regarding their production methods, ownership models and income distribution principles. Kate Raworth adopts a more nuanced view on her proposals to build a doughnut economy (Raworth, 2017). According to that vision, society should aim not only at limiting carbon and other toxic emissions, but also at providing minimal conditions for everyone to have a decent living. In doing that, Raworth targets not only externalities of the global economy in terms of raw materials and emissions but also social concerns in the very structure of global production streams. The is also a practical tool also to make explicit the links of such streams with the particular conditions of each city and respond with adequate policy and measures. Notoriously, Amsterdam is leading the way in that direction (Raworth, 2020).

The vision of industrial production and consumption as an integrated system helps to notice gaps and act to overcome them. A group of Finnish organisations recently hosted a conference called Data4Circularity (Circular Design Innovation, 2021) to discuss how data collection and analysis could help promote circularity. As well as green deals and the doughnut, the circular economy seems palatable and understandable enough for authorities both at local and national levels to engage with. The attempt at promoting waste prevention through a commons-based management of used goods and materials could adhere to circular and doughnut strategies. There is the risk of excessively reducing the complexity of issues and treating incremental circularity as the end goal, thus losing sight of the urgency to act on materials already being discarded. However, as referred to by a participant in Chapter 5, when cities announce their adoption of such strategies they indirectly draw attention to initiatives otherwise isolated, which might help on *culturing* change.

6.4.3.3. Zero Waste

There are diverse ways to define 'zero waste'. The US-based Environmental Protection

Agency has mapped common descriptions (US EPA, 2016), including those from the Zero Waste International Alliance (Zero Waste International Alliance, 2017). Most of them propose a systems-based approach to increase the conservation of materials on ethical grounds. In terms of policy, there are focal points on zero plastic waste, zero waste food, responses to electronic waste and other approaches (GAIA, 2022). Zero waste shops and community events are gaining traction following public discussions on how to address climate change.

The zero waste movement embeds and expands discussions on shifting from a linear toward a circular economy. However, instead of focusing on the incremental increase in the circularity of industrial production and consumption, zero waste champions prefer to focus on the horizon of eliminating all waste and to discuss topics such as degrowth and resource sufficiency. Whilst arguably utopian, the zero waste narrative is significantly more open to embedding grassroots, hyperlocal, experimental and informal initiatives. Promoting more open, spiral-shaped and bottom-up approaches to handling excess materials, the zero waste discourse may be a critical mediating device due to its clear message, without downplaying enormous efforts required for change.

Zero waste can both inform local initiatives, help them earn trust from local communities, and incorporate the concept of waste prevention to address the climate emergency. As mentioned earlier, I have departed from the idea of setting up new infrastructure in the form of Transformation Labs towards a perspective of recognising existing infrastructure and creating collective protocols to put it to use. The Reuse Commons described in Section 6.5.1 is a tool to achieve that goal.

6.4.3.4. Right To Repair

A more concrete approach to material reuse can be found in the movements advocating for a right to repair. Grassroots initiatives such as the Restart Project (The Restart Project, n.d.), niche media companies like IFIXIT (iFixit, n.d.), and high-level policy campaigns have been pushing – and succeeding at that – for legislation to be passed in many regions of the world (“Right to repair | Think Tank | European Parliament,” n.d.). The right to repair engages movements coming from a background in consumer rights, repair cafés, environmental activism and social inclusion. The right to repair movement requires manufacturers to ensure the long-term repairability of products – including access to service manuals, spare parts and tools, while also makes a case for the role of repair economies at a local scale.

The European Commission has introduced a comprehensive ‘Right to Repair’ concept in strategic documents related to the European Green Deal and its Circular Economy Action

Plan (Šajn, 2022). Similar legislation is being passed elsewhere, sometimes sector-specific such as the State of New York's digital fair repair act (Wiens, 2022), product repairability indexes (Ministères Écologie Énergie Territoires, n.d.) or in the form of direct incentives to repair like tax exemption (Piringer and Schanda, 2020) or bonuses (Runder Tisch Reparatur, 2022).

6.5. Weaving Generous Cities

The participants of the research studies conducted in earlier cycles, reported in chapters 4 and 5, pointed that cities often have physical workshops where skilled people transform, repair and adapt goods and objects. To increase the reuse of materials, what needs to be better developed are governance tools enabling individual and collective actors to connect and find ways to cooperate. Cooperation can take many forms – sharing tools, equipment and skills, circulating materials, bidding collectively to acquire infrastructure or influencing policy-making at a local scale. The policy areas described in Section 6.4.3 can inform and help local initiatives get support and traction.

Defining a more inclusive role for local urban populations – incorporating their explicit desires and limitations, their prejudices and contradictions, changes of mood and environmental influence – should be an integral part of policy-making. Moreover, instead of coming up with brand-new ready-made external solutions to be imposed onto cities, in many cases it would be better to start by involving local communities and initiatives who are already experimenting with alternatives. That approach enriches contextual understanding, helps build trust, and may provide buy-in and potential alliances for implementation. As noted earlier on this thesis, my use of the term *weaving* reflects the choice for identifying and improving on such existing or latent systems of reuse instead of creating new ones.

This understanding made me return to another of my design concepts. Originally described as an 'ecosystem for the collective stewardship of post-consumption materials', the Reuse Commons can be thought of as a mediating layer connecting initiatives on the ground. It can also become a systemic tool to negotiate waste prevention strategies between communities, nonprofit organisations, businesses and the public sector.

The Reuse Commons is – explicitly so, as evident in its name – inspired by the literature on commons-based governance systems. Chiefly the work of Elinor Ostrom (Bond, 2013; Ostrom, 1990; Savazoni, 2019) posing the concept of institutions as collectively recognised formal or informal systems to govern common-pool resources. That perspective on the commons is helpful in situations with diverse stakeholders simultaneously competing and cooperating in a sustainable way. Developing ways to

govern materials reuse in cities and regions should draw inspiration from these forms. A Reuse Commons strategy can help reinforce the social and environmental benefits of actors often seen as isolated, such as repair shops, clothing swap events, mobile bike repair workshops and a vast diversity of other initiatives.

Ostrom proposes eight rules for managing the commons, most of which can be immediately applied to the Reuse Commons concept. Risking oversimplification, they are as follows (Wall, 2017):

1. Clear boundaries.
2. Locally relevant rules.
3. Participatory decision-making.
4. Monitoring of the commons.
5. Graduated sanctions for abuse.
6. Easy conflict resolution.
7. Right to organise.
8. Nested within larger networks.

Departing from top-down waste management defined exclusively by local authorities in the direction of commons-based governance of excess materials can significantly improve multi-stakeholder trust in social and environmental strategies for waste prevention. In the following section, I introduce the Reuse Commons toolkit as a concrete means to co-design policies to aid in that.

6.5.1. Absorbing Excess In Cities

To address the question of excess materials in a time of multiple crises, we need to create a different story. Of course, increased awareness of unsustainable industrial practices that don't account for their long-term impacts is a good starting point. However, staying biased by a paradigm that tries to remove excess from the public eye and make it disappear exclusively through landfilling, incineration or (often premature) recycling is not the way forward. Neither should we count only on the private sector to shape the public services for re-absorbing materials, as they will only seek to fulfil profit-oriented needs. Such a feedback approach – literally 'feeding back' the industrial beast with the materials it needs to keep growing – has many disadvantages. For instance:

- It makes things less valuable in objective terms through downcycling.
- It wastes – dissolves, practically – the value already invested onto materials in prior phases of manufacturing by using energy, transportation, knowledge, and other elements.
- By focusing on objective productivity based on normalisation and

automation, it arguably steals society at large of the potential concrete uses the materials could have besides recycling and re-incorporation in manufacturing.

- It often relies on public funding to collect and process materials, whilst private corporations retain the profits, reduced costs of material sourcing and symbolic impact (‘green’ / ‘sustainable’ PR).

Things typically possess more value remaining in use than being downcycled. The dominant industrial paradigm would contend, suggesting that their economic growth can only be sustained if the products they deliver are periodically replaced. This is the main rationale behind decisions leading to planned obsolescence in product design or production engineering – a practice largely unacknowledged but very much existing. Such contradictions will not be overcome by giving corporations even more power over material resources, as is often the assumption on circular-inspired policy.

Adopting participatory methods to create alternatives for handling excess materials is arguably a more complex challenge. The idea of ‘waste’ suggests undesirable materials. To a lay audience, it evokes associations such as ‘toxic’, ‘stinky’, or ‘flammable’ – all of which are potentially true, though not of the totality of materials. Contemporary waste strategies cleverly use more neutral terms such as ‘material recovery facility’. Still, it is not the most attractive topic to invite positive participation. I remember hearing from a public official in São Paulo of the backlash when they proposed to set up a lab to repair discarded computers together with a waste pickers’ cooperative. Retailers and repair shops complained about disloyal competition, neighbours feared chemical emissions, some waste pickers were wary of sharing their limited space with that new initiative coming from outside their circles. Here again, trying to impose better futures from a productivity world view leads to friction and distrust.

Building on conviviality, and borrowing from Lafuente’s notion of ‘affected communities’ (Lafuente and Estalella, 2015), requires a shift in focus. As I found through my research studies, there’s not much in terms of class identify between diverse types of repair professionals. Even less is perceived in terms of commonalities between, say, staff at a hardware store and the members of a neighbourhood zero waste collective. All are, nonetheless, part of a vast sector of society that keeps things working – what Lee Vinsel and Andrew Russell call ‘the maintainers’ (Russell and Vinsel, 2016). Establishing stronger ties between people active in those fields will certainly contribute to reframing the discussion about how objects are used and transformed, and how they circulate in the urban scenario. In a sense, the particular skills and knowledge present in the work of the *valoriste* can arguably be found in a distributed way between maintainers, repairspeople, personnel at second hand shops, and other professionals.

6.5.2. Reuse Commons

Reuse Commons was designed as a toolkit to involve diverse stakeholders in creating new systems – or improving existing ones – to increase the reuse of goods and materials benefitting local communities. It can be used as a guide to facilitate strategic debate at the municipal scale or otherwise applied by individual organisations to identify potential tactics to promote conviviality-oriented system change in handling excess materials.

The Reuse Commons can be used for varied possibilities. Listed below are some examples of community contexts that can use the toolkit, or else be part of reuse systems established across organisations:

- self-organised donation networks and collection points for donations;
- solidarity-oriented nonprofits and charities offering second-hand goods for free or at affordable prices;
- religious organisations offering material donations to aid those in need;
- repair cafes and community repair workshops;
- things libraries and tool libraries;
- project led by the public sector involving waste collection points, reuse centres, second-hand donation infrastructure and zero waste strategies;
- groups in social media for free donations (freecycle, free your stuff groups on Facebook, etc.);
- online platforms to mediate sales or donations of second-hand goods (ebay, gumtree, Kleinanzeigen, etc.);
- artist-run initiatives offering training on repair and upcycling.

In addition to the contexts listed above, arguably not ruled driven exclusively by market forces, there are also commercial operators playing a healthy role in reuse strategies which should be incorporated in local systems. For example:

- second-hand, vintage and antique shops, flea markets and similar;
- pawn shops and custody businesses;
- professional repair shops;
- hardware stores selling tools, equipment and spare parts;
- technical schools;
- retail outlet and salvage shops;
- auction agents;
- scrap shops and junkyards.

Recognising the diversity of potential actors for local systems, the first layer of the Reuse Commons is what I call generative mapping. It starts from a geographic map of the city or

region, on top of which participants locate actors in multiple sectors that can potentially integrate the commons.

Figure 26: Generative Mapping

On a second level, similarities and complementarity between agents are discussed. Profile descriptors are used to map offers and requests of each agent to the commons – for instance, tools, equipment, goods, and materials. Current and desirable flows of materials and information are plotted back to the map.

Figure 27: Trigger Cards

Finally, thematic cards trigger conversations between participants and drive them to agree on strategies and future actions. Relevant gaps in data generation and availability, legislation, communication, organisations, facilities and other aspects can guide the development of novel responses on multiple levels – from policy to technology to infrastructure. Matters such as the ownership of tools, governance of materials and the system's future evolution are decided upon collectively. Naturally, the stakeholders can add new cards to the toolkit based on local needs and characteristics.

Ideally, the Reuse Commons would create and maintain environments on top of which my other design concepts and prototypes can come to life. These can feature as individual cards in the toolkit, to be applied where users see fit. That would be the case with the Universal Registry of Things, the Evaluation Interface, Point and Reuse and Transformation Labs, the Reuse Dataset and others.

Groups activated by the Reuse Commons can partner with initiatives under diverse framings such as smart cities, circular economy, and zero waste to design and implement

protocols, policies and cooperation projects that reinforce the importance of addressing climate change at a local level. Participatory local legislation on the right to repair can expand national or international policy and improve the conditions for initiatives on the ground. Furthermore, technologies and collaborative methods can be used to track objects and ensure they have a longer lifetime, provide information about parts and components, and offer the means to reward individual or organisational behaviour that helps keep materials in use instead of discarding them. Participatory strategies explicitly committing to addressing global change by setting the conservation of materials as a goal can foster innovative solutions based on the generation and use of open data.

The Reuse Commons can be an instrumental step in weaving generous cities. It helps visualise and improve the relationship between the diverse actors potentially interested and relevant to building generous city strategies. It can also help provide structure and scale up initiatives once isolated, in order to politicise the discussion about waste and excess in a context where the public opinion is interested in smart city projects, as discussed in the next section.

6.6. Waste Prevention In Smart Cities

Smart city initiatives are in the privileged position of having a mandate – and often the financial means – to reshape public services based on contemporary concerns. As suggested earlier in this thesis, it is essential to move beyond a framing only interested in improving objective efficiency – reducing costs, increasing speed, or availability. This section advances some ideas on connecting the concept of waste prevention to smart city projects.

To achieve that, some measures are required. First, smart city projects should involve all stakeholders in discussing whether they want change to happen. Instead of being driven by the predefined need to find relevant uses for emerging technologies, they should understand the real needs of each particular locality. Only then should data, IoT devices and other technology – which can certainly help – be brought into the discussion. Again, instead of predefined one-size-fits-all solutions, digital tools should be co-designed with local participants, and their governance made transparent and inclusive.

With a focus on conviviality-oriented waste prevention, the Reuse Commons can promote transformative dialogue for smart city initiatives. It can shift the focus of waste management from an uncritical effort with the concrete effect of speeding up the pace of consumption and discard, toward one in which care for humans and objects is central. This combination may establish a new vocabulary setting smart cities as powerhouses of environmental regeneration in the context of a global climate emergency. Involving

stakeholders every step of the way can also contribute to strengthening social ties and rebuilding trust in institutions. Once again, that points to a horizon of cities in which generosity is a socially recognised value.

Waste prevention strategies can benefit from the use of digital technologies. I have identified a need for more data about the reuse of materials in contemporary cities. The lack of such data makes it even harder to challenge the status quo on waste management, a field already served by significant datasets (Department for Environment, Food & Rural Affairs, n.d.; Recycleye, n.d.; “Recycling rate of municipal waste - Products Datasets - Eurostat,” n.d.). Making an effort to augment the skills and experiences of the *valoriste*, creating distributed approaches that generate privacy-aware data about repairs, re-circulation, transformations and upcycling would arguably increase buy-in for waste prevention strategies. In this sense, it could be that in some contexts the role of the *valoriste* is not performed by an individual professional, but instead by a network of people and communities, using open technologies designed for that purpose.

New equipment such as the speculative design of E-I – the machine with sensors to identify objects prototyped in my second research cycle – can help collect such data and make it available for stakeholders. Another of my designs, the Universal Registry of Things, can ensure such data to be maintained collectively by commons-based governance arrangements. There is a vital role for digital-literate local authorities in promoting and managing data for those purposes. Municipally supported reuse centres like those in Berlin, Barcelona, and Helsinki can become stewards of locally available datasets in addition to their physical facilities and benefit from local smart city strategies’ offer of data infrastructure.

6.7. Generosity As A Common Language

This chapter draws connections between my research on waste prevention in smart cities and the overall themes of OpenDoTT – open design, trust, and 'internet health'. It discusses policy settings to influence smart city projects and address the issue of waste in the urban context. Instead of managing waste simply as a logistic operation, I propose to help prevent it through collective practices of reuse – namely repair, upcycling, and re-circulation.

The main objective of the last research cycle was to reflect on how my investigation relates to policy-making and, conversely, how policy impacts my research topic. In the previous sections of this chapter, I made considerations about climate change, explored my past involvement with policy-making, situated areas of policy that may be interesting for waste prevention, and described Reuse Commons as a practical toolkit to establish

systems for material reuse in cities and towns. Additionally, as a result of the three research cycles described in this and the previous chapters, I was able to start developing the concept of generous cities.

Seeking to make space for convivial approaches in my research, my view about excess gradually changed. From my past engagement with reuse initiatives looking inward, I used to see excess manifest as abundance. From that perspective, materials abound for those initiatives willing to act. On the other hand, such abundance can be seen as a side effect of a dysfunctional mode of production based on infinite growth and unsustainable extraction. Addressing it is urgent, and the conviviality lenses adopted for this research informs the choice of seeking solutions through generosity, interpreted as intentional care for others, instead of passive abundance with no contextual consideration. In the next chapter, I will explore further the core contribution of my thesis for discussing generous cities, as well as some elements in which I saw potential for future projects.

7. Concluding… Or Am I?

This chapter is a clear inflection point in my research. As described in general in Chapter 3 and particularly in Section 5.1, my process of experimenting and learning with others on topics related to waste prevention in contemporary urban settings will likely continue for the next years. Likewise, it didn't start on the moment I enrolled in my PhD. As the third cycle of my research spiral came to an end, my natural movement was to look back, reflect on recent findings, reinterpret the whole journey and look ahead for the next cycles.

However, this is a doctoral investigation, and that has its own idiosyncrasies. To be in line with the appropriate rituals of a society that recognises knowledge validated with the scientific method and, this way, be considered a valid peer in that context, I am expected to present a thesis. That is, a selection of words and images that show what I have done, what knowledge was generated, how I have addressed my Research Questions, and my contribution to scholarship.

Part of me – the *griot* apprentice, the digital *tuxáua* – wants to say that those are not my most important accomplishments of the last years. I have survived trying times, and I am thankful for that. Meanwhile, I maintained a good relationship with my family, with the friends I already had, and made new friends. But that's not the whole story to be told.

When I joined the OpenDoTT programme, in many senses, I kept on doing the kind of things I have done since the early 2000s: observing, talking to people, creating, intervening, and changing how I understand things and the world. Existing as an individual and as a node in many networks. The academic part was another layer on top of that. By the same measure, once I submit this document and eventually progress to being considered a Doctor of Philosophy (here's hoping), I will keep doing the same things I have been doing all these years. The work is never complete for those occupying the margin between science and activism, as many others have found (Leal et al., 2021).

Odd remarks made, yet another bit of personal scent added to this already atypical thesis, and I'm back into the structure. My PhD investigation was an opportunity to choose a particular section of my research interests and go through a deep immersion into it. It was part of the OpenDoTT programme – an industry-academia cooperation developed around concepts of open design, internet health, open-source hardware and software, and design research. OpenDoTT assigned to me the research topic 'Smart Cities'. Recapping the first two chapters of this thesis: I subscribe to a critical perspective on smart city projects, in line with a trove of authors and activists drawing attention to the pitfalls of such projects regarding democratic participation and alignment with the real interests and concerns of

local populations.

At the intersection of that critical take on smart cities and my interest and previous experience on initiatives of reuse and repair, I found a significant gap in scholarship. There is little being said about waste in smart city projects. And when there is something, it is generally reinforcing a top-down perspective that tries to increase the objective efficiency of the systems in place. That is, increasing the speed of collection, optimising route-planning, and exerting more control over the logistics. None of these transient goals is wrong in itself. However, waste is not merely a logistic issue.

As indicated throughout my research, the existence of excess, and in particular, the wasteful premature discarding of materials that still possess potential value, is a problem with political, social and cultural aspects. The most appropriate way to frame potential solutions is through the lens of waste prevention instead of waste management. In other words, acting with the horizon of making so that the process of discard is interrupted even before materials are considered waste.

Optimising for measurable efficiency, a system that points in the wrong direction has the effect of amplifying its distortions. In other words, the unreflected adoption of a mindset that merely accepts recycling as the end goal for waste management makes the scenario very dry for those attempting to create alternatives and solutions based on waste prevention. That is the centre of my research focus. To recap, my research question is:

> How can practices of reuse contribute to reimagining and reshaping the way cities handle excess materials – from industry-oriented waste management to community-based practices of local waste prevention?

For the purposes of this research investigation, such ‘reimagining and reshaping’ should be oriented to generous conviviality rather than cold efficiency, following Illich (Illich, 1990). It should also contribute to designing commons-based (Ostrom, 1990) and participatory reuse systems to identify and constitute generous cities. To that end, I sought to develop and experiment with activities bridging community-building, education, technology development and policy-making in order to illustrate and prioritise the vision of promoting reuse cultures in contemporary cities that would contribute to such reimagining of the bases of the waste imaginary. I did so following what I came to define as a spiral of open research. The results of that endeavour were documented in this thesis, and are summarised and expanded upon in this chapter.

7.1. A Look Into The Spiral Shape

Before I re-engage with the findings of my research, it's useful to reflect back on the spiral as a method for participatory constructive investigation. Having experimented with it for a couple of years, I collected some more discoveries and insights along the way. I use the verb 'collect' here intentionally. In a short yet very influential piece on fiction-writing, author Ursula K. Leguin challenges the image of the male western Hero, and how it is interweaved with a dominant view of human history based on killings, wars and conquers (Le Guin, 2019). In contrast, Leguin argues that in parallel there are untold stories which she's more interested in. She indicates the contrast between those two visions through the objects their stories revolve around.

Epic, heroic dominant tales (one might say, coming back to a reference made earlier in this thesis, *WEIRD* stories) seem to focus on spears, sticks, arrows, knives, swords, hammers, and other devices for breaking, cutting, and piercing through things. The alternative stories Leguin draws attention to would best be understood through another object, the carrier bag.

To Leguin, the carrier bag allowed primitive humans to transport what they gathered and hunted, to carry their offspring, to recollect the objects they found along the way. Granted, the bag is also useful to store and redistribute the bounty after conquering or raiding. One might say that it is complementary to the spear and the arrow. In any case, Leguin foregrounds the need to tell that other story, the story of the bag, the bottle, the pot, the recipient. The life story, feminist in essence. One could add, the non-*WEIRD* story. To resort to another image used earlier in this thesis, the carrier bag may also be related to the activity of the *griot*, collecting stories and connecting people as they wander through different communities.

As I stop and look back to my three research cycles and to what I collected along the way in my carrier bag, some things stand out. Researching on a spiral is definitively not following an arrow 'starting *here* and going straight *there'*, in Leguin's words (Le Guin, 2019, p. 14). That is not to say that the spiral has no linearity. I walk, collect things, and eventually return to the vicinity of my point of origin. When I look back, I see a continuous line. A curved line, but a line nonetheless. The path bends over time.

As my research cycles went on, I experimented with ways to represent the spiral. For instance, Figure 28 was created for an OpenDoTT interim report (Work Package 2), in 2021. It shows a spiral in whose centre lies a question: 'how to increase the reuse of materials in cities and regions?'. As the spiral expands, it indicates research studies, concept ideas and prototypes I worked during what I would later call the first two cycles of my research.

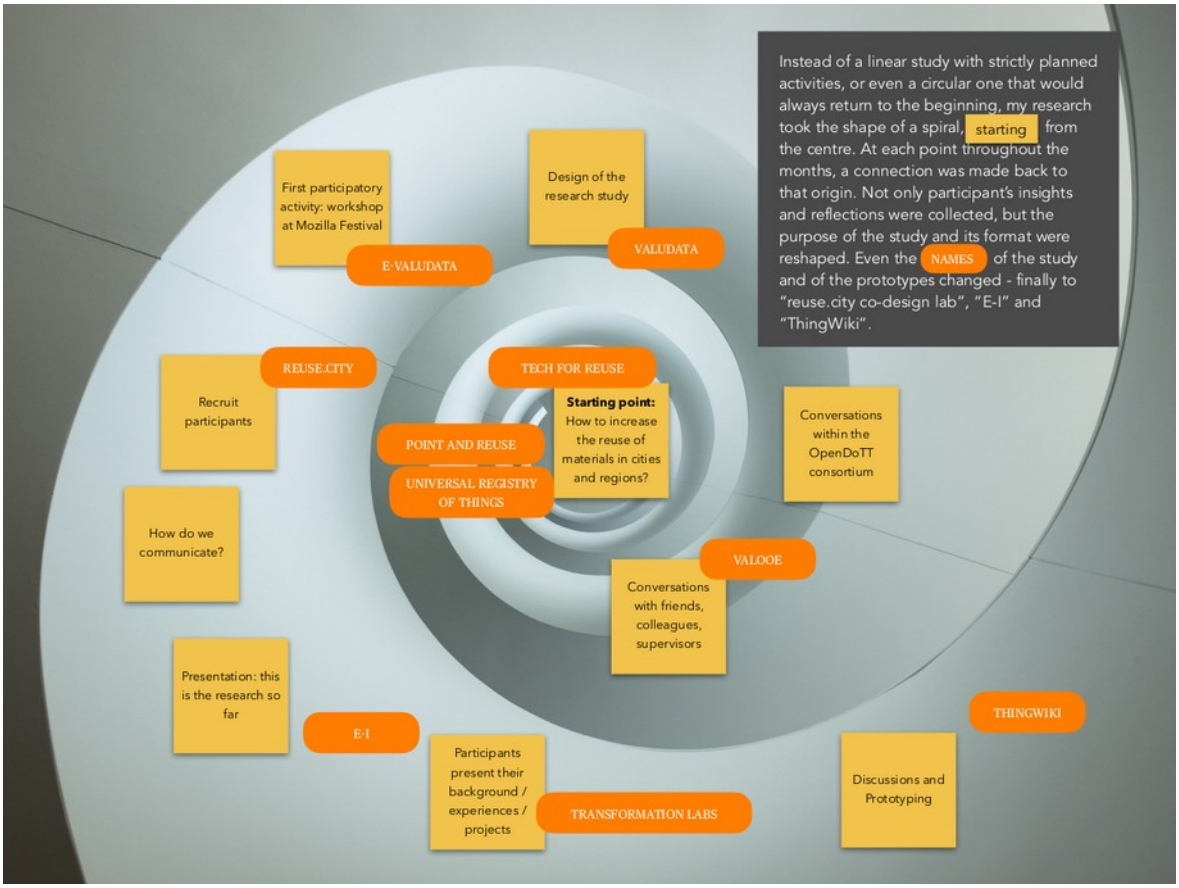

Figure 28: Spiral, WP2

When I returned to that depiction later, I was not satisfied with it. While it has the value of countering the usual vision of a project following a directional arrow forward, it's not that useful to represent the recurrent aspects of my investigation. The way the elements are positioned may in fact suggest that as time passes, my research expands further away from the point of origin, which is not at all the way I experienced it.

The main problem is likely the bi-dimensional shape of that approach. As I see it, it is not as though time expands away from the point of origin. Quite the contrary, through the cycles my perception of the project would iteratively return to a state that was similar to previous ones in some aspects, while radically different in others. A better way to visualise it could be to see the spiral expanding not outwards from a centre in two dimensions, but rather projecting onto a third dimension over time. Following that, Figure 27 should not be seen as a map, but a three-dimensional looking glass pointed at the path the research went through.

To better visualise the cyclical nature of the research spiral, I experimented with ways to shift the perspective over the spiral. Figure 29 shows some sketches I experimented with while reflecting on the nature of my research cycles. One of which was that I would iteratively return to something similar to my initial research questions, the ones in green. I

also saw different modes of approaching my research topics.

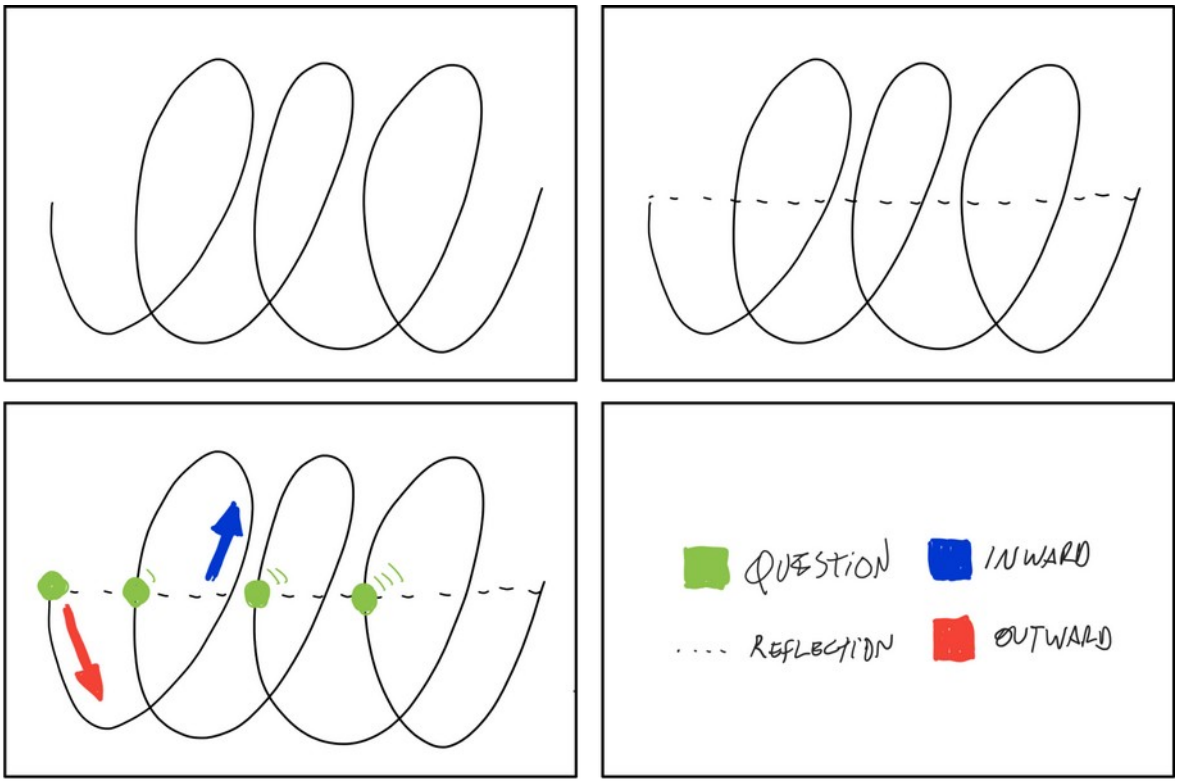

Figure 29: Sketches: spiral from the side

As I formulated the research questions, I would at first go *inwards*, so to say – reflecting on my past experience, researching bibliography, organising my current understanding of the field and shaping my following steps. Then I would engage *outwards*. In my research, that meant conducting studies with participants, attending public events and seminars, discussing with peers and colleagues. The opposition of what lies in- or outside is debatable, of course. Here again, the exactness of the visual representation is not as important as what the reflections it entails.

Those sketches allowed me to stress that even though there were similarities in each cycle, my research never returned precisely to the same place. Each new iteration would not only add more layers to the research questions and findings, but fundamentally reshape and allow for a reinterpretation of objects collected along the way, how they relate to the surrounding fields, and even what those fields are composed of. In other words, just as I walked in (non-elliptical) circles, the contents of my carrier bag changed. And so did my way to see the scenario and act on it.

As described in Chapter 3, the image of the spiral to describe my research was a direct inspiration from a talk by the late astrophysicist Germano Bruno Afonso talking about indigenous people's depictions of the sky (Borges, 2020). Before I move on to show the contents of my carrier bag, there is one more conceptual exercise to be made exploring

spirals as ways to frame cyclical developments, and once again it's connected to depictions of the universe. In an article on Forbes in 2018, another astrophysicist, Ethan Siegel, debunks an inaccurate depiction – then becoming popular on the internet – about how the solar system travels through space (Siegel, 2018). Such images suggested that as the Sun moved in its orbit around the centre of the Milky Way, it pulls the planets behind it, describing a helicoidal movement. In the article, Dr Siegel points to a more precise visualisation, in a short animation created by Rhys Taylor (Taylor, n.d.). Figure 30 show some frames captured from Taylor's animation.

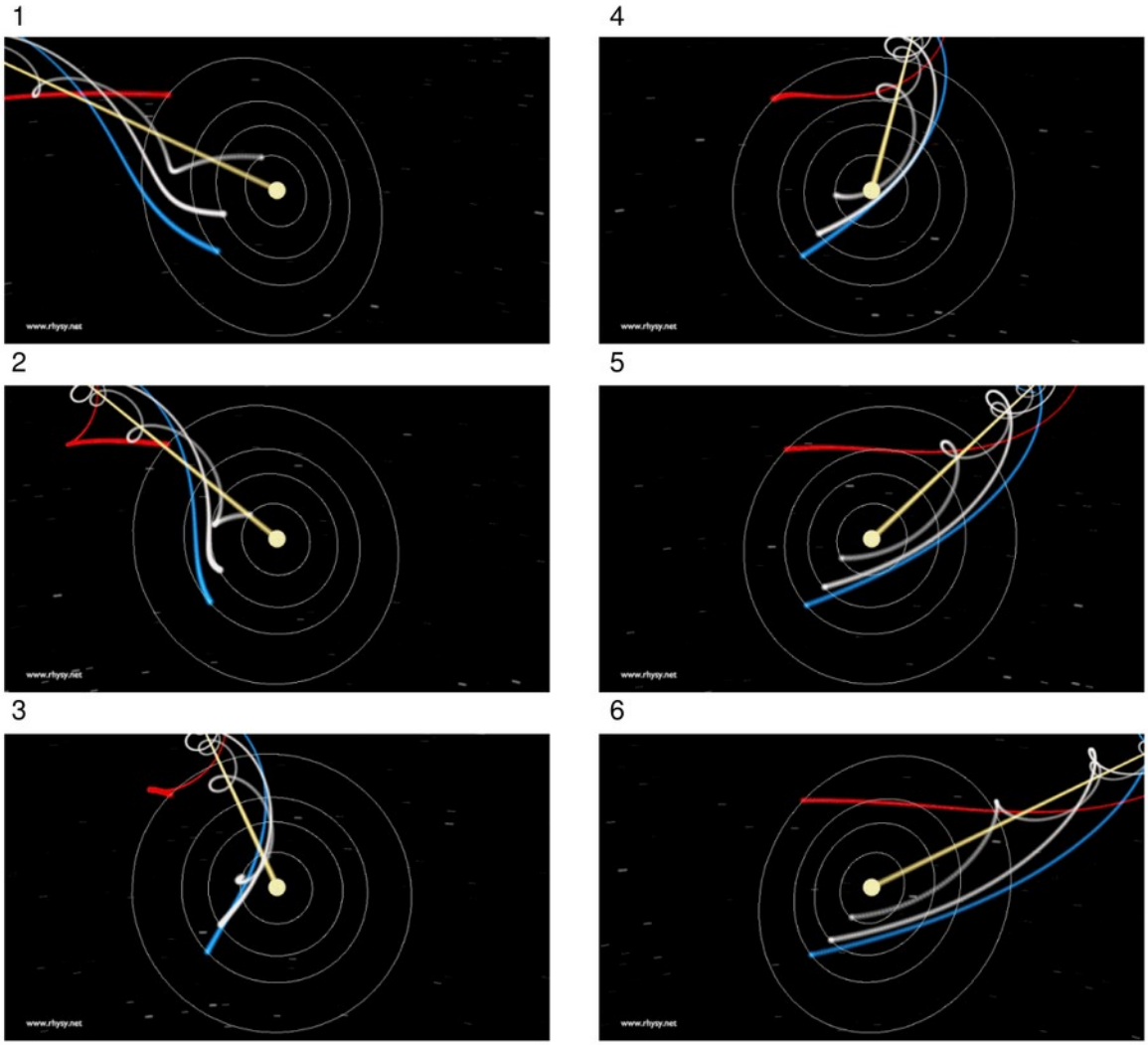

Figure 30: Solar System - capture of frames from animation by Rhys Taylor.

Leaving aside the technical discussion, those images are incredibly evocative in that they show how the understanding of systems within systems enables one to reframe the understanding of the repetition of cycles. That is, even if one considers that Earth completes a turn around the Sun every 365 days and 6 hours (give or take), our planet won't really return to the point it was the year before. Because the Sun itself is also moving around larger systems that are also moving around larger systems:

> Our planet and all the planets orbit the Sun in a plane, and the entire plane moves in an elliptical orbit through the galaxy. Since every star in the galaxy also moves in an ellipse, we see ourselves appear to pass in-and-out of the galactic plane periodically, on timescales of tens of millions of years, while it takes around 200-250 million years to complete one orbit around the Milky Way. (Siegel, 2018)

So that the reflection doesn't become excessively abstract, I will only comment briefly on how those images influenced the understanding of the spiralled shape of my doctoral investigation. Those insights emerged after I was done with the research studies and concentrated on writing the thesis.

I started, as mentioned in this section, with a bidimensional view of the spiral, to escape the limitations of shaping my work as a timeline following a straight arrow into the future. In a second moment, that spiral projected onto a third dimension, indicating that its shape resulted of time passing as the research went.

A concluding take on the spiral can be that, just like the Sun, my research is always in motion, itself circling around topics that draw my interest and connect to the path that brought me to this point. Around my research are many elements – literature, research studies, contact with different people and fields of knowledge, prototypes, writing, future plans. Those elements have each their particular speed and cycle, and as they orbit my research, they draw discrete spirals. None of them will return to their point of origin in the foreseeable future, and yet their seemingly (but not so) eternal recurrence helps to overcome the apparent contradiction between linearity, cyclic recurrence, and continuity along the way.

7.1.1. Research Cycles

While further work is necessary to better specify how to conduct spiral-shaped research, the previous section brings important reminders: how at every turn the scenario can be redrawn in whole or parts, the continuity of a linear while curved path, and the importance of collecting elements (and re-telling stories) along the way.

To summarise, the spiral shape enabled me to set directions for my research, and conduct studies, experiments, and reflection. I would subsequently cycle back to the proximity of the starting point, while I recollected what I learnt, reviewed my questions and set new directions. Each cycle could be significantly different from the others. By going through spiral-shaped paths, I always had the notion that the route ahead was also a way of connecting with past activities.

My research took place along three cycles:

- The first cycle comprised two studies largely inspired by design

research methods. The Repair Journey and the Ecosystem Mapping were created to provide an overview of the field, by understanding the individual and the organisational scales of the reuse of materials in cities. The analysis of studies' outputs shaped a design briefing to inform the creation of concept ideas in response.

- The second cycle combined practices common in the open-source and startup worlds, like iterative communication and prototyping, with a deeper investigation of the commonalities among people experienced in reuse initiatives, and their embodied knowledge. It took the shape of an online co-design lab. It also became an exercise in forming a proto-community that answered some of the questions made by participants themselves.
- The third cycle was a return to more individual research. I explored areas of policy to which my research could contribute, revisited my past experience with participatory policy-making, and developed further a design concept created on the first cycle that I see could become a valuable tool to weave generous cities.

7.1.2. First Cycle

The two research studies conducted in the first cycle generated significant outputs, and enabled me to develop a system view of the field. I have identified elements on a micro level of repairs and reuse such as different takes on value, the role of stories and the need to access reliable information on how and where to get things repaired. I also sketched a method for analysing and repairing things, based on participant's contributions. Additionally, I was able to get a glimpse of the flow of materials between manufacturers, retailers, reuse initiatives, and waste authorities. The role of policy and culture in the reuse of materials in cities was also present in the discussions. Data generated in the studies formed the basis of a design brief. Through iterative reflection and ideation, I created eight design concepts that addressed commonly found obstacles to a greater reuse of materials in cities. Finally, this phase helped me define the focus of research on convivial waste prevention rather than customary top-down waste management. Concepts of visibility and sovereignty over the provision of public services, cooperativism, and regenerative design grounded part of my reflections in this cycle.

7.1.3. Second Cycle

The second cycle was at the same time an effort of prototyping a subset of the design concepts created earlier, and the cultivation of a proto-community formed around the reuse.city online co-design lab. I was also a peer in that proto-community, occupying transitorily the role of the researcher whilst wearing the hats of *griot*, the storyteller, and of *tuxáua*, the generous leader. The main intention of the lab was to establish a dialogue with people experienced in reuse initiatives in different contexts worldwide. I presented

them my research up to that point, seeking feedback and complementary perspectives. Additionally, I constructed – in dialogue with the participants – my speculative prototypes ThingWiki and E-I, with the goal of exposing what kinds of information, skills, and sensibility are necessary to reimagine how excess materials are managed in contemporary cities. The second cycle resulted in considerable documentation, and new insights. I even worked on the Transformation Labs blueprint, a prototype I had not initially intended to, once I understood the importance of reverting the discussion back from the workbench to the city scale. The notion of conviviality, and its relation to community-based waste prevention, was central during this phase.

7.1.4. Third Cycle

Inspired by the need to act on the urban scale – identified in the second cycle – and connecting to the OpenDoTT programme's expectation that I engaged with policy, the third cycle was one in which I refrained from opening even more fronts of conversation and interaction. Instead, I went back to my proverbial studio to ponder over different temporalities. On one side, there was my past involvement with policy-making, advising lawmakers and public officers, and designing public programmes. On the other hand, there was a growing perception of the urgency of a climate agenda, which reframes and accelerates a good part of what I had done in the context of reuse and repair over the last decades.

In order to concretely help reshape and re-imagine how cities handle excess, I worked further on the design concept of a Reuse Commons, shaping it as a toolkit to be used in local contexts. As described in Chapter 6, the Reuse Commons is a facilitation tool as much as it is a documentation device for discoveries and reflections on my research. The expansion of the research onto existing practices in cities had me reflecting over excess, abundance and generosity. That take was expressed in the development of the concept of 'generous cities'. Instead of merely adopting another adjective to the city, my intention is to denote simultaneously the materiality of resource efficiency, and the explicit call for care and conviviality to be incorporated explicitly into community initiatives, as well as city planning and management.

7.2. Concrete Outputs

As well as the theoretical and meta-level contributions described in the previous section, my research has produced concrete outputs that can inform further work both in academia and outside. They are:

1. Eight design concepts, some of which can potentially be turned into

products now or in a near future.

2. The Reuse Commons toolkit, ready to be deployed immediately as a facilitation method for creating local reuse systems.
3. Considerable documentation – in the form of blog posts, wiki pages, videos, and slides – about my research studies, discoveries during the doctoral investigation, and how my understanding of the field and of my work evolved along the way.
4. A series of project deliverables produced for the OpenDoTT project. Even though not incorporated in this thesis, those deliverables comprise reports, designs, and documentation that greatly expand the understanding of waste prevention vis-à-vis smart cities and responsible technology development. As a telling example, I include below an excerpt of one of such deliverables, whose focus was recommendations for smart city projects about waste prevention policies.

7.2.1. Recommendations To Smart Cities

Drawing on my work exploring waste and the smart city, I have the following recommendations for policy and smart cities in general:

- The top-down approach of most smart city initiatives fails to earn trust from stakeholders such as city inhabitants, communities, organisations and businesses. I recommend participatory and transparent policies be created and implemented. Technology should not only be developed for people but also about and with people.
- Frictionless systems (e.g. solutions for waste management focused on making materials disappear from the public eye) hinder transparency and erode trust. People need to see, hear and touch information related to their everyday life in order to get the big picture. That extends to data about the waste generated and circulated in contemporary cities. I recommend adding friction to systems by making data more visible and relatable to the inhabitants of smart cities.
- Positive and trusted transformation must ensure inclusion, human rights and respect for differences by default. I recommend policies that ensure inclusion and human rights since their early design phases for any new smart city developments. Within the concept of generous cities, that means incorporating informal agents seldom considered in official waste policy conversations – such as waste pickers, members of community-based zero-waste initiatives and repair professionals.
- There is a mismatch between the time required to build collaborative policy and the time of political/electoral cycles. I recommend stronger cycles of development that weave city inhabitants into collaborative policy-making activities for the future of the smart city, ensuring buy-in and resilience against changes in the political scenario.
- Transparency needs to be built in by default. As well as friction, I recommend data stewardship as a strategy for smart cities to achieve more transparency and give people more agency over the data that is being collected through IoT devices in the smart city.

7.3. Contribution

At its core, my research creates an alternative framing for how cities and towns should handle excess materials. Its main goal is to overcome the conceptual and practical limitations of the dominant waste management paradigm focused chiefly on recycling, landfilling and incineration of discards. Such alternative framing is a concept I called ‘generous city’. It promotes the weaving of collectively governed systems to identify and realise the value of excess materials through practices of reuse that benefit local communities, organisations, and businesses. Reuse is defined here in a quite concrete way: repairs, upcycling, and re-circulation of goods and materials

The generous city responds to contemporary contingencies, namely the following:

- It is crucial to reduce the consumption and discarding of natural resources, to help mitigate the effects of climate change through resource conservation;
- Recycling is not enough to cope with the large volume of materials being manufactured and discarded every day. In fact, in many cases, recycling is done prematurely and generates considerable negative impacts in economic and environmental terms, which are not usually accounted for at a system level;
- Even though profit-driven enterprises and market-based mechanisms are certainly part of the equation to reduce waste, they won’t solve the whole problem. In some cases, they will increase inequality and negative impacts.
- There is little public discussion about waste prevention connecting local administration, environmental policy, participatory commons-oriented initiatives and smart city strategies.
- Civil society and social entrepreneurs worldwide are active in creating situated solutions that actively divert materials from the waste stream, contributing to waste prevention even when not recognised as such.

The generous city borrows elements from diverse fields of knowledge and policy development. It is aligned with growing awareness of the need to act fast to promote transformation in society. Generous cities critically challenge the unregulated industrial production, only guided by the generation of profit under neoliberal capitalism. The idea is to promote situated conviviality as a core element for the regeneration of social bonds and the creation of more sustainable practices.

At its core, my research is not an attempt to create a novel type of construction to be imposed from the top down. On the contrary, it proposes that the qualities and practices of convivial care through collective material reuse are already part of everyday life in cities and towns. The fundamental aim of the generous city as a concept is then to promote the connectivity of such practices with each other, as well as their visibility to and recognition by civil society, private organisations, and the public sector. The generous city is a fertile

setting to create regenerative ways of addressing and handling material excess. It enables local initiatives to amplify their positive impact, by equipping them with useful methods, technologies, and policies.

A generous city strategy for a particular location can, for instance, establish concrete alliances between the local waste authority and zero waste initiatives to set up reuse centres in neighbourhoods. Technical schools can invite repair professionals and upcycling artists to create curricula focused on reuse to address the types of excess materials more common in the region. Charitable organisations can create libraries of things that allow residents to borrow tools, sports equipment, house appliances and gardening accessories. A combination of stakeholders can work together to create membership-based incentive systems to reward the people and businesses promoting the reuse of things, or local policies that provide incentives for reuse-centred social businesses.

None of these possibilities sounds particularly new. I have seen collaborations and partnerships along those lines happening *ad hoc* in places I visited or lived in – Nantes, Barcelona, Berlin, São Paulo. The most important difference here is the use of the generous city concept, almost as a reminder of the centrality and regenerative potential of conviviality and care. It is in some senses a narrative device that enables the emergence of otherwise unlikely cooperation between actors that don't necessarily share a vocabulary, assumptions, or expectations. As discussed in Chapter 6, the Reuse Commons toolkit can help map, visualize and connect those actors across disciplines and worldviews.

While the generous city has points of contact with notions such as the circular economy, it is not necessarily aligned with its most common depictions. I am a Latin American activist-researcher whose work has for decades promoted dialogue between non-western knowledge and the fields of human rights, social inclusion and technology. Coming from that background, I welcome the move from seeing time as a linear arrow to a perspective of circularity. Iterative cycles, dynamic system reshaping, redundancy and repetition are important elements within the human communities I have worked with on many occasions. I need nonetheless to question some assumptions of how the circular economy discourse is being framed and shaped by industrial actors, and in particular its purposes.

For starters, and reinforcing a point made in earlier chapters, I have serious doubts over the capacity of for-profit corporations to lead the way towards more circular futures. The mainstream vocabulary around the circular economy emphasises market-based mechanisms and the importance of reincorporating materials in a cyclic way to ensure sustained industrial production and reduce the need for the extraction of raw materials

without compromising growth in production. Even on interesting ideas such as the move from a focus on product sales towards a service-oriented economy – renting things instead of buying them – there are critical issues to discuss. To the industry-backed vision of a circular economy, decisions should obviously be made by corporate actors. There is little discussion whether that kind of change is, in fact, beneficial for society at large, and if so, how.

To overcome such limitations, my investigation engaged with diverse areas of knowledge in order to reshape and re-imagine how cities handle excess. It combined research methods rooted in the social sciences, innovative forms of shaping and testing concrete ideas through open prototyping, and the 'turn to social' in design. I based my research on concepts of conviviality (Illich, 1990), commons-based governance (Ostrom, 1990), and political approaches to socio-ecological transformation (Scoones et al., 2015).

The methods and approaches used here are inspired by – and in turn bring concrete contribution to – emerging fields of social design. The focus on the interconectedness of living beings to promote the system-wide regeneration of social and environmental bonds establishes a productive dialogue with regenerative design (Wahl, 2016). The importance of the co-evolution of initiatives on intersectional and inter-local networks is aligned with principles of transition design (Irwin, 2015). Finally, the persistent focus on the perspective of communities – both as beneficiaries of design efforts as well as the ultimate authors of their own self-design challenging homogeneous and top-down perspectives – situates my work in contact respectively with the concepts of design justice (Costanza-Chock, 2020) and pluriversal design (Escobar, 2018).

7.3.1. Research Questions

The main Research Question addressed by this doctoral investigation revolved around ways in which practices of reusing goods and objects can inform new formats for how cities handle excess materials. I proposed a shift from industrial-minded recycling towards community-based waste prevention. My research studies generated significant outputs:

- I was able to identify typical stakeholders of community-based waste prevention and learn about their expectations, conditions, and limitations.
- I systematised information about skills, methods, and technologies to aid in setting up, connecting and potentialising reuse initiatives.
- I created concepts, design briefings, prototypes, and a toolkit geared at generating positive intervention in the creation of local reuse systems.

My research provides significant contribution to scholarship, beyond the objective outputs listed above. Such conceptual contribution can be summarised in the following topics:

- The understanding of excess materials simultaneously as a sign of societal unbalance and as a resource with potential to become a regenerative element.
- A spiral-shaped method to frame and conduct academic research and other knowledge-generating activities.
- Actionable insights about conviviality, participatory policies and social-environmental transformation.
- The formulation of generosity as a crucial binding force to address the multiple crises of our times whilst establishing connections between humans and humans, between humans and other beings, and between humans and the planet.

7.3.2. Excess

To ground generous cities, it is important to describe the notion of excess materials. As discussed in Chapter 2, in my research I refer to those physical goods and objects that still retain potential value but are either:

- prematurely discarded after being used for a time,
- broken or considered unfit, obsolete, or otherwise inadequate, or
- kept out of use for any other reasons.

The generous city engages critically with the way contemporary societies organise, understand and reproduce themselves. It assumes that, for the foreseeable future, humanity will keep manufacturing goods, and that those goods are not likely to be used to their full extent at all times. Such excess materials deserve urgent attention, not only for their environmental impact vis-à-vis potential concrete applications, but also for their significance as symbols and signals of wasteful practices of global capitalism.

The idea of generous cities challenges the assumption that all municipal waste should be immediately sent to recycling by an industrial-minded logistics operation (Syberg, 2022). It is a way to shift the emphasis of the recycling narrative towards one centred on reuse, particularly through repairs, upcycling and re-circulation. (Jørgensen, 2019)Additionally, my research centres on the human perspective of the reuse of materials by proposing ways to augment the capacity of people and communities who engage with such practices. That is, intentionally shifting away from a strictly efficiency-oriented industrial perspective and incorporating wider social and political considerations (Mazzucato, 2018a).

7.3.3. Commons To Weave Generosity

Generosity is a crucial aspect of human sociability, despite what neoliberal ideology wants us to believe. It is arguably present as a cultural practice in virtually every human group,

sometimes highly ritualised or politically structured. The kind of material generosity that relevant to waste prevention may take place in public, as I saw on the streets of Berlin and other cities. In other contexts, generosity may happen in private settings, as I recalled being used to in Brazil.

Urban material generosity should play a central role when designing sustainable systems of waste prevention based on reuse. If we widen the spectrum of observation, it's clear that every city and town abounds in examples of material generosity. One just needs to go a couple of steps beyond the superficial description of cities as pure markets of labour and trade to realise that every city is a generous city. Remaining only on the material side of things, there are many examples of initiatives where it can be seen concretely.

The scenario is partly composed of private enterprises that operate on the re-circulation of second-hand goods. Some of the stakeholders facilitate and are businesses themselves. As mentioned earlier in this text, there is an important role for for-profit organisations in developing systems-based ways to cope with excess materials. My position, however, is that markets should not be the only mode to make things circulate. Here's where another change in narrative may come at hand: my proposal is to weave such systems. Instead of building anew – especially the startup-inspired language proposing to break things and recreate amid the debris –, I propose to weave connections between diverse actors.

Needless to say, if we are to create a commons-based response, based on conviviality and engaging with affected communities, all those processes should be as open and participatory as possible. Generous cities suggest that making more sustainable futures requires a change in how society sees its urban areas developing moving forward. Of course, solar panels, green areas, effective waste collection and electric transportation are desirable. But spaces, infrastructure and policy dedicated to the maintenance, reuse and repurposing of shared materials should be part of the map and the plans just the same.

Having tried, over the earlier stages of research, to develop the skills of the *valoriste* in my own sensibility, my attention was often trying to connect the immediate experience of seeing things with the relational value I could ascribe to them. One way to interpret the generous city is as an attempt to recognise and disseminate such skills. In some cases, it will make sense to have a dedicated professional to evaluate the potential reuse of available materials. But there's a case to be made for those configurations in which the people already engaged with the reuse of materials become group *valoristes* operating collectively.

7.4. Limitations

A series of conditions challenged my ability to achieve the outcomes I expected from the research. Some of them were variables outside of anyone's control. Others were institutional contingencies. Finally, some obstacles were mine individually. This section will expand on all three.

The first set of challenges was the ever-changing scenario in which the research took place. When I applied to the OpenDoTT programme, I already expected to move with my family to Dundee and later to Berlin. What was not anticipated was the world facing a global pandemic with no precedents. Not only my access to University facilities was suddenly cut – office, workshop, library, sports and cafés -, but I had to reshape my studies that initially had the expectation of engaging with local communities as a form of creating roots and understanding. COVID-19 also had an impact on my moving to Berlin, as the German consulate in Edinburgh was closed for months and due to another variable – Brexit – the visa I was required to have before moving to Germany was delayed. My other four colleagues never made it to Germany. And my expectation of working at the Mozilla Office in Berlin in contact with people from the whole world was also impacted as the office remained closed for most of the time.

The institutional challenges were, in fact, many. First, some months into the research, my colleagues and I learnt that the entire project was moving from the University of Dundee to Northumbria University. The transition was relatively smooth, but it added uncertainty and change in a complex scenario. Some difficulties within the project were initially managed poorly, which impacted the trust in a collective setting and generated noise. All of that had effects on the morale of a project that was supposed to be collaborative and open. Additionally, the culture in a University is considerably different from one in a technology-oriented organisation such as Mozilla. Even decisions over what videoconference platform we were supposed to use, whether we were able to record sessions or how to secure ethical consent from participants were often subject to ambiguity, delaying processes and bringing uncertainty.

Adding to the institutional conditions, the OpenDoTT programme was cleverly designed with a progressive structure in mind: in the first year, design research. The second year, open-source prototyping. The third year, policy-making and thesis writing. The intention was that the project deliverables would be building blocks for the thesis. However, not everyone followed such a linear path. In my case, some of the activities more focused on prototyping technologies were diversions to which I was forced to commit but had limited contribution to the overall research.

Finally, my own estrangement with design as an academic field was a recurrent

challenge. Coming from a long experience in politically situated open participatory projects and short incursions into academia in social science settings, I felt difficulty affiliating my research to recognised disciplines of design. And would often have a conflicting relationship with the concepts of authorship, leadership, and authority that come with it.

I am superficially familiar with the attempts to open up the field of design by questioning authorship, incorporating communities and adopting methods originated in participatory social sciences. But I felt that the project timeframe, with its constant cycles of deliverable deadlines and my need to adapt to constant changes outside the research, didn't allow me to explore much of such alternative literature on the field.

Still regarding the limited timeframe, I tend to agree with one of my supervisors who, at some point, suggested I was trying to cover too many aspects of the research topic. In my view of an always-returning spiral, that is not necessarily a problem. But the need to finish the thesis, submit it and only then open again to other interesting sides was not that easy.

7.5. Further Research

My research sought to discuss community-based waste prevention through practices of reuse, while also prompting areas for further exploration. The development of concepts and interventions focusing on the promotion of convivial reuse cultures generated outcomes and raised several questions still open.

Firstly, there is a need for more in-depth examination of the policy implications of shifting from industrial waste management to commons-bases reuse of materials. This thesis has addressed the potential role of policy in setting the groundwork for such changes, but more work is needed. Understanding how specific policies can influence behaviours on a larger scale, and how they can be crafted to promote reuse initiatives incorporating the experience of those already active in the field could provide practical guidelines for decision makers. This includes implications on the level of incentives, regulation, and legislation across different jurisdictions.

Secondly, while the concept of generous cities has been introduced and partially explored, further research could be devoted to developing this idea in concrete and theoretical terms, understanding its implications in various contexts. Different cities have unique circumstances, resources, and challenges that may influence the viability and specific shape of generous cities within them. Implementations in particular cities and comparison of different urban strategies could help expand the understanding of how to build generous cities globally.

Additionally, I have touched on the role of technology in facilitating reuse and reducing

waste, but there is still much to explore in this realm. Developing and testing new tools and platforms that support local reuse networks, owing to new developments in both technology and legislation, could be an interesting avenue for future work. In a similar vein, studies could be conducted on the role of emerging technologies, like blockchain and AI, in fostering and scaling reuse initiatives. Thinking of the *valoriste* not only as an individual, but potentially as a collective being connected to multiple actors, can also inspire the development of new technology.

Finally, more work needs to be done to understand the mindset and cultural changes required to shift towards a society that values and prioritises reuse over disposal. This includes both the motivations and barriers individuals and communities face in adopting reuse practices. Exploring cultures of reuse, their societal implications, and potential strategies for encouraging positive change could provide valuable insights to guide future initiatives.

On a personal note, I wish I had more time during the research to engage with excess materials and their reuse not only in terms of infrastructure, skills, experience and data, but to going into the types of materials being discarded or kept out of use, and what they mean to former or potential future users and owners. There are cultural aspects to excess and premature discard that I was unable to grasp on this investigation, but hopefully will find opportunities to do so in the future.

7.6. Final Words… For Now

Transformation, to echo Stirling one last time in this thesis, won't happen by waiting for the perfect policy to be designed in a lab and adopted without criticism (Stirling, 2015). With my research, I want to help promote the vision that the notion of generosity provides powerful lenses to look at cities, and design ways to improve life quality. Regarding the topic of my research, diverting things from the waste stream has not only economic but also social and cultural advantages. As mentioned, the generous city is not merely an attempt to replace the adjective used to qualify desirable cities. Instead, it attempts to politicise waste policy from a perspective of care, social regeneration, community-building and environmental awareness. Generous cities incorporate and offer ways to overcome issues of pressing crises. The inevitable impacts of climate change, the growing inequality, the dissolution of social bonds, and intolerance towards differences. Generosity, in this sense, emerges as a core element for creating what Illich calls conviviality, as discussed throughout my thesis.

Generous cities are also a way to ensure recognition and provide support to those people already active in reuse initiatives. That includes waste pickers, upcyclers, repair café

organisers, zero waste activists, community *valoristes*, and hobbyist repairers. The same is true for those engaged in second-hand and scrap shops, donation boxes, cloth swap events, flea markets, tool libraries, and many other initiatives. These people and organisations are at the forefront of making concrete local strategies to address the waste of potential value. They possess embodied knowledge of materials, tools and local societies, and should never be replaced by machines or solely market-driven solutions. I dedicate this thesis to them. To us.

8. References

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