TREASURE

D4.6: Report on ethnography of CE in the automotive industry (final version)

30/04/2024 (M35)

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003587

Project Acronym	TREASURE
Project Title	leading the TRansition of the European Automotive SUpply chain towards a circulaR future
Project Coordinator	POLITECNICO DI MILANO (POLIMI)
Project Duration	36 months as of 1 June 2021

Deliverable No.	4.6
Dissemination level [1]	Public
Work Package	4
Task	N/A
Lead beneficiary	Edgeryders
Contributing beneficiary(ies)	N/A
Due date of deliverable	30 April 2024 (Month 35)
Actual submission date	30 April 2024 (Month 35)

Document history		
V	Date	Beneficiary partner(s)
V1.0	30/04/2024	Edgeryders
V1.1		
VF		

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EXECUTIVE SUMMARY

This report represents a two-fold approach to studying the issue of a circular economy in the automotive industry. It aims to understand ethnographic nuances in the present and extract actionable insights for future policy-making, awareness-raising, and consumer education.

The report describes the research conducted on two fronts: the online forum with the community journalism program and its workshops, and event ethnography workshops and conversations conducted within physical events with the selected public.

The document describes the tools and methodology used for the research, the scope, the data publication, and the target audiences.

It is structured as follows: We first describe TREASURE's methodological framework and research design, which was conducted in two phases. Next, we review the ethnographic insights that have emerged from the data extracted from structured interviews via coding, connect them with visualisations derived from the same data, and link them with additional ethnographic data.

We conclude with data-driven policy recommendations synthesized from our insights and analysis. The recommendations include strategies to promote circular economy practices and sustainability in the automotive industry, such as:

- implementing extended producer responsibility (EPR) policies,
- promoting product design for reuse,
- supporting peer-to-peer and family-centred circularity awareness campaigns,
- supporting holistic consumer awareness programs,
- promoting civic education on sustainable mobility,
- creating open data and tech platforms,
- integrating concepts of intergenerational equity.

The final annex provides a more detailed description of all the outreach and engagement activities for data collection, such as in-person events, online workshops, or community journalism, and the tools we used to conduct such activities.

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TABLE OF CONTENTS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003587

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003587

1. Introduction

This report is a contribution to the TREASURE project under WP4 (platform design, development and integration), Task 4.3. Semantic social network analysis module aiming to combine primary and secondary data (WP2, T.2.3) in a Semantic Social Network (SSN). The data will be exported in a widely used format (JSON) and stored for long-term safekeeping in the Zenodo repository.

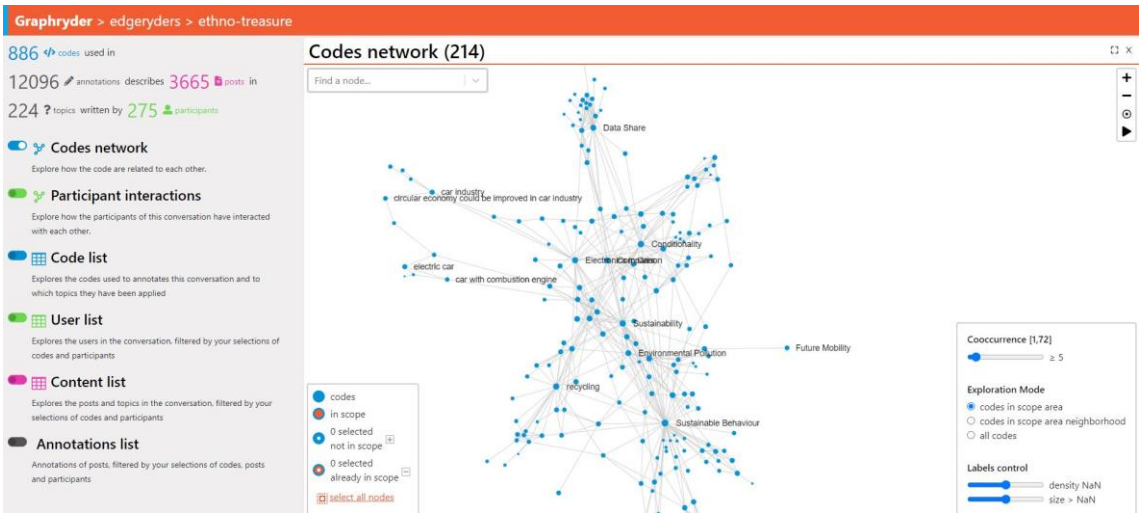
The report updates the deliverable D4.5 Report on ethnography of CE in the automotive industry (1st version), submitted in August 2022.

The analysis feeds from the work done under WP2 (TREASURE assessment methodology definition), Task 2.3. Participatory social impact assessment, described in the deliverable D2.3: Participatory social impact assessment report.

Project Overview

The idea is for the TREASURE project to make use of social science and humanities research in order to discover the point of view of drivers about their own contribution to the circular economy; and use that knowledge to develop the TREASURE platform. The report addresses the data collected from the beginning of the project and up until the time of writing. The method we used in the study is ethnographic in essence. It makes use of techniques lifted from network science to aggregate the data and visualise them in network form for additional clarity and intuitiveness of presentation.

The research results are integrated into the TREASURE toolbox within the Eco-design module, complete with documentation, access to the Graphryder visualisation tool and the complete ethnographic data corpus. The integration is part of Edgeryders exploitable route focusing on consultancy for design and policy making.



Graphryder with the level 5 cooccurrence visualisation of the entire TREASURE network. The dashboard on the left side of screen allows access to the complete ethnographic corpus. The dashboard on the bottom right side manages the level of detail

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Research Team

The research team is led by Veronica Davidov and includes Alberto Cottica for phase I and Pierre-Yves Koenig for phase II (data processing and visualisations); Ivan Cukerić, Bojan Bobić and Inge Snip (the community journalism program); Sirin Knecht (coding); Jos Soldo (interviews), Owen Gothil (transcripts). Davidov is this report's principal author; Cottica, Koenig, Knecht and Cukerić are its co-authors.

2. Methodology and Research Design

2.1 The Ethnographic Method and Semantic Social Network Analysis

The ethnographic method is a social science method associated primarily (though not exclusively) with the discipline of cultural anthropology and employed to reveal how cultural meaning is formed, experienced, and reproduced from the perspective of the interlocutors under study. Essentially, as outlined in Hassoun et al. (2021), ethnography "is a qualitative research technique used to discover how groups of humans perceive sets of issues. It seeks analytical depth through long-term engagement with community members (Geertz, 1994; Abu-Lughod, 2000). Ethnographers study individuals as social members of communities, analysing how people with unique worldviews and life experiences live and work together. Ethnography is especially valuable because its findings articulate the analytical concepts and worldviews of the group(s) under study. It seeks to find novel social, political, and economic understandings that arise organically from human interactions rather than imposing researchers' preconceived categories of analysis."

While historically, ethnography has dealt with (and is still sometimes perceived outside the field of anthropology as exclusively focusing on) non-Western cultures and "exotic" topics, contemporary ethnography has long turned its lens on Western societies and "modern" topics. Environmental anthropology, in particular, anthropology of sustainability (McDonagh and Murphy, 2016), anthropology of infrastructure (Gupta, 2015; Harvey, 2015), and anthropology of technology (Pfaffenberger, 1992; Ingold, 1997) are all directions in anthropology that have yielded examples of ethnographic studies that prefigure this study of the circular economy in the automotive industry. The specific methodological toolbox of ethnography contains various ways of gathering data. This study centres around interviews in an "event ethnography" (Campbell et al., 2014) setting:

- Positive expectations are associated with knowledge and expertise about sustainability in the car industry. This insight dovetails with insights produced by our general data analysis and is connected to our recommendations in the next section regarding education and awareness raising.
- People may consider full circularity utopian and impossible without a major paradigm shift. However, at the same time, they see circularity as a spectrum and are excited about practical measures to move along the spectrum. This insight can also be used to shape awareness-promoting initiatives.

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- People distinguish between recycling and reuse, and reuse is seen more favourably—this, of course, mirrors the findings in our study and, in part, informs Recommendation #2 below.

In the mixed-methods tradition that we draw upon, ethnographic data yielded by the interviews is transcribed and coded, where snippets of text from interviews are associated with semantic codes and expressed as a network of co-occurrences. Said network is then analysed, reduced, and visualised using techniques from network science. This approach gives us a bird's eye view into the structuration of discourses and meaning. Ethnography explores what people say and how they say it, with attention and sensitivity to cultural context. Visualisations help us see the patterns of co-occurrences of those codes and identify when they are prevalent enough that their association also signifies something about the cultural production of meaning. Thus, the combination of two methods allows us to see not only what people are saying and how they are saying it but also explore what things are mentioned together by the same people, identify areas of broad consensus, and overall produce a mental map of informants as a cultural group (Cottica et al., 2020).

2.2 Study Design

This section will provide an overview of the various ethnographic approaches and engagements we used to draw our conclusions.

First and foremost, to produce the coded corpus discussed in this report, we focused on ethnographic interviews to help us map the conceptual space around the circular economy and sustainability practices in the car sector, and to accompany the work of the TREASURE Consortium on greening the car electronics components. The project was split into two phases, the first focusing on car-industry-focused events and interlocutors and the second focusing on sustainability-focused events and interlocutors. For the first phase, Jos, a native German-speaking researcher, conducted structured interviews at six car industry events, 5 in Germany and 1 in the Netherlands. For the second phase, Jos conducted structured interviews at five events focused on sustainability, recycling, and circularity, 2 in Switzerland and 3 in Germany. In the annex is the overview of the events and the information about the number of interviews each yielded.

We divided the project into these two thematic phases for three main reasons. By focusing on self-selected communities of meaning and subcultures of lay and professional expertise, we aimed to benefit from holistic contextualization, identification of critical issues, and comparative analysis that this research design could provide.

- **A holistic understanding of the context** in which the meaning of electronic car parts (and their manufacture, utilization, and disposal) in the context of user experience is crucial for grasping the complexities of sustainability and circular economy initiatives in this domain. Interviews with subjects involved in the car industry, either professionally or as enthusiasts, offered insight into how these topics are understood in a context where the semiotic domain of cars and car electronics was foregrounded, and its connection with sustainability was elicited from the background. Conversely, interviews

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with subjects focused on sustainability at events centring on sustainability afforded us insight into the semiotic connections and associations made in a context where issues of sustainability and circular economy were foregrounded, and their link to car electronics was elicited from the background. These two approaches are complementary.

- **Identification of Sets of Key Issues:** The first phase enables the identification of critical issues, concerns, and opportunities related to sustainability and circular economy practices within the car industry and among car enthusiasts. Because ethnographic research is iterative, these insights informed the formulation of focused questions for the second phase of interviews, ensuring that discussions with sustainability experts covered the most relevant and fruitful topics in the first phase.
- **Comparative Analysis:** Conducting interviews with interlocutors in these two communities of meaning allows for a comparative analysis of perspectives, practices, and approaches toward sustainability and circular economy principles in the context of electric car parts. Considering discrepancies, gaps, or areas of alignment between these two communities of meaning enables a deeper understanding of the interplay between industry practices around circularity and sustainability, user experiences, and sustainability aspirations of stakeholders committed to green practices in their professional and personal lives.

There is a robust body of literature in environmental anthropology and sustainability studies showing that specifically large-scale environmentally themed and/or future-oriented events yield useful results for "event ethnography" practitioners (see Davies et al., 2014 on the Emerge event at Arizona State University, Suiseeya and Zanotti 2019 on the Paris climate summit, for example). Researchers have also pointed out the value of multi-event ethnography and conducting research in pluralistic settings (see, for example, the Delgado and Cruz 2014 methodological analysis, grounded in studies of meetings organized by the United Nations Secretariat of the Convention on Biological Diversity).

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Outreach and engagement tables

Event	Location	Date	Informants	Description
Community journalism open calls	Online	2022 - 2024	30 applicants, 6 selected	The community journalism is a tool for engagement of a broader and more diverse community of interested public on the themes of circular economy and automotive. It serves for eliciting conversation-starting posts as "seed" for the forum exchange and for communication and dissemination purposes. The program generated self-standing contributions and provided the base for some of the workshops.
Automotive Nightmares	Online	29 April 2022	17	This series explores circularity and automotive topics through a community journalism approach. The inaugural workshop on April 29, 2022, discussed themes like wastefulness and pointless car features, setting the stage for ongoing exploration of car electronics, privacy, and their role as "computers on wheels".
Participatory Workshop on Circular Cars with Neol		18 August 2022	22	This workshop encouraged participants to envision a circular future for mobility, particularly focusing on the concept of circular cars. Discussions ranged from the practicalities of circular design to broader socio-political considerations, including urban planning and societal shifts towards sustainability.
How to Green Cars - For a Deeper Understanding of Circularity	Online	25 January 2023	19	Expert Paul Nieuwenhuis led a workshop exploring the environmental impact of automobiles beyond emissions. The discussion delved into challenges like car disposal systems and proposed solutions such as design optimization and alternative business models to promote circularity.
AMA: Circular Economy & The Future of Material Recycling in the Automotive Industry with Jean-Denis Curt	Online	07 March 2024	88 registered, 40 participants	Jean-Denis Curt discussed Renault Group's pioneering circular economy efforts, and particularly Renault's "Re-Factory" project, its urban mobility brand promoting sustainable sharing models and "The Future is Neutral" project enhancing vehicle recyclability, during an AMA event. Curt highlighted the CE shift from a linear "take, make, dispose" model to resource maximization. Re-Factory showcases the transformation of the assembly plants into circular hubs, focusing on retrofitting, energy, recycling, and innovation.
Paris Spring School Ethnographic exercise	Online and in person, Paris, France	24 April 2024	40	The Paris Spring School Ethnographic Exercise served as a methodology showcase. It merged data gathering and collaboration, engaging participants on TREASURE project themes, and the results were presented at the Paris School. The gathered data was in line with the findings of the general research.

Table 1. Community journalism, online workshops and dedicated events

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Event	Location	Date	Informants	Description
Technorama Ulm 2022	Ulm, Germany	22-23 April 2022	21	Classic car enthusiasts and mechanics gathered at Technorama Ulm, a longstanding event celebrating automotive heritage. The event facilitated discussions among like-minded individuals, providing insights into automotive restoration and sustainability.
Frankfurter Automobilausstellung 2022	Frankfurt, Germany	22 May 2022	24	The 8th Frankfurt Motor Show showcased a variety of vehicles, blending classic and modern cars. Interviews with participants revealed diverse perspectives on automotive trends and preferences.
Audi Meeting Krefeld 2022	Krefeld, Germany	26 May 2022	16	Audi enthusiasts converged in Krefeld for a vibrant gathering, reflecting the community's passion for automotive culture and heritage.
Stuttgart Karrieremesse Automotive TopCareer	Stuttgart, Germany	20 June 2022	26	The Automotive TopCareer fair in Stuttgart provided a platform for industry professionals to explore advancements in electromobility and connected vehicles, fostering discussions on innovation and talent acquisition.
Allsted Cars Meet Photographers 2022	Allsted, Germany	10–11 June 2022	32	Car customization and photography enthusiasts convened at Allsted for a weekend of capturing automotive artistry, showcasing the intersection of creativity and passion within the automotive community.
4WD Event Oss 1	Oss, Netherlands	24-25 September 2022	26	The 4WD Festival in Oss attracted off-road vehicle enthusiasts, highlighting their perspectives on environmental awareness and scepticism towards electric cars. OBJ

Table 2. Event ethnography – car enthusiasts

Event	Location	Date	Informants	Gender split	Description
Bern User Forum on Circular Economy	Bern, Switzerland	28 March 2023	14	7F - 7M	The Bern User Forum convened circularity experts to discuss sustainable practices and solutions, underscoring the growing interest in circular economy initiatives.
IARC 2023	Leiden, The Netherlands	21-23 June 2023	31	7F 24M	The International Automotive Recycling Congress facilitated discussions among industry experts, focusing on the transition towards a circular automotive supply chain.
GTF Berlin 2023	Berlin, Germany	14-16 June 2023	41	21F 20M	The Greentech Festival in Berlin convened environmental activists and industry professionals to explore sustainable technologies and solutions, including those within the automotive sector.
TechBlick Berlin 2023	Berlin, Germany	17-18 October 2023	32	9F 23M	TechBlick Berlin facilitated conversations among industry leaders and tech enthusiasts, exploring opportunities for circularity and sustainability in electronics and beyond.
Kongress BW Stuttgart	Stuttgart, Germany	15-17 November 2023	34	17F 17M	The Congress for Resource Efficiency and Circular Economy in Stuttgart provided a platform for experts to collaborate on implementing circular economy concepts across various industries, showcasing a commitment to sustainability. OBJ

Table 3. Event ethnography - circular economy experts

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2.4 Demographics and gender

The overall pool of ethnographic informants was self-selected – as car enthusiasts are people likely to attend these events. While we did not include a demographic survey designed to record the interviewees' age, income, and education level, we can make some general assumptions that the majority of the people interviewed are likely to have at least some disposable income and/or leisure time to dedicate to cars as a hobby, and to attending such hobby events. We assume also that a part of the interested public may be the big-sector-mechanics operators. All the car events yielded interviews with almost exclusively men, which is likely the function of the car sector being culturally "gendered" as more predominantly masculine than feminine, and which dovetails with social science literature noting that cars tend to be constructed as "masculine technologies" situated in cultural arenas (Wilson, 2003; Landstrom, 2006; Plugfelder, 2018; Havet et al. 2021). On the other hand, sustainability and circularity events in phase 2 yielded a more balanced sample in terms of gender, which is consistent with the finding by Barreiro-Gen and Puig (2022) that women's presence in sustainability research has been increasing in recent years. The gendered difference was meaningful in the project's second phase, which is reflected in our data analysis in the visualisation section.

2.5 SSNA Analysis

The data that emerged through ethnographic interviews allowed us to identify recurrent salient themes that informants used to discuss the topics under study. This, in turn, allowed us to identify and map the emergent discursive categories relevant to understanding how car owners/users conceptualise and affectively relate to the notion of circular economy in the automotive sector. After coding the interviews, we were able to construct a Semantic Network, which offers us a visual map of how and in what configurations people are linking the salient concepts about the specific topic of the study in the broader context of discourses about sustainability, personal responsibility, automotive politics, modernization and shifts towards electronic technology, etcetera.

3. Phase 1

This section covers the ethnographic team's insights based on the data analysis. So, notable concepts emerged in the interview transcription and coding process before SSNA visualisation and reduction techniques were applied. These insights, combined with visualisations, help us holistically understand our informants' discourses and perspectives. The combination of qualitative and quantitative methods achieved by combining the ethnographic insights with code visualisation can offer us either validation or deepening of the ethnographic insights through the visualisations or can reveal a divergence between ethnographic insights and emergent visualisations, which can indicate complexities and contradictions not detected by ethnographers in the first instance, and/or point to the opportunities for further refining the

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ethnographic research methods, e.g., iterating the interview questions to explore such divergences. Each insight reviewed below is also situated within relevant anthropological/cultural studies scholarship for a more robust context. The following is divided into two sections: synthesising insights and visualisation from Phase 1 of the project and the second from Phase 2.

3.1 Ethnographic Insights from Phase 1

The first ethnographic insight gleaned from interview data processing reveals that informants treat **sustainability as a cross-scale and collective phenomenon.** Ethnographic engagement reveals that sustainability practices are conceptualized on micro and macro levels; interviews yielded emergent discourse about behaviours and effects on a small and large scale and their (possible) relationship to each other. This insight is mirrored in the visualisations below, where we will see a cluster of codes around individual choice and behaviour and another around more political and social choices and phenomena. For example, one of the interviewees at the Stuttgart event explained: " For example, I don't eat meat. Again, that is connected to other issues. But if you really focus on it, if everyone reduces their meat consumption a little bit, everyone reduces their shopping behaviour, everyone reduces their consumption, really, then we can live better in a balanced way thinking ahead to several generations." Another interlocutor from the "Cars and Photographers" event noted, "So one can be fully vegan, can only be on the bike on the road, but there are also many small possible steps. And yes, the individual can also do a lot. But [this shift to sustainability] is more economically likely if large companies participate." This dovetails with the concept of "environmentality" which is shaping up to be an important conceptual framework for this project based on the data so far. Anthropologist Arun Agrawal defined "environmentality" as a "a framework of understanding in which technologies of self and power are involved in the creation of new subjects concerned about the environment." (2005). His definition references the notion of "governmentality" coined by political philosopher Michel Foucault who sought to understand and explain the political techniques by which a society is made governable, and by which the subjects of that society essentially internalize the governing-governed dynamic, removing the necessity for top-down enforcement. "Environmentality" following Agrawal has become a term applied to understanding the strategies and techniques by which environmental consciousness is cultivated in social actors who have either lacked it or even opposed it previously to such cultivation. It is a process conceptualised when a social actor considers themselves a part of something larger. It may think about and speculate how others could or should be acting. For example, an interviewee from the Stuttgart event says, "I think a lot of people are already trying to find a way. Whether hydrogen, electric, or hybrid solutions, I think the next few years will show what will prevail or whether people are really thinking completely in terms of other electromotive mobility."

The second insight highlights pervasive ambivalence about car electronics. Interviews revealed a certain ambivalence about the development of electronics in the car sector and the question of to what extent electronics can be a blessing and a curse at the same time. This is also in line

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with recent social science scholarship on "ambivalent technology" and the "need to find a balance between the positive opportunities of technology and the negative impacts and risks" (Dorrestijn, 2020, p. 14). In the cultural sphere, there are competing narratives that, on the one hand, frame the transition to electric mobility as welcome and innovative new stage of modernity, and gasoline-powered cars as recalcitrant dependence on fossil fuels, and on the other hand, gasoline-powered cars as legible and dependable, and electric car as an elite novelty, one that furthermore may take control away from humans, for many people, their perception of the automotive sector is negotiated in a space somewhere between those ends of the spectrum. A Stuttgart interviewee expressed concerns in a more affective way (pertaining to the feeling of sitting in the car and its ambiance) but also conditional, in referencing price – historically a variable factor, liable to change: "But I wouldn't switch purely to electric now. Not only because of the price but also simply this, this feeling of sitting in the car and somehow being pressed into the seat or having this noise from the engine." Another interlocutor from the same event also expressed concerns that were less about electric cars and more about the lack of their own expertise: "Because I simply do not know electronics, if there is something broken. I don't know, you can't always tell." A Technorama interviewee also had an affectively framed negativity – that of irritation. When the interviewer asked him about his experiences with electronics malfunctioning in cars, the interviewee responded: "Constantly! Constantly some lights go on. There is just too much information about the car over the data bus and then some control unit; if it doesn't work quite right or a problem comes up, a warning light comes on immediately. And, of course, that's a bit irritating for the average consumer." Some sentiments expressed inchoate anxieties. For example, another Technorama interviewee reflected, "When I think of electronics, I think of something rather threatening. Something elusive, something hard to control."

The last quote in the previous section and its invocation of control offers a segue into our third preliminary insight – into the issue of **fragmented agency.** In social sciences, agency is the capacity (inclusive of resources) to exercise one's will in the social world – it is often discussed in contradistinction from or in a dialectical relationship with structure. The structure generally refers to an interconnected set of social forces, institutions, and relations that shape, constrain, and/or enable human actors' thoughts, behaviours, experiences, and choices (see, for example, Giddens, 1986). One's ability to act in connection with political decisions is questioned or emphasized. The issues of electric cars and electronic components in cars, and circular economy-focused behaviours sit at the intersection of structure and agency and foster a certain degree of awareness reflection on the scope and limitation of choices people feel they can make in both of those domains, and awareness of choices (on various levels) being constrained by anything from the structure of electronic technology (where the driver has less practical control in the driving sequence than one does in older models of cars) to global political structures that a priori constrain the range economic and environmental choices people can elect in their lives. This sentiment was particularly prominent in interviews at Technorama, possibly because the crowd there was a self-selected group biased towards "classic" cars.

One interlocutor from Technorama noted that his agency as a competent expert on his car was constrained, changing his relationship with the car: "You can't do almost anything yourself anymore. You need, I'm going to say, a number, in 85-90% of the cases, a computer to do it. Just

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to give you an example, just to go back to my car. The first time I wanted to change my rear brake pads, I couldn't even get the callipers to zero position. I would have needed a computer to enter that." Another expounded upon this theme on a grander scale, critiquing the electric car development as an intrusion of power and control into a sector that previously offered independence and freedom to an individual: "You basically want to take away people's individuality, I think. Sure, I can drive way too fast, I can crash into something, I can fail as a human being. But of course, I always have the decision, and you actually want people to have the individual freedom to get in their car, drive somewhere, and not be accountable to anyone, and then sometimes make mistakes. That's what you want to take away from them. And that, I think, is a very unpleasant aspect of Europe. The one where you take care of things where I think to myself, they should leave me alone, I want to be left alone. The nice thing about the car is that's my thing and I get in it and I go where I want to go. And I don't ask anybody… I think the car used to be such a piece of personal freedom and I see it very threatened now." Another appealed to the lack of agency in the positionality of the consumer of an electric car: "So it's all far too complex that the whole thing... Let's put it another way: the pensioner who just wants to go shopping has to buy 1000 functions that he neither wants nor can operate, nor will he ever need. He has to pay for them with every repair, even though he doesn't need them and has never used them. So there's just too much that's automatically forced on the customer that he doesn't really need." Another interlocutor from the same event highlighted the lack of agency from a different angle when specifically discussing the issues of circular economy – according to him, what an individual can do is limited by the larger structure (of industries and institutions) in very concrete ways: "It's often not up to the consumer…if [he] has a 5-liter canister of used oil, he can only make sure that it is properly recycled, but he personally has no influence on what happens to it. If it is burned, it is reprocessed or poured away. He cannot decide that… Appropriate bodies have to be available, they actually have to get the whole thing going."

Constrained visibility of knowledge and politics: The communication and transparency of political decisions, processes, and economic interests regarding the automotive industry and its marketing is the subject of controversial debate. The question of transparency and its role in successful and sustainable regulatory regimes (beyond just the environmental or the automotive sector) has been the subject of numerous studies (Graham, 2002; Baldwin et al., 2012). Sentiments among the informants indicate that – perhaps dovetailing with the awareness of limited/fragmented agency, there is an awareness of a limited or constrained visibility into political systems and systems of knowledge and expertise associated with the electric car domain. The affective space here is that of scepticism and suspicion. Some informants critically invoked the logic of "planned obsolescence," that is, "the production of goods with uneconomically short useful lives so that customers will have to make repeat purchases." (Bulow, 1986). One Technorama informant said along these lines: "...A vehicle may not become so old. That's the way of today." Another Technorama interviewee discussed the same issue at greater length, seemingly aiming to illuminate the obfuscated aspects of electric cars that are at odds with the ideology of sustainability: "In the meantime, with the batteries, with the electric cars, you don't even have to start with the rare earths, which are overexploited somewhere in some ex-colonial states, which are then exploited at our expense. As before, it is politically impossible. Therefore, clear recycling definitely. But I must also say that the cars of the 90s, which are now being driven or pushed to the sidelines, could have been kept on the market for

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a long time with a few technological innovations, perhaps retrofit kits or something else. But these cars could have been kept on the market instead of a car that is produced today. After all, it's a throwaway society car that might run for another five years and then go into the garbage can or the press. And that is the problem with today's industry, which is simply consumption, consumption, consumption. Man today is just a grasshopper, no longer sustainable, just eats up the area, but leaves nothing behind. And that was definitely not as pronounced in the past with cars as it is nowadays. " An interviewee from the Cars and Photography event invoked the idea (without using the term) of greenwashing – managing the public perception so that electric vehicles appear to be more environmentally friendly, specifically focusing on the under-recognized danger of the lithium-ion batteries that are used in most of today's all-electric vehicles and PHEV. "And if you take a closer look at these lithium batteries, then such a battery should never leak, if it leaks, then the environmental damage is higher as when I now drive with my combustion engine, be it gasoline or diesel, through area, there is the pollutant emission much lower, as if now such a lithium battery leaks." While sentiments such as this last one suggest that the citizen actors may suspect and illuminate occluded knowledge, others emphasize the fact that there is no way for them to have all the information that would make it possible for them to calibrate their behaviour to be optimally sustainable. An example would be this quote from a Technorama interview: "We [customers] have the least influence…The industry has to specify that…It is like this, if water is offered in a recycled plastic, then I can buy this mineral water more easily than the mineral water that is offered in other units, for example .Well, if I have good, well-labelled products, then I can decide more easily as the customer - whether it's about a car or about food. With everything, if I know, I can decide; if I don't know, I can't decide."

Privacy and surveillance – we hypothesized this as a salient issue that is a likely barrier to embracing a recycling/circular economy in the electric car sector, and indeed, our informants aired several concerns. However, not all of them share them. A Technorama informant who specified that he has a professional background [in data security] said: "What bothers me eminently is the whole data exchange that takes place between the manufacturer and the vehicle. You can read out from the navigation systems which pub you were in last night. They can look up movement profiles, where I was the last two years on vacation and so on." Another Technorama informant weighed in: "GPS, all the systems with which cars are installed, which only serve to make the cars vulnerable from the outside, also for hacker attacks, code-breaker attacks and others, I think is absolute nonsense." Another said: "So the digitalization is drawing a level of surveillance into the car that I find very, very threatening and unpleasant." Yet another interviewee concurred that "The EU has passed it, the one law that GPS is stored in the control unit and that every car can be tracked and the data is freely available" (however, it should be noted that this sentiment was expressed during a group interview, and his companion commented: "I say, if 80 million data sets come, then who will read my data set? I have nothing to hide. I don't mind" after which the first speaker ended up concurring and saying, "if it helps sustainability then it's good, just don't abuse it." This issue is an especially important one to keep returning to throughout this research because social science literature has demonstrated surveillance and attenuation of privacy to be important concerns in various "modernisation" projects, and studies in social uptake of technological innovations, for example "smart homes"

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have shown that user acceptance of technology "has been shown to be linked to perceptions of privacy." (Hesse-Biber 2011)

3.2 Visualisations from Phase 1

Below, we move to the preliminary visualisations of the corpus of data gathered from these six car-themed "event ethnography" sets of interviews. The TREASURE corpus for Phase 1 consists of 4,466 posts in 103 topics, for a total of almost 147,237 words. There are 160 participants. This corpus was enriched with 5,664 annotations, which use 426 codes. The 426 codes are connected by 12,048 co-occurrence edges, many of them parallel (which means that the same two codes co-occur multiple times). Unique co-occurrences are 4,440. The association between perception of recycling and modification is the strongest one in the corpus, with 117 co-occurrences in the interviews of 54 informants. As is usual for codes co-occurrence networks, this particular network is too large and dense for visualisation. We therefore need to reduce it before visualisation. In what follows, we present this network reduced according to different criteria, to support different types of inference (Cottica et al., 2012).

Parametre	Value
Number of Posts	4,466
Number of Topics	103
Total Words	147,237
Number of Participants	160
Number of Annotations	5,664
Number of Codes	426
Total Co-occurrence Edges	12,048
Unique Co-occurrences	4,440

Table 4. Phase 1 network elements

In what follows, the Courier font is used to indicate ethnographic codes present in the data, for example: the concept of circular economy.

Reduction by edge strength

A first approach to network reduction is based on filtering out the weakest edges, i.e. those that indicate relatively low numbers of co-occurrences in the corpus. We interpret co-occurrence as association (two codes are frequently evoked together, hence are associated to one another by one or more informants); hence, more co-occurrences indicate a stronger association. We call the number of co-occurrences between two codes in the same answer of the same informant across the whole corpus the *association depth (d)* of those two codes.

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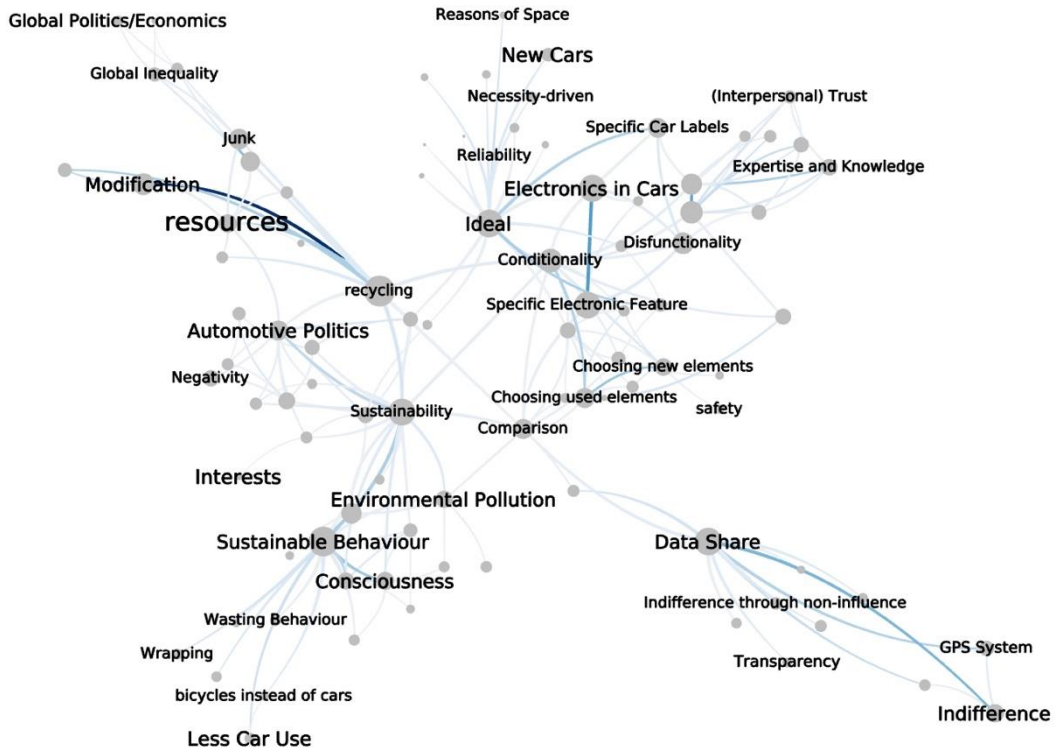

Figure 1: The reduced codes co-occurrence network of the TREASURE corpus (96 codes, 190 edges). Only the edges between codes that co-occur 10 times or more are represented. Brighter blue edges indicate higher numbers of co-occurrences, so deeper associations.

Figure 1 shows the code concept of circular economy (to the west of the graph) situated mid-way between two distinct clusters of codes. The first cluster aggregates codes around resources, modification, recycling – we can think of them as practical/how-to codes that are more corporeal or material in essence. The second cluster aggregates more conceptual codes, including sustainability and its relatedness to more social/global issues like politics and political measurements, as well as pertaining to feelings of agency and responsibility, which then branch off into discourses sustainable behaviour. We propose that that latter group of codes, positioned in the southwest quadrant of the graph, represent conceptualizations and discourses around self-discipline and cultivating the cultivation of the aforementioned ethos of "environmentality."

From that perspective, the concept of circular economy, which we surmise is not a "native term" of informants (which was initially pointed out by the interviewer member of the ethnographic team, and which accounts for its relatively small presence in the visualisations), could be seen as a node linking discourses about concrete material resources and how they are handled with discourses of sustainable praxis, and the political space of sustainability. There appears to be only a weak association between the circular economy and discourses about economic considerations (for example, cost effectiveness).

As mentioned in the ethnographic insights section, we hypothesized that the data sharing that is a feature in electric cars might be a barrier to an enthusiastic uptake of the circular economy because of privacy concerns. While certainly many modern vehicles, not just EVs, have GPS technology built in, EVs are recognized as nodes for "big data" technologies, and this role of electric cars is highlighted in the media: "Trip information is collected by the vehicle's computer,

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including start and end times of journeys, connect and disconnect times of chargers, and the battery level. Cars with GPS navigation systems can also collect detailed information about routes. And advanced systems can record details like how much the air conditioning is used, or how hard a driver accelerates." (Stewart 2013). This feature of contemporary cars is also discussed by data analytics scholars: "The data generated by electric vehicles come from *sources that vary from sensors to trip logs. Once this vast amount of data is analysed using big data techniques, they can be used to develop policies* for siting charging stations, developing smart charging algorithms, solving energy efficiency issues, evaluating the capacity of power distribution systems to handle extra charging loads, and finally, determining the market value for the services provided by electric vehicles (i.e., vehicle-to-grid opportunities). (Li et al 2017).

The visualisation does depict it as a salient topic, but not as central or prominent as we might have imagined it to be. This aligns with the mixed nature of interview responses on the topic, where some indicated it was a fraught issue, while others expressed that they had nothing to worry about with regard to data sharing, either because they did not think their own individual data would be discernible or catch anyone's attention, or because they had "done nothing wrong." The data share code is visible in the southeast of Figure 1.

An alternative approach to reducing the network on the basis of edge strength is to count, across the whole corpus, the number of informants that have associated each pair of codes in a single answer. We call this the *association breadth (b)* between two codes; it is a measure of the consensus that exists across informants about that particular association.

In the case of this corpus, the reduction with association breadth encodes similar information, because the correlation between *d* and *b* is very high (the correlation coefficient is 0.95). This is shown in Figure 2. a reduction with *b* >= 7. Brighter edges indicated higher values of *b*, so more informants endorsing the same association. Such a high similarity between depth and breadth is an indicator of broad consensus among the informants with regard to associations (so, while hypothetically association depth could emerge from a small number of voices being heavily invested in certain associations and producing them time and again, skewing the results, the association breadth validating the associations ensures that the associations we are seeing truly emerge from the cultural meaning map)

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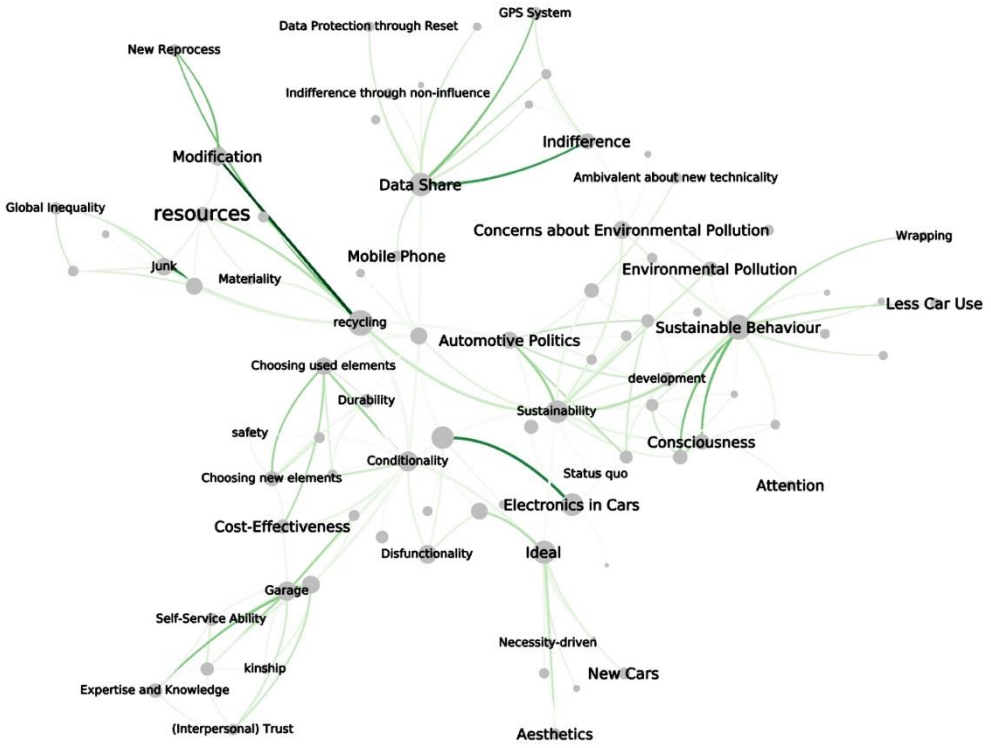

Figure 2: The reduced codes co-occurrence network of the TREASURE corpus (85 codes, 176 edges). Only the edges between codes that co-occur in the interviews of 7 or more informants are represented. Brighter green edges indicate higher numbers of informants, so broader associations.

Modularity

For further insight, modularity analysis was performed. The modularity value of a network is a number between zero and one. Zero indicates that the network has no discernible community structure: its pattern of linking is indistinguishable from that generated by a random process. High values indicate a pattern of linking that is unlikely to be random. The reduced network of Figure 2 is highly modular (Q = 0.72), which means it resolves quite naturally into a number of communities of codes, seven in our case. Figure 3 shows the same network as Figure 2, but this time codes and edges are color-coded according to the community of codes they are part of, as detected by the Louvain algorithm (Blondel et al., 2008).

Here is a more formal definition: Modularity (Q) (Q metric - Newman and Girvan, 2004) is a metric that measures the fraction of the edges in the network that connect within-community edges minus the expected value of the same quantity in a network with the same community divisions but random connections between the nodes. If the number of within-community edges is no better than random, we will get Q = 0. Values approaching Q = 1, which is the maximum, indicate a strong community structure.

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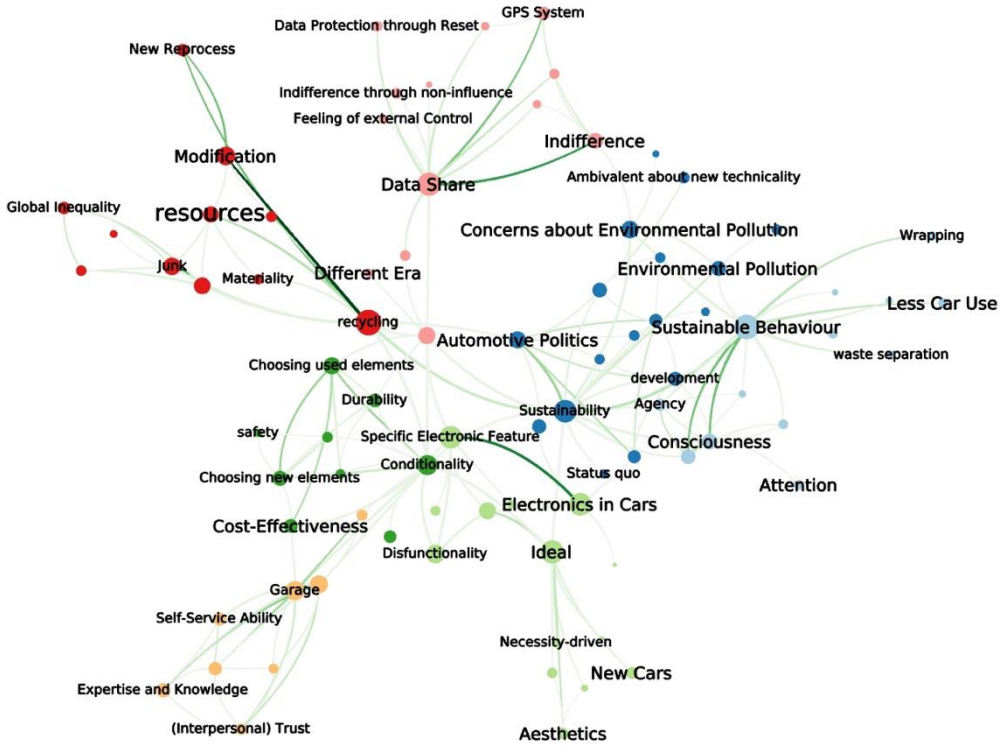

Figure 3: Modularity analysis of the network of Figure 2. The network resolves quite naturally into seven communities of codes, coded by colour.

The communities are semantically quite coherent. What follows is a list of all codes and their frequency by community.

- The light green community includes codes related to *pros and cons of electronics in cars*. These are: `'Ideal': 156, 'Electronics in Cars': 148, 'Specific Electronic Feature': 146, 'Dysfunctionality': 94, 'Specific Car Labels': 75, 'New Cars': 35, 'Aesthetics': 33, 'Relevant Features': 26, 'Necessity-driven': 23, 'Electronics as Comfort': 22, 'car electronics as controlling': 19, 'Appearance': 14, 'Reasons of Space': 11, 'Electronics as Entity': 9.`

- The red community includes codes related to *materiality and the circular economy*. They are: `'recycling': 198, 'Modification': 94, 'Junk': 83, 'Knowledge of transportation of useless electronics': 75, 'resources': 67, 'Global Inequality': 38, 'New Reprocess': 37, 'Effort to recycle': 29, 'Awareness of Inequality': 27, 'Materiality': 26, 'limits to recycling': 14.`

- The orange community includes codes related to *personal expertise networks*. They include: `'Garage': 101, 'Expertise and Service': 87, 'Expertise and Knowledge': 53, 'Careful Car Maintenance': 45, 'Self-Service`

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Ability': 43, '(Interpersonal) Trust': 32, 'Specific Service from Producer': 29, 'kinship': 24.

- The dark green community includes codes related to *deliberation/consideration by drivers*. They include:
  'Conditionality': 112, 'Choosing used elements': 79, 'Choosing new elements': 59, 'Cost-Effectiveness': 49, 'Durability': 48, 'Elder Automotives Models': 38, 'Guarantee of Quality': 28, 'Gradual Functionality': 24, 'safety': 17.

- The pink community includes codes related to *data sharing and surveillance*. They include:
  'Data Share': 156, 'Comparison': 78, 'Indifference': 65, 'GPS System': 44, 'Indifference through non-influence': 29, 'Mobile Phone': 27, 'Data Protection through Reset': 27, 'Global Surveillance': 25, 'Feeling of external Control': 21, 'Different Era': 19, 'Transparency': 18, 'Reluctance': 18, 'privacy': 13.

- The light blue community includes codes related to *systemic consideration of sustainability*. They include:
  'Sustainable Behaviour': 182, 'Consciousness': 63, 'Responsibility': 55, 'Agency': 37, 'Less Car Use': 25, 'Wasting Behaviour': 24, 'Self-Reflexion': 23, 'Attention': 23, 'Wrapping': 22, 'waste separation': 21, 'bicycles instead of cars': 15, 'Being independent': 15, 'public transportation': 13.
- The dark blue community includes codes related to *systemic consideration of sustainability*. They include:
  'Sustainability': 147, 'Concerns about Environmental Pollution': 83, 'Automotive Politics': 77, 'Environmental Pollution': 57, 'Ambivalent sustainability': 55, 'development': 51, 'Negativity': 51, 'Innovative Electronics': 43, 'Innovative Automotives': 42, 'Ambivalent about new technicality': 33, 'Political Measurements': 28, 'Ambivalent battery': 27, 'Market Strategies': 26, 'Emissions': 25, 'Status quo': 19, 'politics': 19, 'climate change': 14.

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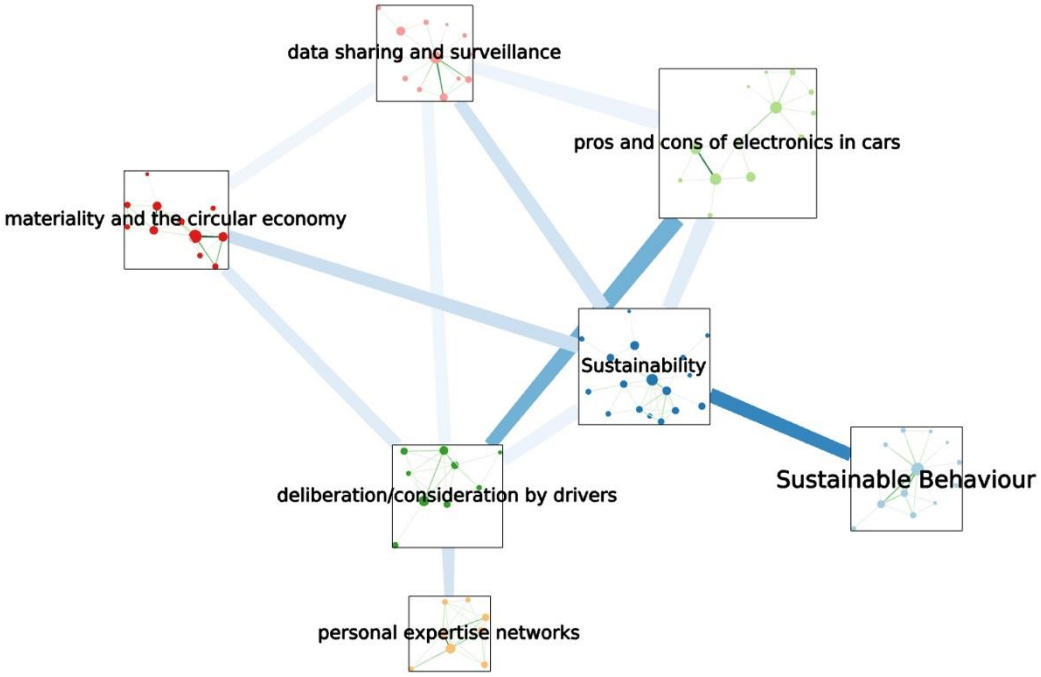

Figure 4: Community graph where the meta node represents clusters and edges the link between them.

The modularity analysis both resonates with the preliminary ethnographic insights, and dovetails with the association depth and association breadth graphs, and also offers possible nuances to delve into as the research project continues. Looking at the modularity visualisation, the following things seem notable:

- Concept of circular economy itself is located in the red group, which aggregates codes related to materiality and the specifics of recycling behaviour, modification, reprocessing. While the outer edges of this group touch on issues more conceptual and global in scope (e.g. `Global inequality`) overall the group is grounded in corporeality, materiality, and practice. That is a valuable insight for continuing to explore people's relationship to the idea of the circular economy.
- The orange group appears to contain codes that most closely pertain to an individual actor's experience with regard to car ownership and repair – their relationships with individual others in their community, and their networks of knowledge and expertise built around trust linked to the practices of car maintenance. `Garage` is the most prominent code in the group – we can think of it as a literal locus but also a symbolic space of knowledge and expertise that is close enough to oneself that it is not ambiguous or depersonalized.
- On the opposite end of the visualisation is the dark blue group, which contains codes that are more global and conceptual – consciousness, automotive politics, political measurements. Interestingly, this group also includes `sustainable behaviour` (light blue group) which as a meta-category might contain concrete behaviours that belong in the red group, but as a concept in and of itself is linked to larger institutional

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and political forces that shape the contours of what, exactly, sustainable behaviour is and could be. This harkens back to the ethnographic insight about fragmented agency and how the classic sociological/anthropological issue of structure vs. agency is a relevant framework for understanding this ethnographic domain.

- The light green group resonates with the ambivalence about car electronics outlined in the preliminary ethnographic insights section. The codes contained in this group stand for discourses of pros and cons pertaining to space, appearance, functionality, etc.
- The most notable thing about the dark green group of codes is the prominence of `conditionality` which stands for considerations and deliberations that social actors engage in when making decisions that can contribute to (or work against) sustainable initiatives, such as the expansion of the electric car sector and the strengthening of the circular economy therein. In the corpus, conditionality was a code marking hypotheticals – "I would do X under these conditions'' or "If it weren't for Y, I might purchase this kind of car." Examples from the corpus include: "If I had to pay for it myself, I would probably choose the golden mean. In the case of less life-saving parts, I might even buy a used part" or "So if I can afford it now and I say I've always wanted this car, I'll buy it now. Then I think it's perfectly okay to buy it. There are people who have a different attitude than I do, for example, who say I would like to have the car, but I don't want to buy it because it's unnecessary for me, because it's just a luxury." The relevance of the conditionality framework is that it can help develop a heuristic for potential acceptance of circular economy in the automotive sector – and it is not surprising that it links to another metacognitive code, comparison. In the process of coding, the ethnographic team found that feelings, emotions and ideas about circularity, recycling and sustainability in the context of automotive were often brought up in comparison to older car models, politics, times, styles, circumstances etcetera. Going forward with this research we can then consider comparison as a modality of sensemaking/meaning-making and use it to refine reflections and discourses about circular economy potential.
- Last but not least, the pink group contains the codes pertaining to data sharing and surveillance. This visualisation essentially mirrors the preliminary ethnographic insights on this topic: it is an area of concern, but not an overwhelming or monolithic one, skewing more towards ambivalence than absolute rejection.

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4. Phase 2

4.1 Research Design in Phase 2

Before delving into the design and substance of Phase 2 of our research, we want to acknowledge that activities in Phase 2 were informed by the feedback from the project reviewers we received during the first Review Meeting in Milan in February 2023.

Specifically, the reviewers' suggestion that we go beyond "car lovers" in our ethnographic sampling and provide a comparison between different perspectives was in line with our initial design and was accomplished in Phase 2. In this phase, the focus switched on different communities of meaning ("car unrelated public" and more specifically sustainability and circularity experts and advocates). We also took on board the suggestion of greater integration between our component of the project and the work of the other TREASURE partners. This was achieved in several ways, including presenting the first set of results (from D 4.5) at the biannual meeting of the International Society for Industrial Ecology in Leiden, NL from 2-5 July, where we had the opportunity to cross-pollinate ideas with other partners in the TREASURE consortium. Additionally, more recently, we facilitated integration through an ethnographic exercise we designed for the MOVEO Paris Spring School. Presenting the scope and possibilities of our research methods to consortium partners and potentially interested stakeholders, we conducted an ethnographic project in miniature, using Spring School participants as ethnographic subjects, and using data collected from them as source for all the methodological stages of a mixed-methods Ethnography/SSNA project: coding, visualisation, and analysis. The final result was presented at the Paris School meeting on 24 April 2024.

As a reminder, ethnographic interviews in Phase 2 focused on 5 events: Bern User Forum on Circular Economy, IARC 2023, GTF Berlin 2023, TechBlik Berlin 2023, and Kongress BW Stuttgart. These events were briefly outlined on p. 8 of this report, and a more detailed description of each event can be found in Annex A.

4.2 Ethnographic insights from Phase 2

Sustainability as a meaningful vision and activity

This section covers the insights of the ethnographic team based on analysing the data. Therefore, notable concepts emerged in the interview transcription and coding process before the data scientists and ethnographers applied SSNA visualisation and reduction techniques. These insights, combined with visualisations, help us holistically understand our informants' discourses and perspectives. The combination of qualitative and quantitative methods achieved by combining the ethnographic insights with code visualisation can offer us either validation or deepening of the ethnographic insights through the visualisations, or can reveal a divergence between ethnographic insights and emergent visualisations, which can indicate complexities and contradictions not detected by ethnographers in the first instance, and/or point to the opportunities for further refining the ethnographic research methods, e.g. iterating the

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interview questions to explore such divergences. Each insight reviewed below is also situated within relevant anthropological / cultural studies scholarship for a more robust context.

The first ethnographic insight considers sustainability a meaningful vision and activity, centring it as a visionary human-made product. Our informants recognise sustainability as a concept that occurs in everyday processes and procedures, which they experience and help shape. They can carry out sustainable practices in everyday life. As a result, sustainable activities are repetitive and practised in different ways and to various degrees. On the one hand, people determine the spectrum or intensity of sustainability. This makes people a subject capable of acting, whose agency, i.e. empowerment to act, determines the nature and behaviour of an individual. In the social sciences, this approach is known as theory-in-practice. Renowned representatives are Bourdieu (1977 [1972]; 1998), Giddens (1984), Foucault (1977), and Ortner (1984; 2006)), who placed the autonomous significance of a person and their actions at the centre of their works. For example, one interlocutor attending the BW Kongress in Stuttgart responded to the question of how he would exercise sustainability in everyday life with the following answer: "(…) that I don't fly too often, try to travel by train a lot, and also to inform myself a bit professionally about why it's important."

Reflections and ways to apply the forms and values of sustainable actions on an individual and societal level are action- and present-oriented, focusing on concrete examples and activities in everyday life of sustainable acting. It also includes one's own level of knowledge or the acquisition of knowledge to (actively) acquire and implement information about sustainability through education and practice and to use it for oneself and one's own purposes. Sustainability in practice is anchored in the present but tends to look prescriptively into the future. The two areas, "private-public", merge in sustainable visions, as sustainability becomes a lived everyday practice.

The vision has an ideological perspective that includes various approaches and combines tasks and problems relating to the environment, resources and energy sources that need to be tackled today and in the future. This consists of the self-chosen career choice, which has something to do with sustainability in the narrower or broader sense, but with which one strongly identifies, and which one also transfers to other situations in life. Based on the field research data, the code "Companies as sustainable Actors" shows a strong tendency to integrate and pursue a sustainable approach in everyday working life. The following statement by a participant at TechBlick serves to exemplify this:

"I already do it through my work by supporting sustainable technologies and also showing how companies can become more environmentally neutral. You shouldn't always say climate-neutral, but rather environmentally neutral."

Visionary sustainability also includes one's own level of knowledge or the acquisition of knowledge to (actively) acquire and implement information about sustainability through education and practice and to use it for oneself and one's own purposes. We observed that the informants were often somewhat torn as to the extent to which sustainable living can also be implemented in practice, as the following statement of a GTF attendee underlines: "Well, I first of all, I try to live consciously, not perfectly. You can't. I try to teach my children. Um, I often

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make decisions in my consumption for more sustainable products. And I work in the field of sustainability, which is also quite, quite a big step."

Educational and awareness-raising work is another measure for actively shaping sustainability in everyday life. One informant described this below: "[I want to have a] high impact on my kids and their friends and in a company. We have, for instance, installed photovoltaic panels to recharge the battery cars. Although I'm not driving any, there are enough people driving them around, so that would be my personal footprint and impact."

On the other hand, however, we must remember the structure that is needed to shape and determine sustainability actively. The structure here involves an interaction between norms, values, institutions and cultural aspects that define and influence the actions and behaviour of human actors. Against this background, structures are legal or economic provisions that stipulate sustainability as a regulation, guideline or measure. For example, this can be expressed in legal norms, i.e., legislation on how companies in the automotive industry produce more sustainable cars in terms of resources, energy consumption, and working conditions. An example would be this quote from an interview at the Cars & Photographers event: "So they're already doing something. I still think that they have their [recycling systems]. I mean, we have recycling systems in our company, and they will have that, too."

Circularity as a continuous result in circular economies

The second insight shows that circularity in the automotive industry, electronics, and environmental contexts is deemed economically feasible when it acts as a closed system to the outside world. Completing a "cycle" or enhancing current cycles requires changes or expansions within individual structures or functions of the entire system. Circularity, thus, represents an ongoing process outcome. Components such as "reuse" and "recycling" evolve constantly based on input and strategies. This encompasses sustainable actions, changing human behaviours, and evolving perspectives towards sustainable practices. For example, an interlocutor who participated in the BW Kongress in Stuttgart invoked the idea that "(..) [y]es there is a whole spectrum of ways to reuse our products. Recycling is undoubtedly not the most sustainable, but it has shifted to reuse." It's a theory-in-practice process where not only self-defined definitions of specific procedures or processes are crucial but also moral imperatives that can influence technologically or anthropologically determined epistemological insights. Here, the circle connects descriptive action-based elements with prescriptive future-oriented ones. Sustainability serves as a driving force to close the loops. For example, one of the interviewees explained: "After all, the circular economy is more than just recycling." Another participant at the same event weighed in: "(…) thinking and acting holistically, starting with myself, from eating to consuming to working, to inspire as many people as possible. With my being, with my existence, I want to inspire other people to live the same way." Circular economy is a widely used concept in social sciences rooted in the Kula trade (Malinowski, 1922) and Mauss' gift perception (2016 [1954]). It represents a give-and-take exchange as an altruistic form of trading with each other. The concept contrasts with the ideological notion of the neoliberal market economy, which aims to maximize the interests of and benefits to the market within the limits of the law and normative order, excluding any forms of gradual commitment such as loyalty,

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kinship, or friendship. The concept has been criticized, reinvented, and redeveloped, particularly by Edward P. Thompson (1980) on moral economy. Based on reciprocal giving and receiving, the concept is linked to obligations and agreements. One party exchanges service with another under the conditions of a reciprocal gift. The services are only received if there is mutual benefit, which emphasizes the receiver as the primary driving force of the agreement. Therefore, such an altruistic form is grounded in moralities such as beliefs, values, and norms and imbued with an understanding of and desire for justice. The moral economy embodies a particular corpus of norms, duties, responsibilities, and values. Its moral message can mobilize forces to act. Thompson discussed the concept of moral economy, describing the rise and growing need of the working class, a labour force needed in the industrial economy. At the centre of the analysis were the ideas of legitimacy and basic assumptions of a good and just life, which led to protests by the working class. It dovetails with our gained data material about moral ideas as a prospect regarding environmental and social changes, as the following statement by another BW Kongress visitor shows: "(…) this [circular economy] is the way to solve many problems in our world."

This convergence of the circular economy concept with moral economy underscores how ethical principles such as justice and moral values can be integrated into economic frameworks. It presents a promising approach to addressing both ecological and social challenges, hinting at a pathway where the circular economy can tackle numerous issues in our world. By embedding the concept of the circular economy within a moral context, it offers a comprehensive perspective on sustainability and social change as the next quote from a TechBlick interviewee demonstrates: "The circular economy. It's an economic system that wants to replace end of life with different concepts at different levels. So not just at the product level, but also it's relevant for cities and regions and countries. Sorry. And it's to the betterment of the current generation and future generations. Not only money wise, but also all kinds of societal aspects." The final quote in this context - shared by an individual interviewed at the BW Congress in Stuttgart- merges circularity and change, thus serving as a bridge to the subsequent insight on social transformation: "When we start to think and operate in cycles, and no longer in a linear fashion, I have great hope that this will change things for the better."

Social change is only guaranteed through societal commitment

The third insight shows that large parts of society have become more aware of social transformations in the areas of the environment, fossil resources, and renewable energies. The broader acceptance of this societal awareness is illustrated through the condensed remarks of specific informants, such as this attendee at the Kongress BW in Stuttgart who questions the necessity of societal change with the statement, "Especially when you look at the landfill sites in Africa." An interviewee at 4WD Oss emphasizes an alleged distinction between regions or countries: "Because I think we in the Netherlands we do a lot about it, but we also have to in the States, in Africa, that kind of countries, China." A third person who has also attended the 4WD Oss is concerned about future generations: "If we do not act now, our children probably won't have a liveable future". Such fear and actual concerns merge with the stated need and urgency to change things, as this statement by an interviewee at BW Kongress in Stuttgart clearly shows: "Because we are already living so close to many tipping points." The last quote to this is an

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appeal to change and, therefore, promotes a "habit turn" comes from an IARC attendee: "Everybody needs to take up about the environment because the CO2, you know, is a carbon emission. It is really dangerous now. You cannot go like this. We need the human need to be quickly stop this happen."

The topicality and development of our planet, combined with impending climate change, is a real political concern that also affects the automotive industry and other industries.

A relevant element of this insight on social transformation awareness here is changes "on a small scale", i.e., in individual everyday areas of life, and at an economic and political level, global and local concerns are combined and sometimes strongly separated from one another. The individual power to act is sometimes seen as a potential for empowerment, sometimes as powerlessness. One visitor at TechBlick states, "I would say it's like middle tier of responsibility because those personal choices won't revert the environmental issues."

Our data analysis shows that a collective, solidarity-based demand for social and environmental change is needed, which must be multidimensional to achieve more significant and sustainable change. Hope, as highlighted by Freire in 1992, plays a crucial role in shaping the course of social change within a collective and holistic perspective.

Global dynamics (such as value chains, partnerships, or agreements/contracts in producing car electronics) need to be reshaped in favour of social and environmental benefits as this subsequent quote from a GTF participant sums it up: "It's definitely international. It affects all of us, especially with just the level of global trade that takes place in modern day. It's something that needs to be combated together and the responsibility that needs to be assumed by everyone for it to function and change to take place."

However, the collective understanding is often ambiguous and - although defined as "we" - no holistic and globally all-encompassing unit is formulated. Although the "need for global action" mentioned above is clear and broad, there are also clear distinctions and demarcations of an intersectional dimension (about social origin, gender and race). In the social sciences, such an argument is in critical and postcolonial theories, where ruptures between the global South and North are undeveloped or developed. It would also be time to change direction here and demand accountability (Rodney 2018 [1972]). The "we" is then problematic and does not fulfil their demand. Following up on this, in a social contract accountability is owed to both the weaker and the powerful actors in society. This unequal perspective requires holding all parties responsible for their actions.

Decision-makers in realms such as politics, business, and industries such as automotive have the responsibility and obligation to establish a standard. Policies and legal actions are increasingly crucial tools for oversight and responsibility, requiring constant refinement, enactment, and supervision.

The final quote by a TechBlick participant encapsulates the idea of holding state institutions, politicians, and influential industry figures accountable, while also demanding a framework from them that fosters social change and allows for practical implementation. "We are very short sighted in making decisions. So I think we need more direction, guidance and sometimes ruling from more governmental authorities."

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Electronics in cars may be seen as obstacles to circularity and sustainability

EU Directive (2000).. /53/EC on end-of-life vehicles specifies that by 1 January 2015, Member States shall ensure that ELVs are treated by specific targets: at least 85% of the vehicle's weight must be reused and recycled, with a maximum of 10% of the weight going to landfill. Furthermore, a minimum of 95% of the vehicle's weight must be recovered. These targets aim to promote the environmentally sound recovery and recycling of materials from ELVs, reducing the environmental impact of vehicle disposal and promoting the efficient use of resources. This is accomplished because Al, Fe, and Cu represent around 95-96% of the total weight of the car, while electronics represent 1%, and it is not always cost-effective.

In this context, we can also consider the following ethnographic insight from the interviews conducted at the sustainability and circularity-themed events: Electronics in cars are often seen as obstacles to circularity and sustainability precisely because of the composite nature of the metal amalgams involved in electronics, and what recycling and closing the loop with them involves. There is a common cultural association between the shift to electronic parts in the automotive industry and more green production and sustainable design for reasons that make sense: electronic components, such as engine management systems and hybrid technologies, are typically considered to be advancements that contribute to better fuel economy and reduce environmental impact compared to older systems. However, across the interviews, when we posed the question of whether the circular economy was possible in the context of the automotive industry, we repeatedly encountered hesitation, ambivalence, or scepticism about the purported greenness and sustainability of electric components in cars, including electric cars, even though it is a commonly held cultural belief that the utilization of electronic mechanisms and components in cars is simultaneous with a greener, more sustainable, car industry. Granted, our interlocutors were largely self-selected experts in various aspects of sustainability or sustainable-adjacent fields. However, it was still notable, as was their reason for scepticism/hesitance: electronics in cars typically have a composite nature and are composed of metal amalgams. Separating and recycling those metal amalgams and closing the loop about all of them is frequently seen as a task that is in and of itself difficult to manage sustainably, much less one that would allow for a truly circular economy. When one interviewee at the IARC was asked whether electric components in cars made the transition in the industry to a circular economy easier or harder, they said: "Probably harder. Because of the components in the individual cars. And I believe you can get this directly from the menu from the OEMs. The cost of getting one specific element may be extremely difficult and it may be in some cases not even safe for the health and safety of the worker." Another IARC interlocutor said: "I think it depends where the electronics are sourced. You know, traditional cars, if you're just talking about steel and rubber or wire, you know, it's fairly that's actually easier because there's fewer levels of manufacturing that go into it. Whereas with electronics, right. It seems like I'm not an expert, this is not my field, but it takes more levels of manufacturing. It takes more rare earth metals, it takes more intensive processes, and the pieces are less simple to be recycled into the next car or the next generation of anything. They tend to be waste [sic]." At the GTF event, an interviewee echoed the same concern over the complexity of composite electronic parts and

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what that means for end-of-life considerations: "It's harder in the case that you have to get all the different materials out of the car. So of course, when you have more electric devices in it, you have to get or separate the stuff. And that's a difficult question when you have PCBs. The cable harness, everything is like sticking together and that has to be separated." This dovetails with increasingly granular research in academic and practitioner research and development literature (Murdock et al., 2021).

At the same time, in a more optimistic vein, when an IARC attendee was asked in an interview, "In your opinion, can a circular economy be implemented in individual sectors or industries?" they answered positively, making an analogy with technology and infrastructure for bottle recycling: "Yes, definitely. The bottle recycling technology has been there for a long time. And then also it comes with a real, let's say, the collection systems and all of that. So if you put the regulations right, so if there is a deposit system, for example, so people really bring the bottles back, then the technology is also there to remelt those and create new bottles for that. So this is one example in metal recycling, So this is one example in metal recycling, there are many others because metal has a value. And if you think about a car or if you think about UBC's used beverage cans, for example, if the collection system works, you can infinitely recycle them. The same you can do with cars. When they are shredded. You can extract the aluminium, for example, out of the stream, the ferries, all of the metals. And those are then infinitely recyclable and can be even changed to the physical or the chemical compositions later on in the melting process. So those are two classical examples." The interviewee acknowledges that it's far from a perfect system in the present day, and concludes by saying that "of course there is a lot to do still in both worlds in metal recycling, but also in plastics and waste recycling" – but it is notable that through analogic thinking and connections to a different area of circularity and sustainability, they are able to see the potential to scale similar economic incentives and technical solutions to make them applicable to electronic components in cars.

Reusing and recycling are not the same; reuse is better

The next ethnographic insight tells us that reuse and recycling are not seen as identical or sequential actions. This fits well into the research demonstrating that not all sustainability-oriented actions are seen as interchangeable or equal (Escario et al., 2020; McClaran et al., 2020). Additionally, reuse has a much more positive connotation among the sustainably-minded contingent than recycling (which differed from the findings from the car-focused events, where fewer interviewees differentiated between the two actions or viewed one as superior or inferior to the other). Interviewee perspectives on this difference include the following sentiments: "Recycle and reuse is not the same. Reuse is that you keep using it. Recycle is still the end. So recycling is better than just, you know, dumping it. But it's not the same. It's different. Different things." (Bern Circular Economy Forum attendee); "Yeah. I mean, reusing is better than recycling. Turning one piece into something else is always more energy intensive than just using it again. So for me, anything that promotes reusing, so being able to extend the life of an object is better than being able to recycle that into something else" (GTF attendee); "I think recycling is a last resort and it doesn't really work, at least in the current systems we have today. They're very outdated. So reusing is definitely a better option and something that I think has a lot of room for creativity as well. And I think it's beautiful what we can create when we start thinking about

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outside of the box and trying to make value of the things that we already have" (another GTF interlocutor).

The perspectives shared in these interviews shed light on the nuanced differences between reusing and recycling, emphasizing the superiority of reuse over recycling. While recycling is acknowledged as a better alternative to simply discarding items, some note that it still represents an endpoint in the material's life cycle. Reuse, on the other hand, involves extending the life of an object without significant alteration, minimizing the energy and resources required for transformation, which is seen as a positive from a sustainability-minded perspective. This distinction is highlighted by the statement that reusing involves utilizing components as spare parts without extensive modification, while recycling involves breaking materials down to composite elements/metals for recovery. As one GTF user said: "it means different things to me because reusing it means you take a component, and you reuse it as a spare part. You don't change much, you just use it in a different vehicle. And recycling means that we go down to the level of elements that can be recovered or gained from different materials." The consensus among these interviewees (which is representative of a perspective of a number, although not all interviewees) is that promoting reuse aligns with sustainability goals more effectively than relying on recycling, which is often viewed as a last resort due to its energy-intensive processes and limitations within current systems. Moreover, reusing is seen as a creative endeavour that encourages thinking outside the box to extract value from existing resources, reflecting a shift towards more innovative and sustainable practices in material management. This dovetails with a recent emphasis in scholarship on theorizing and studying the relationship between sustainability and creativity (see, for example, D'Orville, 2019 or Mitchell and Walinga, 2017) – a link we will return to in the end in our actionable policy suggestions.

If individuals have responsibility, it is primarily as consumers

Our last ethnographic insight from Phrase Two is as follows. There are variable opinions on individual responsibility when it comes to sustainability. However, when individual responsibility is seen as high, it is generally in conjunction with understanding the individual as a consumer/agent of decisions around ethical consumption, fast consumption cycle, or planned obsolescence. The following sentiments were shared by various participants interviewed at the IARC event. One noted: "I mean, it should also start with government law, but also individuals can do a lot about it if they have the money" linking personal responsibility with purchasing power and positioning it as complementary to top-down legislative power. Another IARC attendant linked consumer influence with voter influence, placing the responsibility for choices in both arenas on the individual who can make decisions around purchasing products and voting for political representation: "everybody is very, very responsible and we have so many possibilities to help here. We can consume in a responsible way. We can vote [for] the right parties and we can [make] the right financial decisions." Another IARC participant said: "To be honest, I don't think that the big change in the environmental crisis and situation is linked to single person behaviour, like low packaging, low waste and so on. I think it's more, uh, the mindset and the choices as a consumer to choose not to buy from one company that is not behaving ecologically as we would like to, can be a bank can be…We can as consumers give money to the companies that are going in the right directions." These sentiments resonate with

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the framework discussed earlier in the report about the classic "structure versus agency" sociological problem, where competing interpretations locate social change in large structures that govern and shape individual decisions or, conversely, in individual power that shapes social institutions and structures. Arguably, this point of view, repeated by our interlocutors, mediates between the poles of structure and agency by locating power in a figure of the individual agent, whose agency is constituted through his participation in the structure of consumption. This insight resonates with recent literature on consumer empowerment (Papaoikonomou & Alarcon, 2015), moral agency and ethical consumption (Manyukhina et al., 2017), and Quastel's 2008 work on ethical consumption and self-governance, which draws on Foucault to understand virtue ethics involved in consumption choices.

4.3 Visualisations Phase 2

Below, we move to the visualisations of the corpus of data gathered from these "event ethnography" sets of interviews (*'TechBlick,' 'GTF Berlin,' 'Kongress BW Stuttgart,' 'IARC 2023', 'Bern User Forum'*). The TREASURE corpus for this second phase consists of 6,573 posts in 153 topics for 242,491 words. There are 172 participants. This corpus was enriched with 6,432 annotations, which use 674 codes. 14,264 co-occurrence edges connect the 674 codes, many parallel (meaning that the same two codes co-occur multiple times). Unique co-occurrences are 5,595.

Parametre	Value
Number of Posts	6,573
Number of Topics	153
Total Words	242,491
Number of Participants	172
Number of Annotations	6,432
Number of Codes	674
Total Co-occurrence Edges	14,264
Unique Co-occurrences	5,595

Table 5. Phase 2 network elements

The association between Data Share and GPS System is the strongest in the corpus, with 114 co-occurrences in the interviews of 36 informants. As it is not our primary purpose, look at the second, more vital link, "Sustainable Behaviour" and "CE in daily life," with 108 co-occurrences in the interviews of 32 informants.

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As with the co-occurrence networks in the first phase, the codes' co-occurrence network in the second phase is too large and dense for visualisation. We, therefore, need to reduce it before visualisation. In what follows, we will use the same reduction techniques as the first phase (Cottica et al., 2012).

Reduction by edge strength

Filtering out the weakest edges of the network allows us to reduce drastically the number of edges and then the visual complexity of it. Two association properties are computed for an edge *"e"* connecting code1 and code2. *Association depth (d)* denotes how many times code1 and code2 are present in one or more informants' answers, and *association breadth (b)* indicates how many informants used code1 and code2 in their answers. Our first approach will reduce the network based on the *association depth* properties. We can filter this information if two codes are rarely present in the entire corpus. According to a threshold "*t"*, every edge "*e"* with a depth value lower than "*t"* will be filtered. How does one choose the correct value for "*t"*? The aim is to reduce the number of edges to simplify the layout but keep enough edges to describe the relation between network parts. For a high value of "*t"*, the resulting filtered graph will be a graph with few edges, but it will be disconnected. We will not be able to link the remaining concepts together. Therefore, a trade-off between the number of filtered edges and the number of disconnected sub-graphs should be found.

A threshold value of 6 (*cf. Figure 5.1*) ends up with a graph that is still crowded, and cluster identification is fuzzy. There are still too many links. Figure 5.2 shows the good trade-off with a threshold value of 7, where clusters and their links with others could be identified. A threshold of 8 (*cf. Figures 5.3*) and 9 (*cf. Figures 5.4*) give graphs that are readable enough to catch significant clusters, but links between them could be hard to follow.

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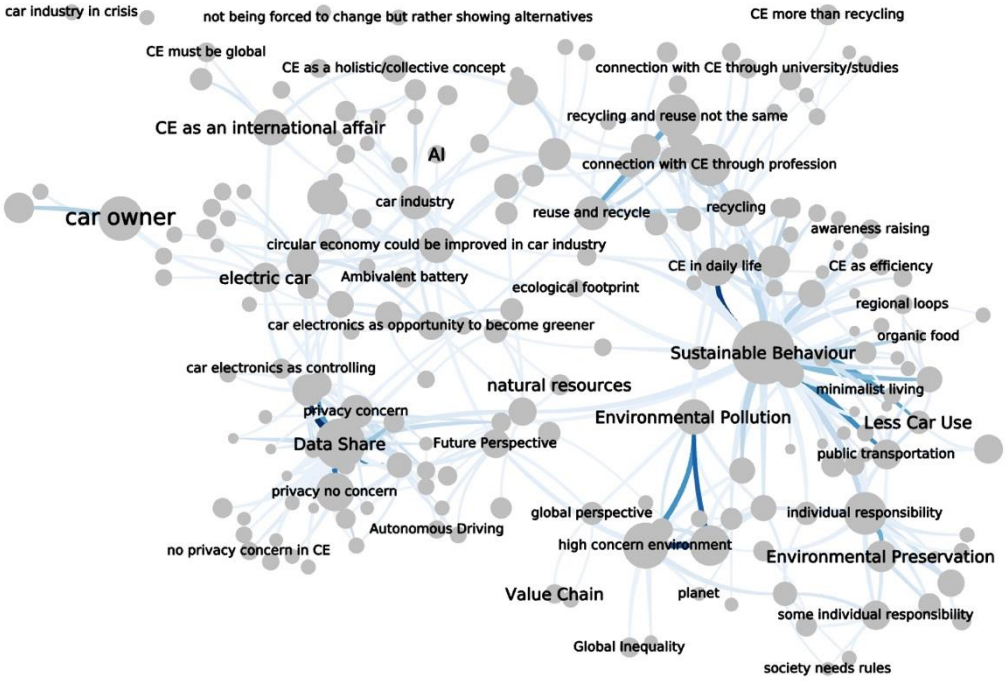

Figure 5.1: The reduced codes co-occurrence network of the Sustainable TREASURE corpus (207 codes, 425 edges). Only the edges between codes that co-occur 6 times or more are represented. Brighter blue edges indicate higher numbers of co-occurrences, so deeper associations.

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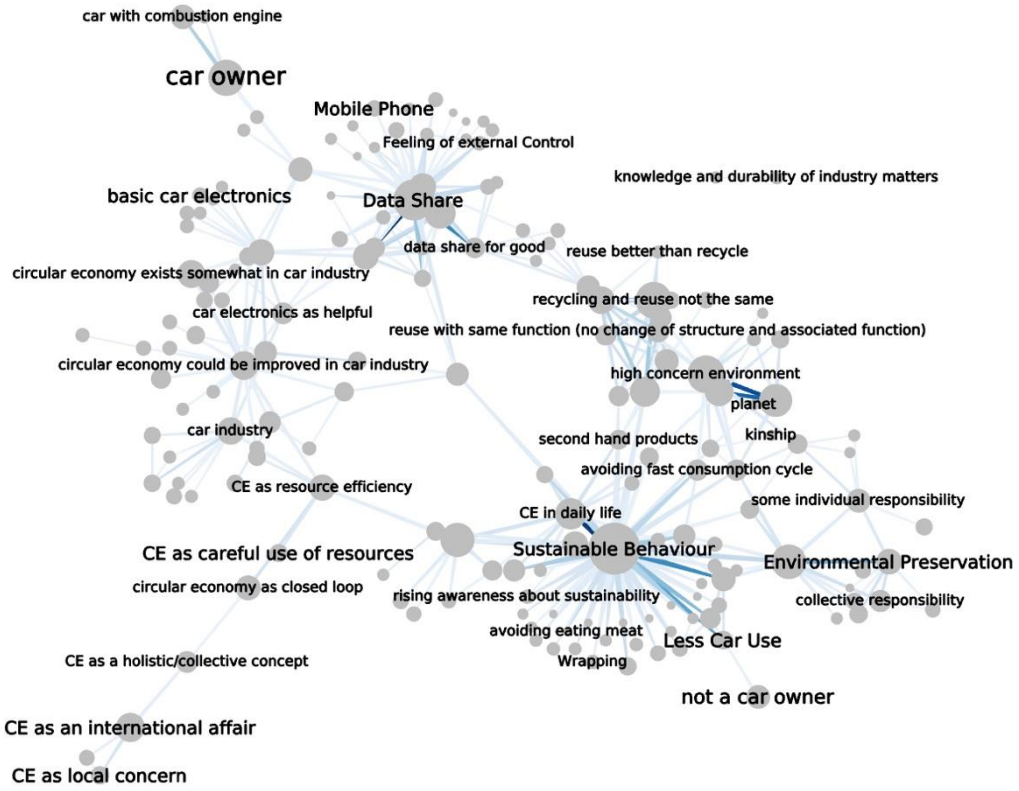

Figure 5.2: This figure is used to describe the network because it offers the best visibility. The reduced codes co-occurrence network of the Sustainable TREASURE corpus (172 codes, 315 edges). Only the edges between codes that co-occur 7 times or more are represented. Brighter blue edges indicate higher numbers of co-occurrences, so deeper associations.

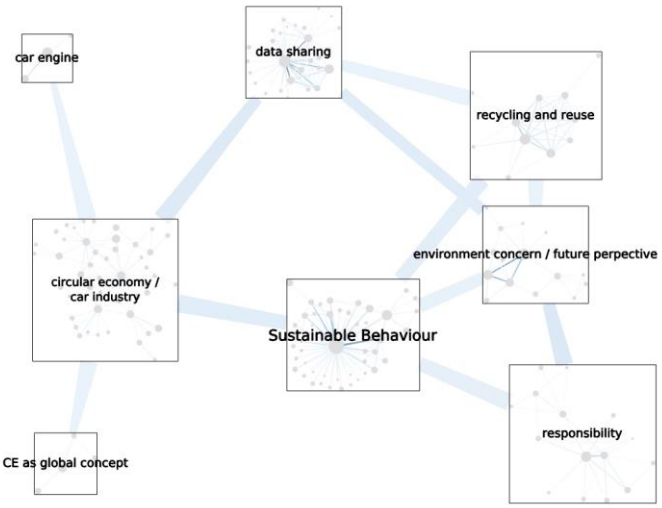

Figure 5.2b: Meta nodes showing cluster links.

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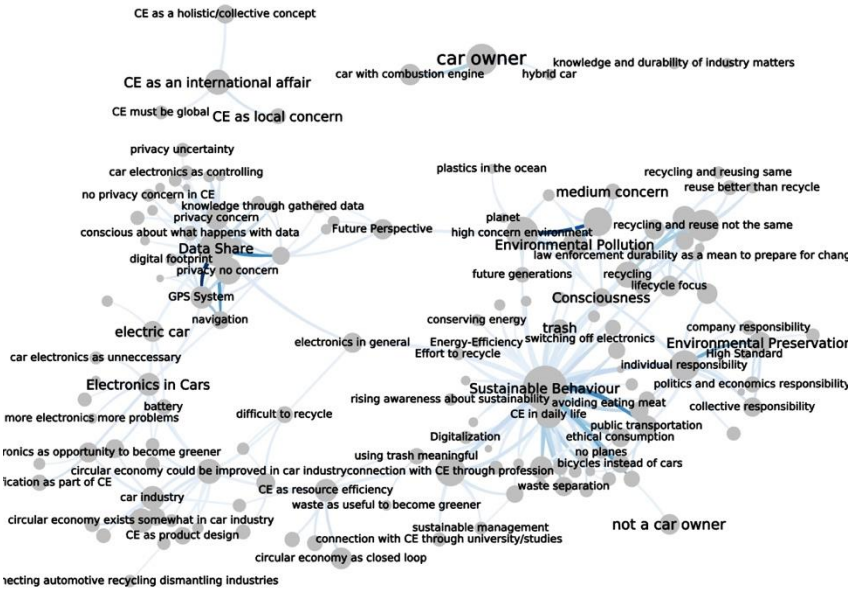

Figure 5.3: The reduced codes co-occurrence network of the Sustainable TREASURE corpus (152 codes, 257 edges). Only the edges between codes that co-occur 8 times or more are represented. Brighter blue edges indicate higher numbers of co-occurrences, so deeper associations.

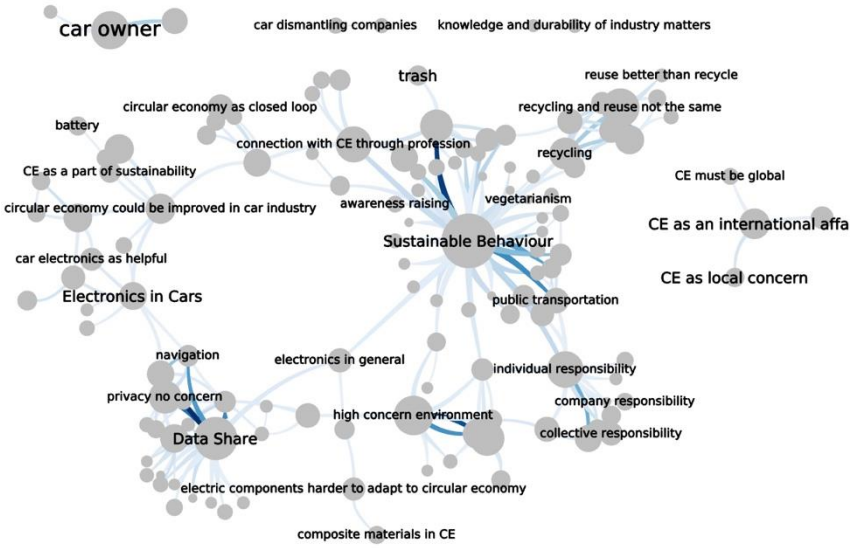

Figure 5.4: The reduced codes co-occurrence network of the Sustainable TREASURE corpus (132 codes, 212 edges). Only the edges between codes that co-occur 9 times or more are represented. Brighter blue edges indicate higher numbers of co-occurrences, so deeper associations.

Combining these different views could produce a good description of the network. We will base the description on the network and meta-view of Figure 5.2.

'Circular economy' related codes are located west of the graph. A first 'global concept' cluster (in the southwest) aggregates codes related to more global concepts ('CE as a local concern,' 'CE must be global,' 'CE as an international affair,' 'CE as a holistic/ collective concept'). Following edges, this cluster is linked to only another cluster (on the west) that aggregates codes around resources and efficiency concepts ('CE as resources efficiency,' 'CE as careful use of resources').

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This cluster is linked to all waste-related ('using trash meaningful') and Sustainable Behaviour ('connection with CE through profession') codes (in its west) and the 'circular economy and car industry' cluster in the north. The 'circular economy and car industry' cluster (west of the graph) has (in it north) 'Electric in Cars' that link to the 'Data Sharing' cluster (in the centre north) and a more isolated cluster (in the northwest) related to 'car engine' technologies.

The 'data sharing' related codes are located in the northern part of the graph. This cluster contains codes related to 'privacy,' 'data protection,' and 'Mobile phone' internal subjects. Codes such as 'GPS System' and' navigation' link to the car industry. This cluster is also linked to recycling and reuse clusters through codes like 'Data share for good' and 'Conditionality.'

On the west of the 'data sharing' cluster is the 'recycling and reuse' cluster ('recycling and reusing same,' 'reuse better than recycling,' 'CE as reuse'). Reuse and recycling codes are strongly linked to environmental concerns ('Concerns about Environmental Pollution,' 'climate change,' 'planet,' 'future generation', 'Consciousness') and Sustainable Behaviour ('second-hand products,' 'avoiding fast consumption cycle').

Our first approach reduced the network based on the association depth properties. The second approach uses the association breadth property. Recall that association breadth (b) indicates how many informants used code1 and code2 in their answers. A high value of association breadth for an edge between two codes indicates that many informants have made the association of the corresponding codes. This could be seen as a measure of the consensus among informants about that particular association.

In the case of this corpus (Sustainable corpus), the reduction with association breadth encodes quite similar information because the correlation between d and b is high (the correlation coefficient is 0.88). However, some differences can be observed locally: we have a broad consensus among the informants about associations, but for a few codes, this is different. The association depth reflects that only a few informants used a code association too often, ending with a high value. In contrast, the rest of the informants did not use this association. The breadth property makes sure that informants broadly share the association. Figure 6. shows a reduction with b >= 4. Brighter edges indicated higher values of b, so more informants endorsed the same association.

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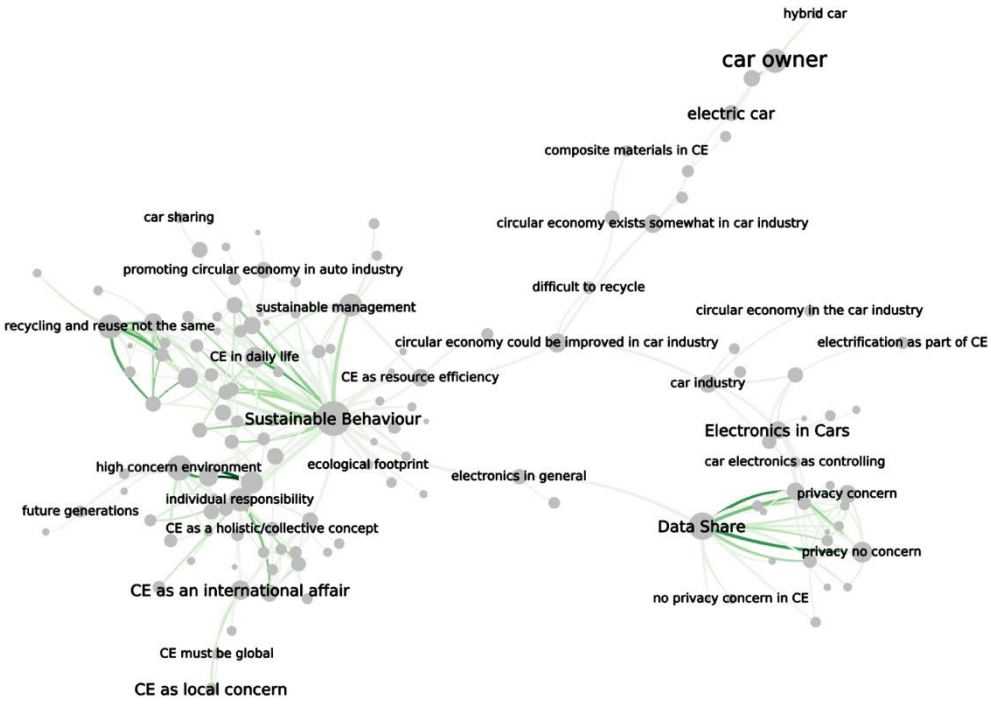

Figure 6: The reduced codes co-occurrence network of the TREASURE corpus (85 codes, 176 edges). Only the edges between codes that co-occur in the interviews of 4 or more informants are represented. Brighter green edges indicate higher numbers of informants, so broader associations.

Modularity

As in phase 1, modularity analysis was performed for further insight. The reduced network of Figure 6 is highly modular (Q = 0.7), which means it resolves quite naturally into several communities of codes, seven in our case. Figure 7 shows the same network as Figure 6, but this time, codes and edges are color-coded according to the community of codes they are part of, as detected by the Louvain algorithm (Blondel et al., 2008).

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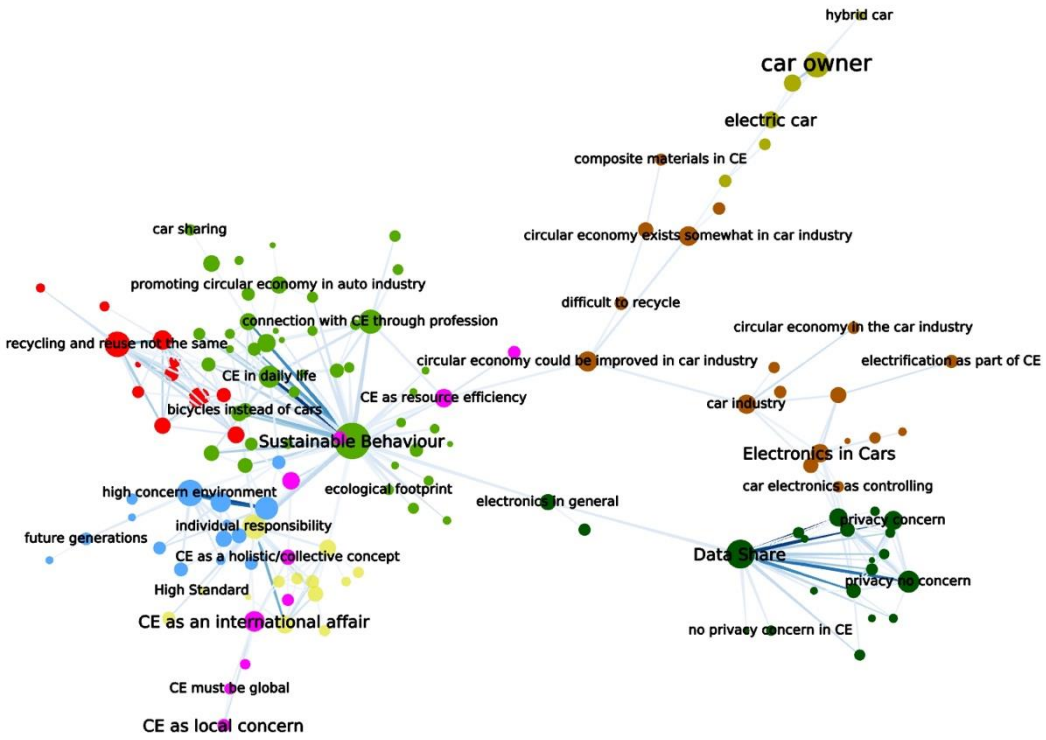

Figure 7: Modularity analysis of the network of Figure 6. The network resolves quite naturally into seven communities of codes, coded by colour.

The communities are semantically entirely coherent. What follows is a list of all codes and their frequency by community. The list is sorted by the more frequent first:

- The red community includes codes related to *recycling and reuse*. These are: `'recycling and reuse not the same': 129, 'recycling': 82, 'reuse and recycle': 66, 'lifecycle focus': 47, 'reuse with same function (no change of structure and associated function)': 43, 'reuse with not the same function (change of structure and function)': 34, 'reuse': 32, 'recycling and reuse as a multi-stage system': 22, 'CE as reuse': 18, 'recycling and reusing same': 16, 'reuse better than recycle': 14, 'New Reprocess': 4`

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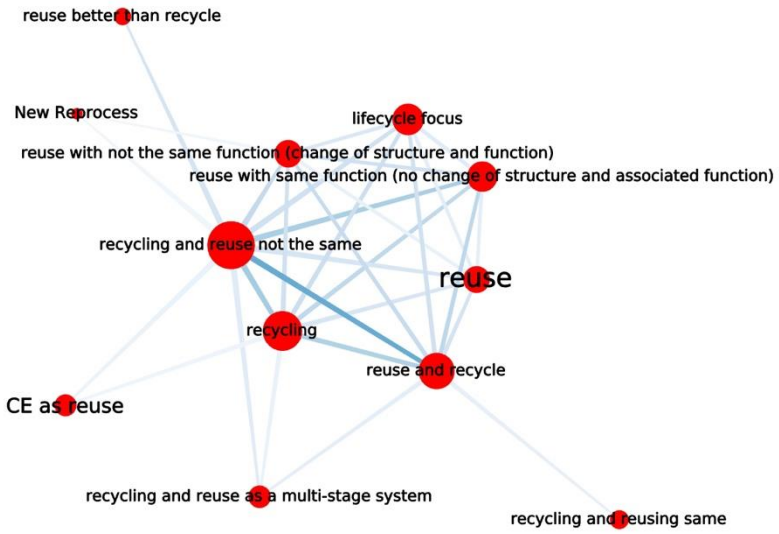

Figure 7.1: The subnetwork of Figure 7 with a focus on the red community - recycling and reuse.

- The dark green community includes codes related to *Data Sharing*. They are: 'Data Share': 171, 'privacy no concern': 89, 'privacy concern': 63, 'GPS System': 57, 'electronics in general': 37, 'navigation': 33, 'data share for good': 33, 'conscious about what happens with data': 22, 'Mobile Phone': 18, 'no privacy concern in CE': 17, 'always a risk with data sharing': 17, 'digital footprint': 16, 'electronics as future': 16, 'knowledge through gathered data': 14, 'Conditionality': 13, 'safety system in Germany': 9, 'Data Protection through Reset': 8, 'assisting/steering system as inherent part of electric car technologies': 8, 'other fields more risky for data sharing': 6, 'data share helpful for effective traffic behaviour': 6, 'data share in CE helpful to track down components': 5.

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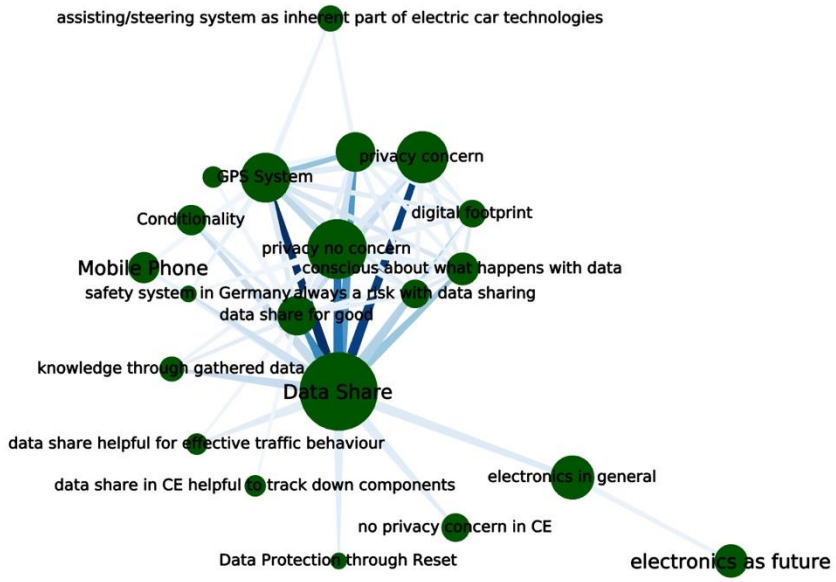

Figure 7.2: The subnetwork of Figure 7 with a focus on the dark green community - Data Sharing.

- The light blue community includes codes related to *environmental concern*. They include: 'high concern environment': 138, 'Concerns about Environmental Pollution': 101, 'Environmental Pollution': 73, 'Future Perspective': 44, 'Consciousness': 35, 'climate change': 30, 'trash': 26, 'medium concern': 25, 'future generations': 24, 'global perspective': 20, 'Global vs local environmental Pollution': 15, 'Global Inequality': 14, 'planet': 9, 'plastics in the ocean': 9, 'kinship': 6.

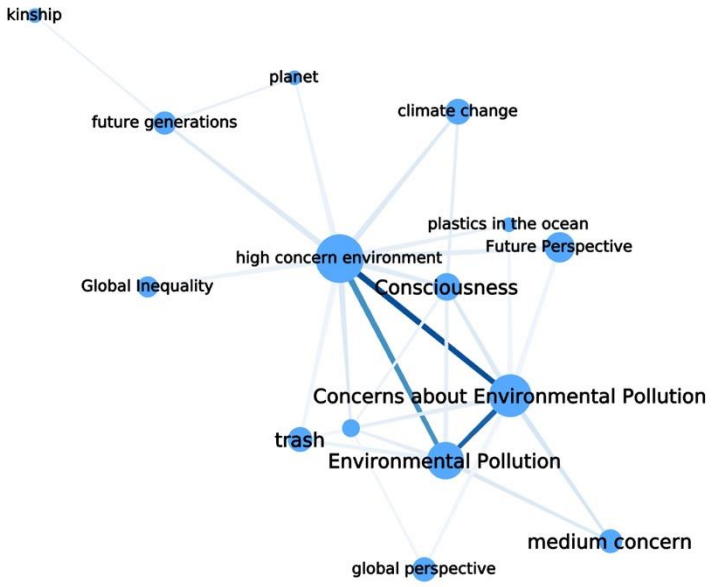

Figure 7.3: The subnetwork of Figure 7 with a focus on the light blue community - environment concern.

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- The brown community includes codes related to circular economy and *car industry*. They include:
  'circular economy could be improved in car industry': 72, 'car industry': 64, 'Electronics in Cars': 59, 'car electronics as opportunity to become greener': 42, 'car electronics as helpful': 37, 'electrification as part of CE': 20, 'CE implementation': 17, 'circular economy in the car industry': 17, 'collaboration across industries': 13, 'car electronics as controlling': 13, 'basic car electronics': 13, 'more electronics more problems': 6, 'Electronics as Safety': 4, ,'circular economy exists somewhat in car , 'electric components harder to adapt to circular economy': 38, 'industry': 66, 'difficult to recycle': 22,'composite materials in CE': 22,'metals': 17

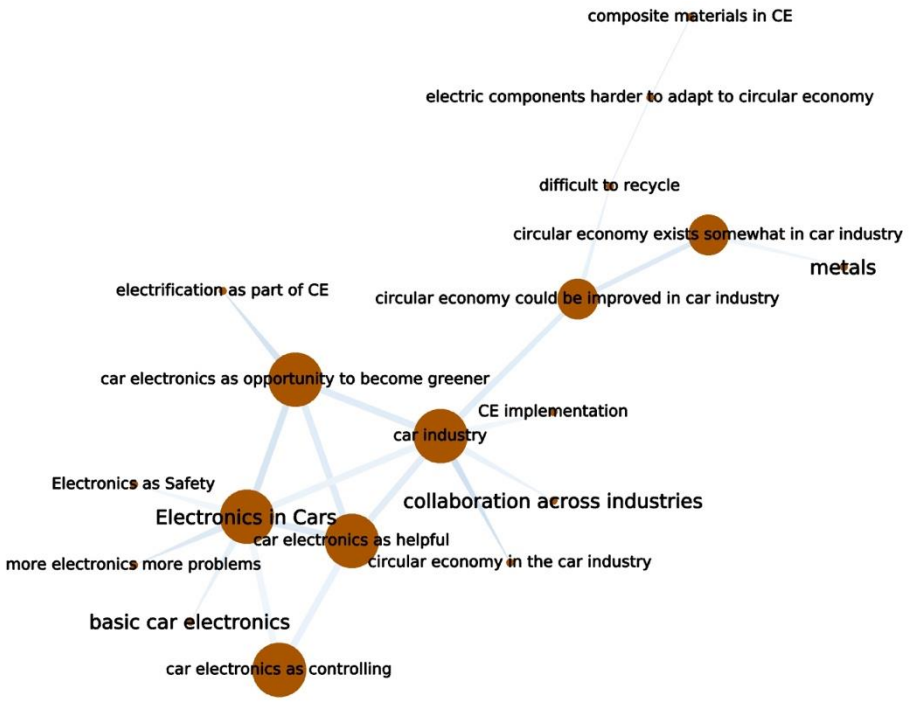

Figure 7.4: The subnetwork of Figure 7 with a focus on the brown community - car industry.

- The light brown-green community includes codes related to *car engines*. They include:
  'car owner': 127, 'car with combustion engine': 50, 'electric car': 42, 'battery': 19, 'Ambivalent battery': 15, 'hybrid car': 14.

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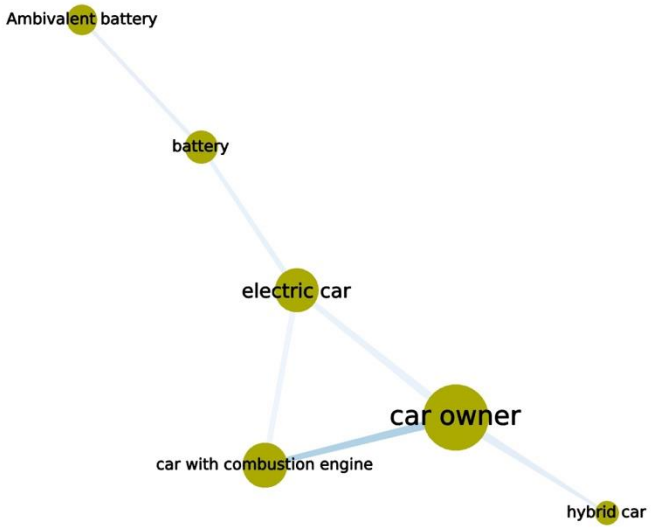

Figure 7.5: The subnetwork of Figure 7 with a focus on the light brown-green community - car owner.

- The pink community includes codes related to *circular economy role*. They include: 'CE as an international affair': 75, 'CE as resource efficiency': 56, 'circular economy as closed loop': 49, 'CE as a holistic/collective concept': 34, 'CE as local concern': 25, 'CE as careful use of resources': 22, 'using trash meaningful': 21, 'CE must be global': 19, 'CE more than recycling': 15, 'globalized supply chain': 11.

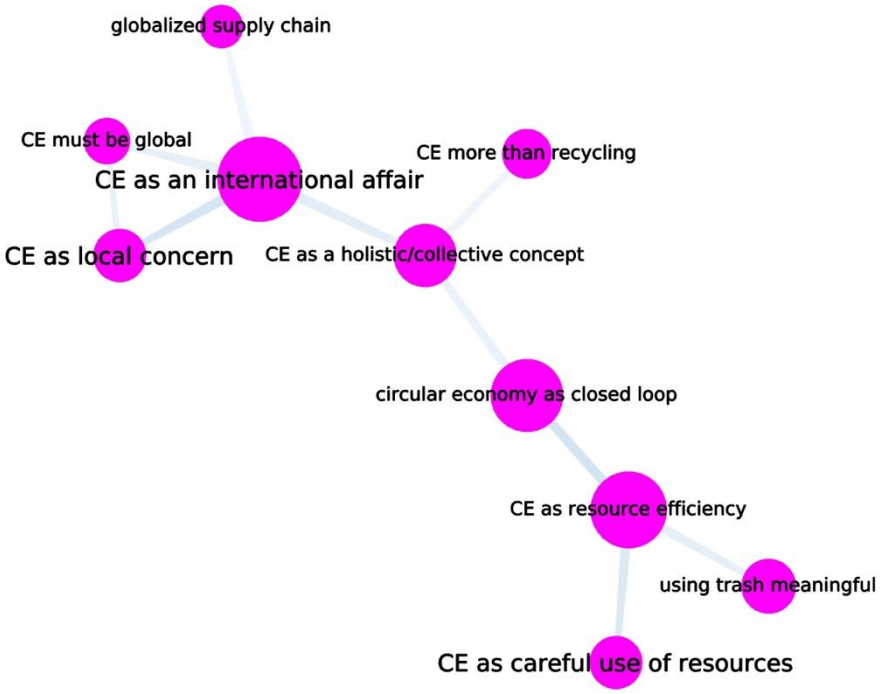

Figure 7.6: The subnetwork of Figure 7 with a focus on the pink community - circular economy.

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- The yellow community includes codes related to *responsibility*. They include: 'individual responsibility': 115, 'Environmental Preservation': 55, 'some individual responsibility': 46, 'collective responsibility': 39, 'consumer responsibility': 27, 'politics and economics responsibility': 26, 'company responsibility': 21, 'government responsibility': 20, 'High Standard': 13, 'Social Change': 13, 'balance between responsible consumption and individual choice': 12, 'greater company responsibility': 8, 'choices': 5.

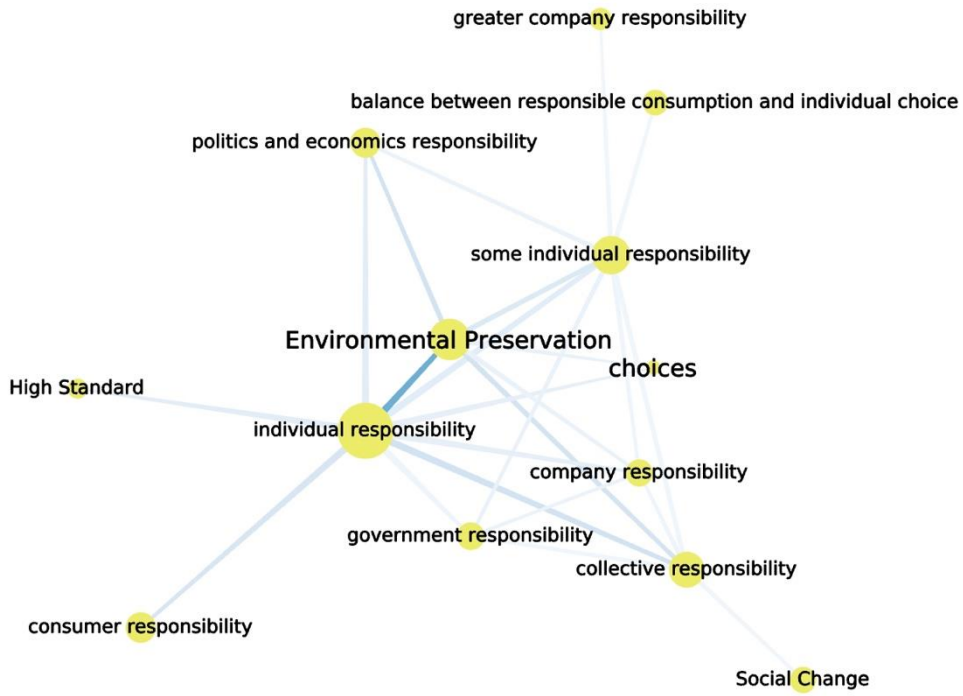

Figure 7.7: The subnetwork of Figure 7 with a focus on the yellow community - responsibility.

- The light green community includes codes related to Sustainable behaviour. They include:
  'Sustainable Behaviour': 297, 'connection with CE through profession': 111, 'CE in daily life': 89, 'sustainable education': 57, 'public transportation': 48, 'promoting circular economy in auto industry': 44, 'not a car owner': 43, 'ethical consumption': 40, 'waste separation': 39, 'avoiding fast consumption cycle': 35, 'bicycles instead of cars': 34, 'A company as a sustainable actor': 31, 'second hand products': 30, 'Less Car Use': 27, 'avoiding plastics': 25, 'Second Hand Clothes': 22, 'research and teaching on sustainability': 22, 'connection with CE through university/studies': 20, 'CE connection through personal background': 20, 'rising awareness about sustainability': 16, 'Effort to recycle': 16, 'awareness raising': 16, 'no planes': 16, 'compost': 14, 'sustainable management': 14, 'regional loops': 13, 'car sharing as circular economy': 13, 'car sharing': 13, 'organic food': 12, 'vegetarianism': 11,

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'avoiding eating meat': 11, 'environmental studies': 11, 'Wrapping': 10, 'ecological footprint': 10, 'conserving energy': 9, 'repair by human force and give it back to loop': 8, 'conserving electricity': 8, 'family education': 7, 'loves nature': 7, 'seasonal food and from the region': 6, 'solar energy': 5, 'avoiding food waste': 5, 'subsistence economy': 5, 'advertising': 5.

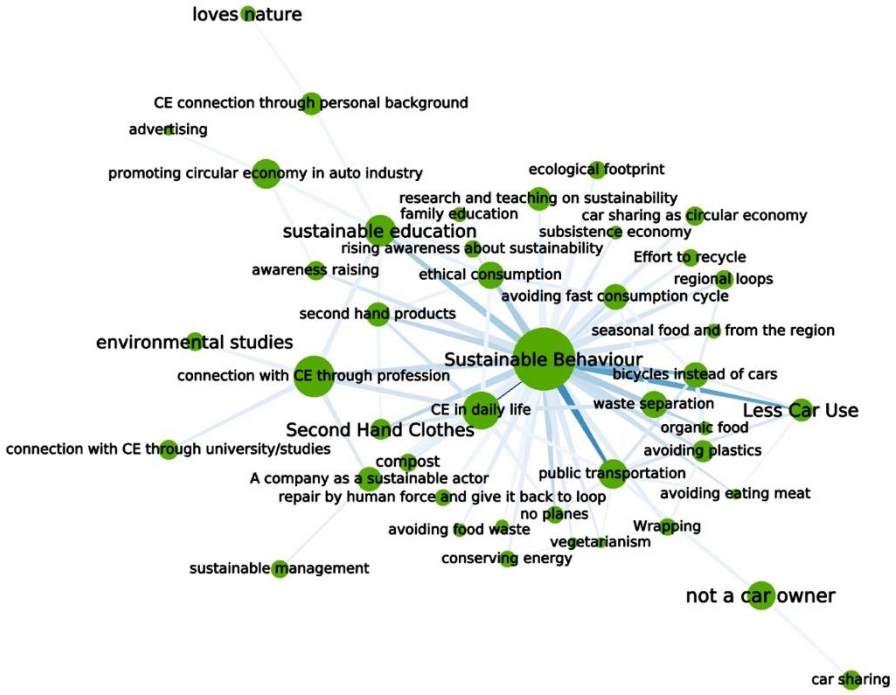

Figure 7.8: The subnetwork of Figure 7 with a focus on the light green community - sustainable behaviour.

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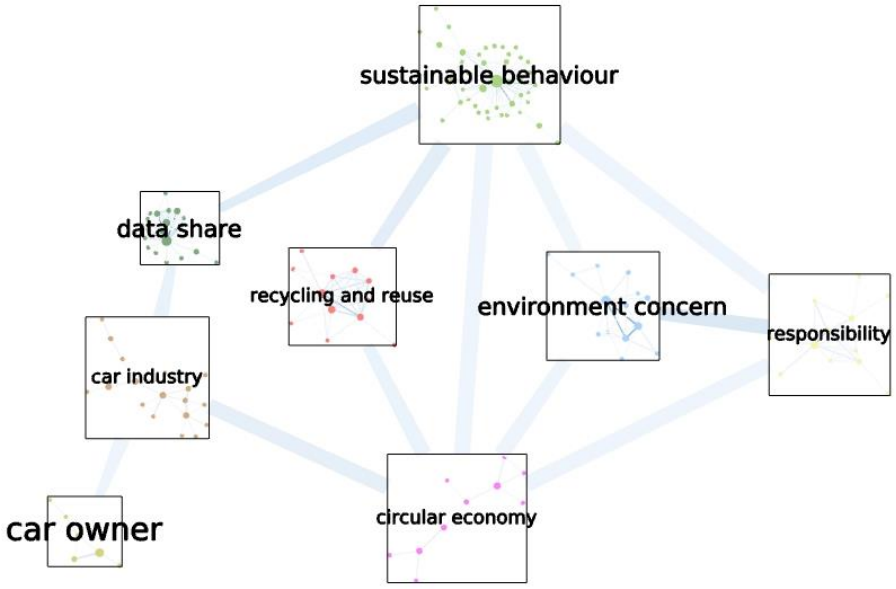

Figure 8: Community graph where the meta node represents clusters and edges the link between them.

The modularity analysis resonates with the preliminary ethnographic insights, dovetails with the association depth and association breadth graphs, and offers possible nuances to delve into as the research project continues. Looking at the modularity visualisation, the following things seem notable:

- The concept of *the circular economy* is located in the pink group, which aggregates codes related to *resource efficiency*. Figure 8 shows this cluster is central in the network, with 5 clusters in its neighbourhood. This cluster has outer edges with concepts of responsibility and environmental concern (yellow and light blue clusters) for the global concept and links to the sustainable behaviour cluster (light green) through the *resource efficiency* aspect and the *life cycle* codes for *the 'recycling and reuse'* cluster.

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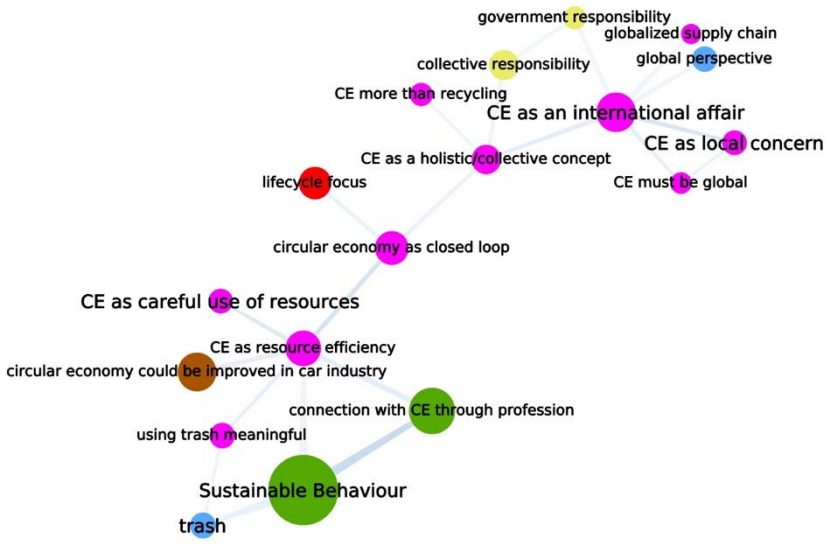

Figure 9: Circular Economy cluster with its close neighbours.

- The concept of *sustainable behaviour* itself is located in the light green group. It is a big cluster in the graph which aggregates codes related to actions that people can take interim of food (‘compost’, ‘avoiding eating meet’, ‘organic food’), in terms of mobility (‘car sharing’, ‘public transportation’, ‘no plane’, ‘Less car use’, ‘bicycles instead of cars’), in terms of waste management (‘waste separation’, ‘avoiding plastics’, ‘effort to recycle’), interim of reuse (‘second-hand products’, ‘second-hand clothes’) and in term of education (‘family education’, ‘research and teaching on sustainability’, ‘awareness raising’, ‘rising awareness about sustainability’). The *sustainable behaviour* cluster is strongly linked to *recycling and reuse* through the concept code ‘Sustainable Behaviour’ and the code ‘second-hand products’, which drive the connection to more than 7 different codes in the ‘recycling and reuse’ cluster. Figure 11 shows code ‘ethical consumption’ and its close neighbours. The visualisation shows that Informants have linked ‘ethical consumption’ and ‘individual

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responsibility', illustrating the insight 3 of ethnographers

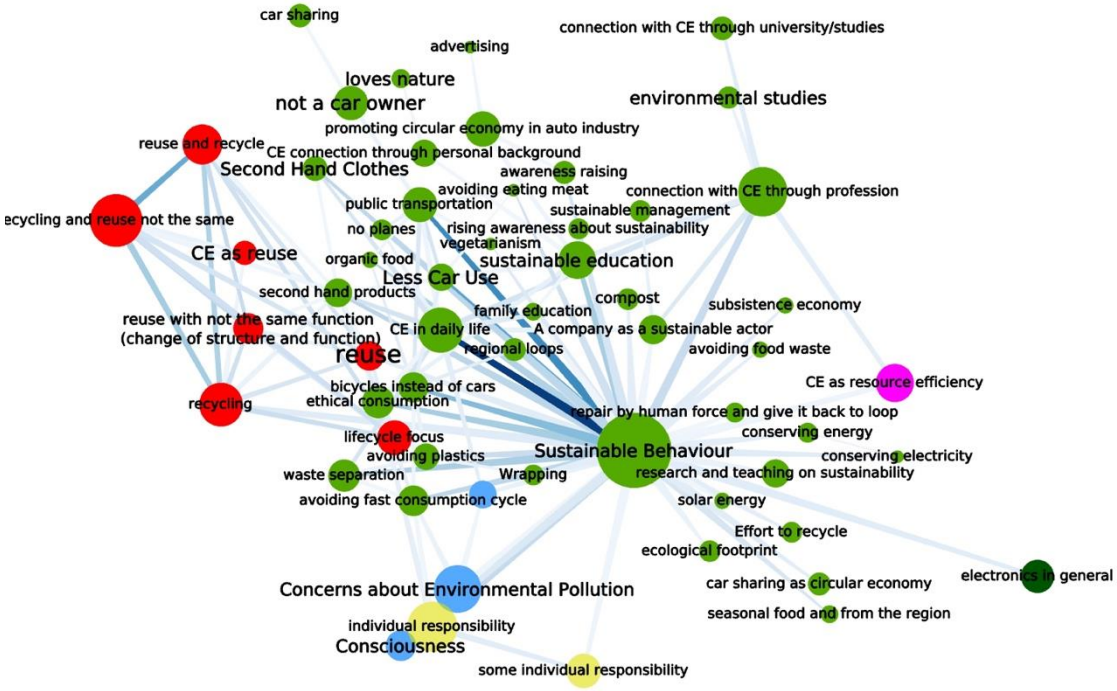

Figure 10: Sustainable Behaviour cluster with its close neighbours.

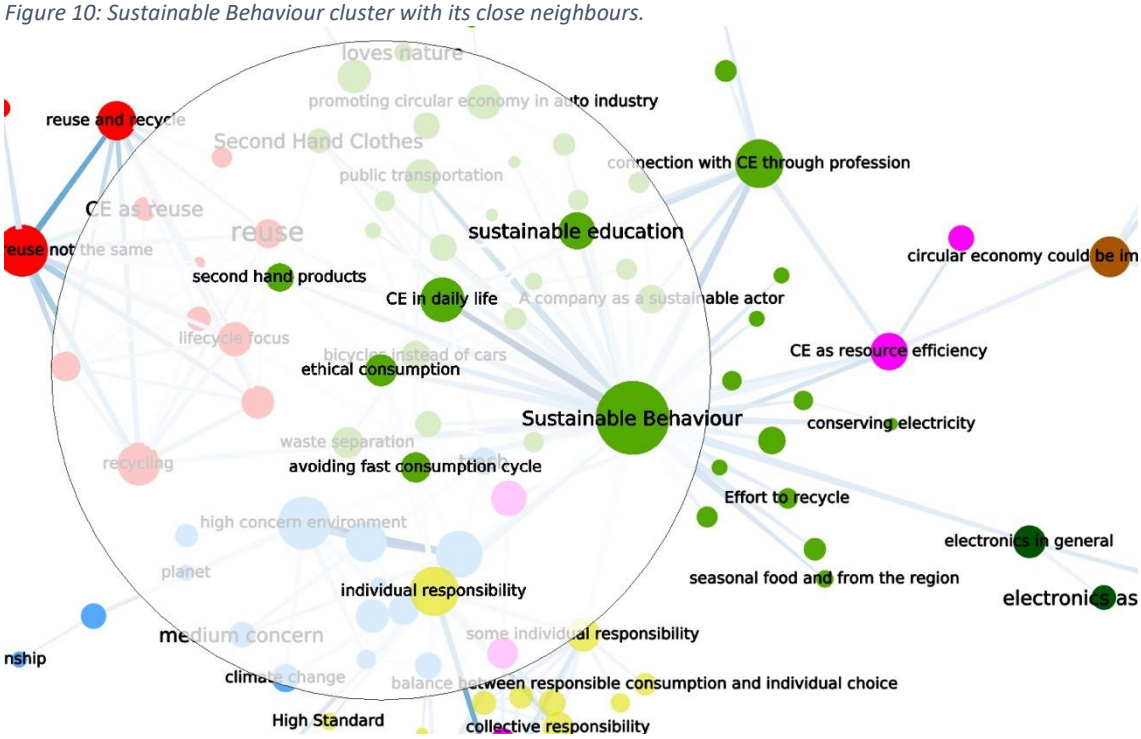

Figure 11: Focus on code 'ethical consumption' showing its close neighbours.

- The concept of *recycling and reuse* itself is located in the red group, which aggregates codes related to reuse compared to recycling. The code 'recycling and reuse not the same' is more frequent, with 129 appearances. Informants also express the opinion that 'reuse better than recycle'. This cluster illustrates well ethnographer insight 1 (Reuse *and recycling are not seen as identical, and not necessarily sequential. Additionally,*

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among the sustainably minded contingent, reuse has a much more positive connotation than recycling).

Gender

Based on the *Sustainable Treasure* co-occurrences network, several insights can be gained from the *depth* or *breadth* associations. What if we have information about the gender of the informants? That is our case for the Sustainable Treasure corpus. The following section will describe how this information could be relevant for new insights through our visualisation.

Our method is all about *associations* (by co-occurrence) between codes rather than *lists* of codes. In this context, a natural way to think about genders is to assign a gender to the edges of the co-occurrence networks. Let us say that Alice, a female informant, answered a question in an interview, and her answer was coded with *code1* and *code2*. As always, we represent this by creating an edge between the two codes; now, we attribute Alice's gender to the edge itself: *e = (code1, code2, "female").*

In the next phase of our approach, we stack all edges between *code1* and *code2*: this allows us to compute the edge's strength and, consequently, to reduce the CCN. So, what happens if an edge represents a co-occurrence between codes that appear in the transcripts of both female and male informants? Imagine the informants were Alice (female), Bob (male), and Carol (female). Then

e(Alice) = (code1, code2, "female") +

e(Bob) = (code1, code2, "male") +

e(Carol) = (code1, code2, "female") =

e(all) = (code1, code2, female_prevalence = 0.67)

In natural language, for each stacked edge, we compute the statistics

female prevalence = number of female edges / total number of edges

A value of 1 is obtained when all the informants who associated code1 and code2 are female. A value of zero indicates that they are all male. Values around 0.5 indicate gender balance. In the example above, 0.67 results were obtained by dividing the number of female informants (2. Alice and Carol) by the total number of informants (3, including Bob). This statistic can then be visualised by colour coding.

A look at female prevalence

In the Sustainable corpus, *female prevalence* has a mean value of (0.47), which is very close to perfect balance. This means that female informants have contributed almost in the same proportion as male ones to the breadth of the edges. *female_prevalence* is uncorrelated with

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depth association (-0.01) and *breadth association* -0.02. Figure 12 shows the frequency distribution of *female prevalence* in the Sustainable corpus.

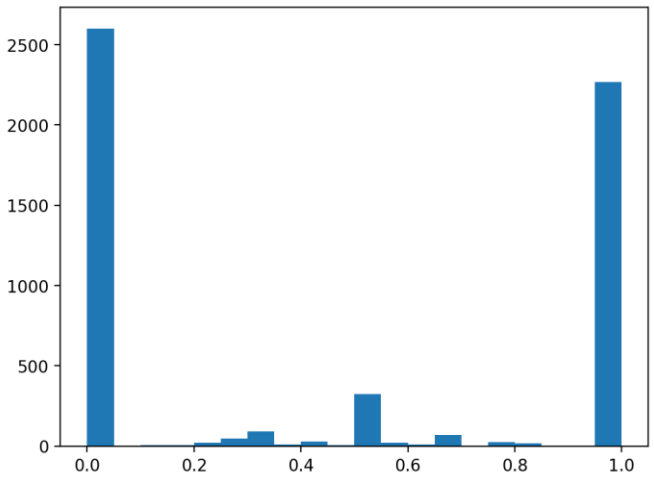

Figure 12: Sustainable corpus prevalence distribution.

The shape reflects the fact that most of the 4870 edges have a breadth value of 1, and therefore they can only assume a value of *female prevalence* of 0 (if the single informant is male) or 1 (otherwise). If we filter for b >= 4, the frequency distribution shows two peaks between around 0.3 and 0.5 (*cf. Figure 13*).

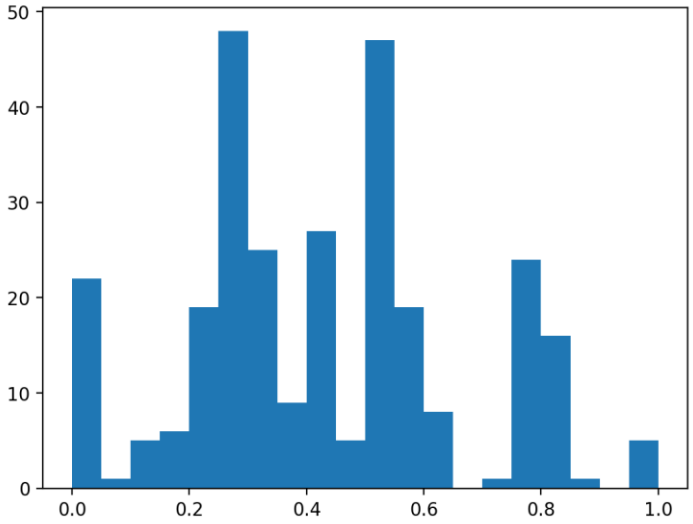

Figure 13: Reduce network prevalence distribution.

The average value of *female prevalence* in the reduced network is 0.42. There are 22 "all-male" edges and 5 all-female ones.

Figure 14 shows the reduced network of Figure 6 (filtered for *b* >= 4) where edges are now coloured according to the *female prevalence* on a three-color scale: green for lower *female prevalence*, grey for *female prevalence* around 0.5, and orange for higher *female prevalence*. We can see that '*Data Sharing'* related codes have a male prevalence (southeast of the graph - *cf.*

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Figure 14.1), '*climate change'* related codes (west of the graph - *cf. Figure 14.3*) and '*vegetarianism'* (*cf. Figure 14.2)* related codes have a female prevalence.

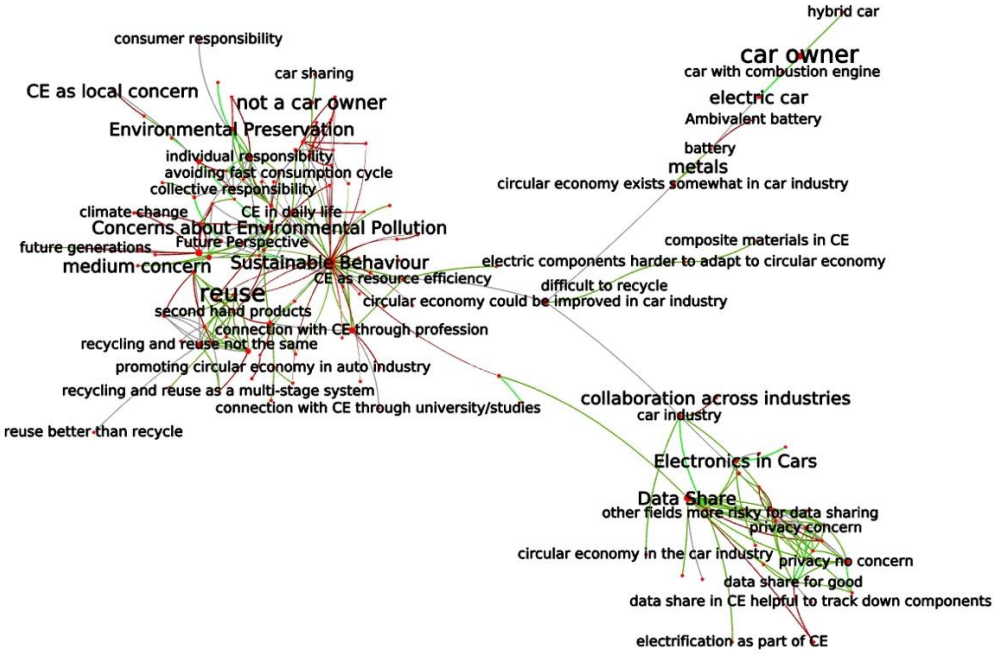

Figure 14: Reduced network of Figure 6 (filtered for b >= 4)

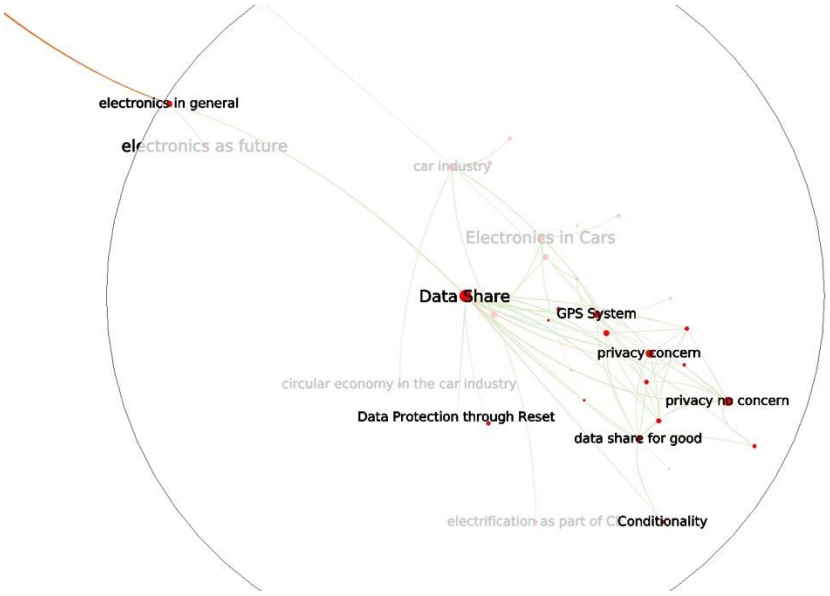

Figure 14.1: Focus of Figure 14 centred on code 'Data Share' on its neighbours.

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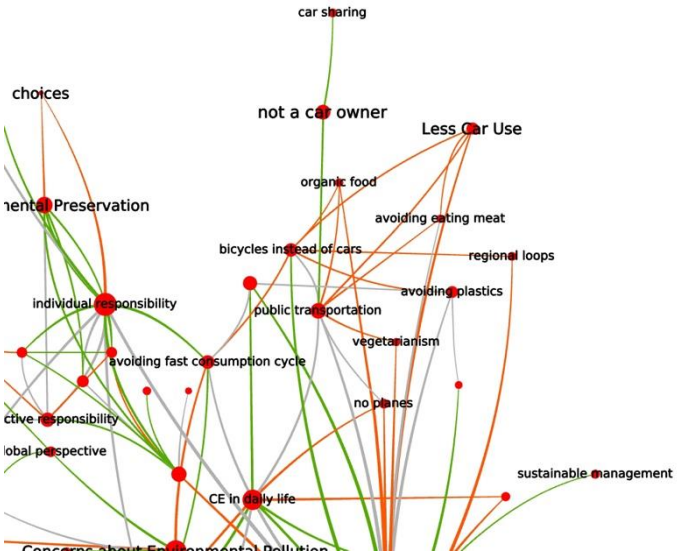

Figure 14.2: Focus of Figure 14 on 'vegetarianism' related codes.

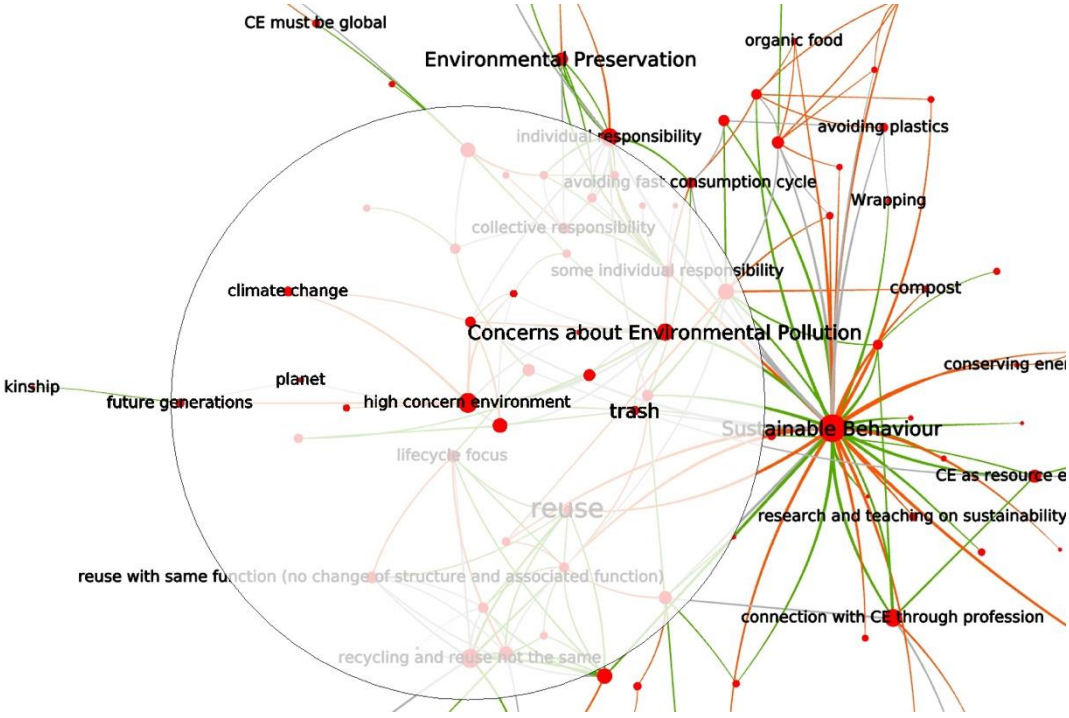

Figure 14.3: Focus of Figure 14 centred on code 'climate change' on its neighbours.

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5. Participant observation method channels

In addition to the events above, which yielded coded data that became the basis for the ethnographic insights and visualisations, our conclusions and recommendations also drew insights from the community journalism program, including the interactive ethnographic events outlined below.

This line of research was aimed at the general public participating in the forum, starting from the initial "seed" content provided by the community journalism program. The conversations on the platform were stewarded by trained community managers who monitor the conversation, encourage and give positive reinforcement to contributors and draw new participants in, which allows the conversation to go "deep".

The program is a tool for engaging a broader and more diverse community of interested public on circular economy and automotive themes. The principle is to elicit conversation-starting posts and use them to kickstart the forum exchange. To this purpose, we used a combination of open calls for contributions and targeted interviews, which led to interactive events, expert articles, and science fiction stories.

For outreach and engagement purposes we created the dedicated Edgeryders Treasure website to act as a gateway to the projects. The website introduces new participants to the project, directs them to the initiatives and facilitates the access to data.

Data from these events was not coded and visualised in the same way as the event ethnography interviews, as the event ethnography events were highly standardized in terms of structured interview scripts and elicitation techniques, which lent itself to a robust coded corpus, while the additional events were thematically relevant but highly variable in structure, modes of engagement, and the scope of topical coverage. We used them as sources of insight, relying on the participant observation method, another pillar of ethnographic methodology.

The observation method yielded insights that aligned with the findings that emerged from the interview data: circularity is conceptualized as a set of material practices and ideological commitments alike; transition to circular economy models within the automotive industry is seen as a spectrum, with incremental advances possible and achievable; cross-industry collaboration is seen as important for achieving the goals of sustainability and circularity within the automotive industry and beyond.

For the duration of the project, the materials collected through the initiative were used for communication and dissemination purposes. At the time of writing, they are being collected into a self-standing publication on the TREASURE project.

The only visualisations for this line of engagement included in this document are the ones made for the data collected in preparation of the Paris Spring School organised by Moveo (Figure 15). The others were used only internally.

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The ethnographic exercise we conducted showcased the Semantic Social Network Analysis and its possible practical use for stakeholder engagement.

The insights gleaned from the exercise mirrored some of the findings of the general research and included the following:

- There are positive expectations associated with knowledge and expertise about sustainability in the car industry. This insight dovetails with insights produced by our general data analysis and is connected to our recommendations in the next section pertaining to education and awareness raising.
- People may consider full circularity utopian and impossible without a major paradigm shift, but at the same time see circularity as a spectrum and are excited about practical measures to move along the spectrum. This insight can also be used to shape awareness-promoting initiatives
- People distinguish between recycling and reuse, and reuse is seen more favourably – this, of course, mirrors real findings in our study, and in part informs Recommendation #2 below.

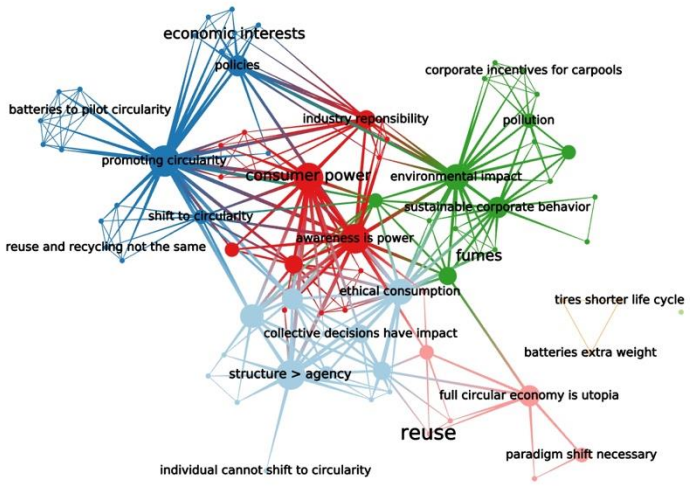

Figure 15: Modular visualisation of the Paris Spring School Ethnographic Exercise Data. The network yielded 79 codes with 607 links, yielding in turn 7 clusters (communities of meaning).

6. Conclusions and Insights

In conclusion, this report presented the results of a mixed-methods two-phase study focused on circular economy in the automotive industry. The researchers explored and analysed nuances around the cultural construction and uptake of concepts related to circularity, sustainability, and car electronics as carriers of meaning, connotations, and associations. Understanding these nuances in the present allows us to extract and formulate actionable insights for data-driven future policymaking, awareness-raising, and consumer education. These semiotically rich topics can and should be continued to be studied as our cultural attitudes towards cars, circularity, and sustainability continue to evolve.

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Our methods and study design can be scaled up or down and repurposed for other investigations into these themes, broadly construed. While we will continue our reflections on the research, below we synthesise our findings into suggestions for policy action items:

1. **Implement Extended Producer Responsibility (EPR) Policies**: promote and prioritise regulations that keep manufacturers accountable for the entire lifecycle of electronic components in cars, promoting designs that prioritise recyclability and ease and "greenness" of disassembly. This recommendation is informed by the link that people make between the importance of sustainability at the end-of-life stage of a product and circular economy advances and achievements.
2. **Promote Product Design for Reuse**: Offer incentives or subsidies for car manufacturers to design vehicles with modular components that can be easily upgraded or repurposed. Encouraging designs that prioritize reusability over single-use components fosters circularity and reduces the need for frequent replacements. This recommendation is informed not only by insights from ethnographic interviews, but also by perspectives gleaned from our participatory workshops, and, as a bonus, it dovetails with insights from Phase 1 of the project that revealed ambivalence and discontent around the precarity and high-maintenance nature of electronic car parts.
3. **Support Peer-To-Peer and Family Centred Circularity Awareness Campaigns**: There already exist educational programs to raise awareness about the environmental impacts of electronic components in cars and the benefits of circular economy practices. Our research revealed that people are attuned to the possibility of awareness raising among peer groups and families. By designing educational / awareness campaigns that leverage the importance of social and familial ties and trust in interpersonal expertise, ideas of circularity and sustainability in automotive design can "land" better within a variety of cultural communities.
4. Related to 3, **Support Holistic Consumer Awareness Programs**: Develop initiatives to educate consumers about the holistic environmental impact of their purchasing decisions and provide step by step guidance on how to make more sustainable choices when selecting vehicles. This could include labelling schemes that make legible the environmental performance of different car models, as well as providing resources for consumers to learn about alternative transportation options, such as public transit, biking, or car-sharing services, so that consumers understand how their choices around automotive purchases holistically fit into their general identity and set of practices as environmental citizens. Furthermore, given the importance assigned to consumer power and influence by our interlocutors, empowering consumers with information and options can create productive pressure for more sustainable products and practices in the automotive industry.
5. Related to 3 and 4, **promote Civic Education on Sustainable Mobility**: Invest in civic education programs that enhance public understanding of the intersections between cars, electronics, and sustainability, as well as the role of political processes in shaping automotive policies. These programs can link individual identities as consumers and voters and empower citizens to critically evaluate policy proposals, advocate for their interests, and engage in collective action to advance sustainable mobility solutions.

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6. **Create Open Data and Technology Platforms related to cars, electronics and sustainability**: Create open data and technology platforms that provide access to information, tools, and resources related to cars, electronics, and sustainability, to a) facilitate greater transparency, accountability, and innovation in the automotive industry and b) to stimulate flow of information between siloed-off professional and lay expertise sectors. By democratizing access to data and technology, governments and R&D initiatives alike can create space for creative data-driven solutions that promote sustainability and circularity, and social equity over the life cycle of cars and electronic components.
7. **Integrate Concepts of Intergenerational Equity and Duties to the Future into Policy Frameworks Pertaining to Cars, Electronics, and Sustainability**: Duty to the future is a concept operationalized by the High-level Committee on Programmes (HLCP) of the United Nations; liked with the concept of sustainable development, it is "often understood as multi-sectoral and cross-cultural [and] commonly expressed in terms of what we owe to our children and grandchildren as well as with solidarity and accountability to younger and future generations." (HLCP 2023). The focus exhibited in our interviews during both phases of the research project on the future, conceptualized through concerns for future generations, especially one's own kin (children and grandchildren), makes it likely that promoting decision-making processes around consumption and car use that take into account the needs and interests of future generations would be constructive and well-received as a mechanism to guide people towards circular economy practices. Practically, this could involve conducting intergenerational impact assessments, as well as including intergenerational dialogue in policy-making arenas.

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ANNEX

PHASE 1 EVENTS

Ulm Technorama, May 6, 2022

Technorama Ulm is a long-established event for, as the organizers put it, "classic car friends." Running for over 40 years, it is described as follows on its own website: "From all over Europe the visitors come together to share their passion for historical classic cars, modern classic cars and motorcycles. They all have in common that they can basically be repaired and restored by the classic cars friends themselves." At Technorama, Jos was able to conduct interviews with 21 people, including both sellers and buyers. As Jos explained, "Technorama is purely a market for the sale of used parts. There were about 60% used parts for old motorcycles, about 20% for old-timer cars and the remaining 20% all sorts of things, like at a flea market."

Figure 1: Ulm Technorama, May 6, 2022

Frankfurter Automobil Ausstellung (FAA) May 22, 2022

Jos reports, "In Frankfurt regional dealers presented 36 car brands, so there were more than 150 cars and 20 motorbikes at the exhibition. The dealers are consulting interested visitors about the actual car models, availability, delivery times and funding opportunities for electric and hybrid cars." Jos also noted that the FAA has been based for several years at the Klassikstadt site, a former factory facility. The Klassikstadt hosts several vintage car workshops and dealers. It also offers a place where vintage car owners can rent a parking place for their vintage cars, when the cars are not in use (usually over the wintertime). The vintage car exhibition in the

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Klassikstadt was open to all FAA visitors and provided a contrast to the new cars in the outdoor area. Jos was able to interview 24 people (22 male, 2 female).

Figure 2: Frankfurter Automobil Ausstellung (FAA) May 22, 2022

Audi Meeting Krefeld, May 26, 2022

Jos attended the first Audi Meeting in Krefeld this year (and, in fact, the first one after the Covid-19 related lockdowns). Jos estimated that at the event there were approximately 40-45 Audi cars, ranging from 1970s vintage cars to new cars, some tuning cars too. Altogether, there were approximately 100 people, including drivers and visitors. The event yielded 14 interviews (12 male, 2 female).

Figure 3: Audi Meeting Krefeld, May 26, 2022

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TopCareer Stuttgart 2022, 20 June 2022

At the automotive TopCareer in Stuttgart, students and young professionals met around 50 companies from the entire automotive and mobility industry. The exhibitors were primarily from car manufacturers and suppliers, car dealerships, and industry service providers. Volvo and Porsche were present. This event yielded 26 interviews (7 male, 19 female).

Figure 4: TopCareerStuttgart2022

Allstedt Cars Meet Photographers 2022, June 10 and 11, 2022

This was a photography industry event at the former Allstedt military airfield in Eastern Germany. It featured over 1,200 cars with more than 60 photographers slated to take pictures and videos of the cars for their owners. A total of 32 interview partners were recorded in these two days (20 male, 12 female, 2 were partially completed).

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Figure 5: Allstedt Cars Meet Photographers

4WD Event, Oss, 24-25 September 2022

The 4WD Festival in Oss attracted off-road vehicle enthusiasts, highlighting their perspectives on environmental awareness and scepticism towards electric cars. A total of 26 interviews were recorded in these two days (19 male, 7 female)

Figure 6: A car at the 4WD Oss event

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PHASE 2 EVENTS

Bern User Forum on Circular Economy, 28 March 2023

The Bern User Forum on Circular Economy was a one-day event held at the Bern University of Applied Sciences, which is one of the leading institutions of applied sciences in Switzerland. The university offers a diverse range of programs in engineering, architecture, business, social work, and health sciences. The forum attracted participants from various sectors, with 99% of them being Swiss nationals and highlighted the growing importance of the circular economy in addressing the world's sustainability and challenges and provided a platform for attendees to share their experiences and ideas. It yielded 14 interviews (7 female, 7 male)

Figure 7: Attendees listening to a presentation at the Bern User Forum on Circular Economy

International Automotive Recycling Congress (IARC), 2023, June 21-23, 2023

Organised by ICM, the International Automotive Recycling Congress 2023 (IARC) took place from 21 to 23 June 2023 in Geneva, Switzerland. The 22nd Congress's theme was "Sustainability through Innovation", and it brought together leading experts, industry representatives and environmentalists from around the world to discuss the current challenges and future perspectives of automotive recycling, with a specific focus on facilitated the transition towards a circular automotive supply chain. It was a valuable terrain for our research in the context of event ethnography because it allowed for an "ethnography of expertise" approach particularly well. It yielded 31 interviews (24 male, 7 female).

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Figure 8: Announcements in the event space at IARC 2023

GTF Berlin, 16-18 June, 2023

The Greentech Festival in Berlin, Europe's largest sustainability festival, convened environmental activists and industry professionals to explore sustainable technologies and solutions, including those within the automotive sector. At the festival, Edgeryders interviewed 41 people from different countries (and had an additional conversation with Nigerian-Israeli sustainability/climate activist Sharonna Schnayder, a speaker at the festival). (21 male, 20 female)

Figure 9: GTF attendants in the Lufthansa hangar festival space, where the airline was showcasing its progress towards becoming carbon neutral by 2050

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Techblik Berlin, 17-18 October, 2023

TechBlick was an event that wanted to show the way into the future of electronics. Held in Berlin from October 17-18, 2023, it brought together tech enthusiasts, industry leaders, and newcomers to the sector to facilitate exchanges of expertise and to help explore opportunities for circularity and sustainability in electronics and beyond. TechBlick yielded 32 interviews (9 female, 23 male)

Figure 10: Expo hall at TechBlick

Kongress BW Stuttgart, 15-17 November, 2023

The annual Congress for Resource Efficiency and Circular Economy (Kongress BW), organized by various ministries in the state of Baden-Württemberg. It brought together experts from business, politics and science not only from Baden-Württemberg but also from surrounding countries to discuss the current challenges and opportunities in the area of sustainable resource use. Around 1,000 participants attended lectures and workshops and discussed the current developments and challenges of the circular economy. This event yielded 34 interviews (17 male, 17 female).

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Figure 11: Expo Hall at Kongress BW Stuttgart

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2.3 Treasure ethnographic interview scripts

The interview was designed to elicit interlocutors' opinions and reveal their schemas about car electronics, sustainable practices, personal and political considerations and reflections pertaining to the car sector and its possible sustainability. The script went through several minor modifications, iterating based on feedback from the ethnographer in the field.

Interview Script for Phase 1 (car events)

1. When is the one adjective that comes to mind when you think about car electronics?
2. Do you currently own a car, or have you owned a car in the past? (If not, do you use a car regularly, for example through a formal or informal care share, or car rentals?)
3. Can you list 5 electronic components in your car? (If they list 5, ask if they can list any more)
4. What kind of maintenance schedule do you have for your car?
5. What are your sources of expertise and authority when it comes to making choices about car maintenance and repair? (If they name multiple ones, ask for a ranking – example: own mechanic, car hobbyist magazine, car dealership)
6. Tell me about the last time one of the electronic devices in your car malfunctioned. Please describe the process step by step (If no actual example is available, convert to a hypothetical: "if one of the electronic devices in your car malfunctioned, what would you do? Please describe the process step by step.")
7. Have you ever heard the term "circular economy" – what does it mean to you in your own words? (If no one in the group knows it, define – we provide definition) [If necessary, definition: "an economy based on sharing, reusing, repairing, and recycling materials and existing products as much as possible to extend their use."]
8. If you had the option to replace a malfunctioning electronic component in a car you were using with a new component or a used one, what would be pros and cons of each for you? Let's take them in turn: pros of new, cons of new, pros of used, cons of used.
9. If they don't mention it – do you have concerns about privacy and personal data stored by car electronics (for example, GPS) when thinking about re-use of car electronics?
10. Do recycling and reusing mean different things to you?
11. Would you feel comfortable with someone you don't personally know re-using your electronic car equipment?
12. What is your ideal car like? Describe it.
13. On a scale of 1-5, with 1 being not at all concerned, and 5 being extremely concerned, How concerned are you about issues of environmental waste and pollution? (If they don't explain themselves, follow up by asking – can you say more about that?)
14. What, if any, steps do you take in your life to promote sustainability?
15. How much responsibility does each individual have to make lifestyle and consumer choices that help protect the environment?
16. What can the car industry do to promote a circular economy? Do you believe the car industry is already doing these things? If not, do you think such changes will happen?
17. Where do you think electronic waste from cars goes after it is no longer used?

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Interview Script for Phase 2 (Sustainability/Circularity Events)

1. Can you define a circular economy in your own words? Do you participate in a circular economy yourself in any aspect of your life? If yet, can you share more about that? [If necessary, definition: "an economy based on sharing, reusing, repairing, and recycling materials and existing products as much as possible to extend their use." – but Jos, I assume at this event they will all know]
2. How did you become interested in the circular economy ideas and practices?
3. In your opinion, can a circular economy be implemented in individual sectors or industries?
4. Do you think the circular economy already exists in the car industry? If yes, to how/to what extent? If not, what role do you think it could play in that industry?
5. Do you currently own a car, or have you owned a car in the past? (If not, do you use a car regularly, for example through a formal or informal care share, or car rentals?) What kind?
6. When is the one adjective that comes to mind when you think about car electronics?
7. In your opinion, are cars that include electronic components easier or harder to adapt to circular economy principles than regular cars?
8. What can the automotive industry do to promote a circular economy? Do you believe the automotive industry is already doing these things? If not, do you think such changes will happen?
9. If they don't mention it – do you have concerns about privacy and personal data stored by car electronics (for example, GPS) when thinking about re-use of car electronics? Electronics in general? Are there general concerns about privacy in thinking about circular economy practices?

10. Does recycling and reusing mean different things to you? Please elaborate
11. On a scale of 1-5, with 1 being not at all concerned, and 5 being extremely concerned, How concerned are you about issues of environmental waste and pollution? (If they don't elaborate themselves, follow up by asking – can you say more about that?)
12. What, if any, actions do you take in your life to promote sustainability? Please discuss in detail.
13. How much responsibility does each individual have to make lifestyle and consumer choices that help protect the environment?
14. Do you see the circular economy as a local, national, or international issue? On what scale can a circular economy be successfully implemented? (--> whatever scale they think, ask how a circular economy would work with regard to car production in general, and electronic components in a car in particular?)

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Community journalism and participant observation method workshops

Automotive Nightmares
29 April 2022, online workshop, 17 participants

The Automotive Nightmares series introduced online forum topics on circularity and automotive through a community journalism approach. Beginning from the initial themes "Unnecessary is wasteful" and "What is the most pointless feature of your car?", the series opened with the online event on 29 April 2022 with 17 participants[1].

Through open calls, outreach, and engagement campaigns, it created the foundation for the following workshops and connected with the field experts and the general public.

In addition to the workshops, through the community journalism program, two expert articles and two science fiction stories were produced as "seeds" for the forum-based exchange and means for communication and dissemination purposes. Among the most relevant contributions, the selected illustrated stories focused on circularity in the automotive industry. In contrast, Caroline Samberger's article *Circularity and the automotive sector* presented an introduction to the topic and the inherent rare earths problems. Herbez explored *Sustainability and Circular Economy Challenges in the Automotive Industry*.

Community journalism has opened with variable success various topics connected to the circularity in the automotive, touching considerations on privacy, the concept of "computers on wheels", the continental second-hand car market, and Georgia in particular as one of its hubs. Part of this research will continue after the end of the project, building on the insights that were gained. All of these themes helped create a rich environment for the forum exchange.

[1] Eventbrite page of the event 29 April 2022

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Participatory workshop on circular cars with Neol
18 August 2022, online workshop, 22 participants

The co-creation workshop focused on the imaginative skill of the participants in shaping a future where today's concept of mobility has evolved into circularity. The participants had to discuss the actual situation of mobility and the private use of vehicles and draw the steps that would have been necessary to get to a society where mobility relied only on circular economy practices. The basis for discussion was the concept of a "circular car[2]," which *uses efficient and renewable energy sources, with lifetime optimised for resource efficiency, materials used without waste, and optimised user rates.*

The exercise yielded interesting discursive strands and framings. Some participants approached the task through more of a macro lens, while others took a more micro approach. The discussion opened the themes of *political ecology*, transitioning to a circular mobility society by situating it in a broader socio-political context, the need for structural changes as predicates to such a transition, the need for a new approach to urban planning, and a general societal shift.

The extrapolation from the visualisations and debrief of the "micro" approach can offer the following insight: the non-circular and resource-consuming mobility/car sector is connected with a highly structured regimented social existence centred around many specific obligations. A more socio-centric and need-centric society, with a basic income and established local food security solution, would require a) less movement and b) fantasising further; it could also have room for objects to move around and come to people (e.g., a movable vertical urban farm feeding the city) requiring less movement around of cars. This imagines a minimized car sector rather than circular per se but in the pursuit of similar environmental goals.

[2] defined by the World Economic Forum's Circular Car Initiative

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How to Green Cars - For a deeper understanding of circularity

25 January 2023, online workshop, 19 participants

The event[3] with Paul Nieuwenhuis, an expert on cars and the environment, delved into the multifaceted impact of automobiles on our environment, beyond the obvious question of tailpipe emissions. Originating his research on emissions, Nieuwenhuis explored the legal approaches to emissions from California State efforts in this domain from the 1950s. The event focused on the current inefficiency of car disposal systems, following the throwaway trend spanning various products introduced over the past century, from washing machines to mobile phones.

Several factors contribute to cars' short lifespans, and the shift towards CE should consider design and standards, together with materials[4], alternative business models such as “micro-factory retail” present in the UK, and harmonisation of the circular economy directions with the new technologies.

Nieuwenhuis’ call for a more in-depth exploration of the circular economy, a step further than the current, too conceptual, understanding, allowed us to open new discussions on the platform considering the clarification of whether loops should be closed within single products, sectors, or economies and at what scale.

[3] Eventbrite page of the event 25 January 2023

[4] The majority of cars are made of steel, capital-intensive, forcing large-scale production for profitability. This leads to an overemphasis on volume production rather than durability.
‘’, a localised, low-volume manufacturing model. Here, cars are assembled in small units, allowing customization and local sourcing. Moreover, as the demand for new cars wanes, the focus can shift to maintenance and recycling.
Circular Economy Concerns: While the circular economy is touted as a sustainable model, Nieuwenhuis argues it presumes a static technological environment. For instance, while steel, a primary component of most cars, is recyclable, not all car materials are. Furthermore, embracing newer technologies might disrupt the circular loop, particularly when shifting from one dominant material or technology to another.

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Ask Me Anything: Circular Economy & The Future of Material Recycling in the Automotive Industry

7 March 2024, online workshop, 40 participants

Jean-Denis Curt, a prominent figure in the automotive industry, discussed Renault Group's innovative approach to integrating circular economy principles during Edgeryders' Ask Me Anything (AMA) event[5] within the TREASURE project. Curt emphasized the shift from linear to circular models, outlining strategies such as waste prevention, reuse, and recycling. He introduced Refactory, a Renault initiative transforming a production plant into a circular economy hub, aiming for zero carbon emissions. Additionally, he highlighted "The Future is Neutral," a Renault venture promoting recycled materials in vehicle manufacturing. Curt's insights underscored the potential for circular economy principles to reshape the automotive industry towards sustainability.

Moveo Paris Spring school

24-27 April 2024, in person presentation, est. 40 participants

Last but not least, a crossover between an ethnographic data-gathering event and an integrative exercise designed to strengthen collaboration between different partners in the process, the Paris Spring School Ethnographic Exercise was designed, in collaboration with the Paris Spring School organized by Moveo. In advance of the start of the Spring School, we asked the participants to participate in a week-long ethnographic exercise related to the themes of the TREASURE project. We directed the participants to our online platform and used open-ended prompts to elicit their perspectives and opinion exchanges on topics that are fundamental to the TREASURE study (circular economy, sustainability, the automotive industry). Once the contributions were available, we coded and visualised them the same way we did with regular data; then we presented the results at the Paris School itself; as a secondary benefit, we treated this exercise as an opportunity to collect a small additional set of real data since, as experts in the fields related to the automotive industry and sustainable technologies and practices, the participants represented a sample relevant to us.

[5] The Eventbrite page of the event

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References

Agrawal, A. (2005). Environmentality: Community, intimate government, and the making of environmental subjects in Kumaon, India. *Current anthropology*, 46(2), 161-190.

Aguilar Delgado, N. & Barin Cruz, L. (2014). Multi-event ethnography: doing research in pluralistic settings. *Journal of Organizational Ethnography*, *3*(1), 43-58. https://doi.org/10.1108/JOE-11-2012-0050.

Baldwin, R., Cave, M. & Lodge, M. (2012). *Understanding regulation: Theory, strategy and practice.* Oxford: Oxford University Press.

Barreiro-Gen, M. & Puig, N. (2022). Women sustainability research: Examining gender authorship differences in peer-reviewed publications. Frontiers in Sustainability, 3: 959438

Blondel, V. D., Guillaume, J. L., Lambiotte, R., & Lefebvre, E. (2008). Fast unfolding of communities in large networks. *Journal of statistical mechanics: theory and experiment*, 10, P10008.

Bulow, J. (1986). An economic theory of planned obsolescence. *The Quarterly Journal of Economics*, 101(4), 729-749.

Bourdieu, P. (1997) [1972]. *Outline of a Theory of Practice*. Cambridge: Cambridge University Press.

- (1998). *Practical Reason: On the Theory of Action*. Stanford: Stanford University Press.

Campbell, L. M., Corson, C., Gray, N. J., MacDonald, K. I., & Brosius, J. P. (2014). Studying global environmental meetings to understand global environmental governance: Collaborative event ethnography at the tenth conference of the parties to the convention on biological diversity. *Global Environmental Politics*, 14(3), 1-20.

Cottica, A., Hassoun, A., Kubik, J., Melançon, G., Mole, R., Pinaud, B. and Renoust, B. (2021). Comparing techniques to reduce networks of ethnographic codes co-occurrence. International Conference on Computational Social Sciences (IC2S2), Zurich, Switzerland. Zenodo. https://doi.org/10.5281/zenodo.5801464.

Cottica, A., Hassoun, A., Manca, M., Vallet, J., & Melancon, G. (2020). Semantic social networks: A mixed methods approach to digital ethnography. *Field methods*, 32(3), 274-290.

Davies, S.R., Selin, C., Rodegher, S., Allende Altamirano, C., Burnam-Fink, M., Di Vittorio, C., Glerup, C., Keys, C., Kimball, M., Liao, M., Monfreda, C. & Trinidad, B. (2015). Studying Emerge: Findings from an event ethnography. *Futures*, 70, 75-85. https://doi.org/10.1016/j.futures.2014.05.003.

DIRECTIVE 2000/53/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 September 2000 on end-of-life vehicles. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0053

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003587

Dorrestijn, S. (2020). A Tool for the Impact and Ethics of Technology: The Case of Interactive Screens in Public Spaces. In Wiltse, H. (ed.). *Relating to Things: Design, Technology and the Artificial*. London & New York: Bloomsbury, 151-172.

D'Orville, H. (2019). The relationship between sustainability and creativity. *Cadmus*, 4(1), 65-73.

Escario, J.J., Rodriguez-Sanchez, C., and Casalo, L.V. (2020). The influence of environmental attitudes and perceived effectiveness on recycling, reducing, and reusing packaging materials in Spain. *Waste Management,* 113(15), 251-260. https://doi.org/10.1016/j.wasman.2020.05.043.

Foucault, M. (1977). *Discipline and Punish: The Birth of the Prison*. New York: Vintage.

-. *Security, territory, population: Lectures at the Collège De France 1977-78.* New York: Palgrave Macmillan.

Freire, P. (1992). *Pedagogy of Hope: A Reencounter with the Pedagogy of the Oppressed*. Rio de Janeiro: Paz e Terra.

Giddens, A. (1984). The Constitution of Society: Outline of The Theory of Structuration: Berkeley: University of California Press.

- (1986). *The constitution of society: Outline of the theory of structuration.* Berkeley: University of California Press.

Graham, M. (2002). *Democracy by disclosure: The Rise of technopopulism.* Washington, DC: Brookings Institution Press.

Gupta, A. (2015). An anthropology of electricity from the global south. *Cultural Anthropology*, 30(4), 555-568.

Harvey, P., & Knox, H. (2015). *Roads: An anthropology of infrastructure and expertise*. Ithaca: Cornell University Press.

Hassoun, A., Cottica, A., Sim, K., & Schulte, L. (2021). The Next Generation Internet: a large-scale ethnography (1.0). https://doi.org/10.5281/zenodo.5741917.

Havet, N., Bayart, C. & Bonnel, P. (2021). Why do Gender Differences in Daily Mobility Behaviours persist among workers? *Transportation Research Part: Policy and Practice*, 145, 34-48. https://www.sciencedirect.com/science/article/abs/pii/S0965856420308090?via%3Dihub.

Hesse-Biber, S. (2011). *The Handbook of Emergent Technologies in Social Research*. Oxford: Oxford University Press.

High Level Committee on Programs (2023). Discussion Paper: Duties to the future through an intergenerational equity lens. United Nations System, available at: https://unsceb.org/sites/default/files/2023-02/HLCP%20Duties%20to%20the%20Future%20discussion%20paper%20%28public%29.pdf (accessed on April 30, 2024).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003587

Ingold, T. (1997). Eight themes in the anthropology of technology. *Social Analysis: The International Journal of Social and Cultural Practice,* 41(1), 1.

Li, B., Kisacikoglu, M. C., Liu, C., Singh, N., & Erol-Kantarci, M. (2017). Big data analytics for electric vehicle integration in green smart cities. *IEEE Communications Magazine*, *55*(11), 19-25.

McClaran, N., Behe, B.K., Huddleston, P., and Fernandez, R.T. (2020). Recycled or reclaimed? The effect of terminology on water reuse perceptions. *Journal of Environmental Management*, 110144.

McDonagh, P. and Murphy, F. (ed.). *Envisioning Sustainabilities: Towards an anthropology of sustainability*. Cambridge: Cambridge Scholars Publishing, 2016.

Malinowski, B. (1922). *Argonauts of the Western Pacific*. London: Routledge.

Manyukhina, Y., Emmel, N. & Middlemiss L. (2017). Exercising moral agency in the contexts of objective reality: toward an integrated account of ethical consumption. *Journal for the Theory of Social Behaviour*, 47(4), 418-434.

Mauss, M. (2016 [1954]). *Die Gabe: Form und Funktion des Austauschs in archaischen Gesellschaften*: Berlin: Suhrkamp Taschenbuch Wissenschaft Verlag.

Mitchell, K.I., & Walinga, J. (2017). The creative imperative: The role of creativity, creative problem solving and insight as key drivers for sustainability. *Journal of Cleaner Production* 140, 1872-1884.

Murdock, E.B., Toghill, E.K., and Tapia-Ruiz, N. (2021). A perspective on the sustainability of cathode materials used in lithium-ion batteries. *Advanced Energy Materials*, 11(39), 2102028.

Newman, M.E. & Girvan, M. (2004). Finding and evaluating community structure in networks. *Physics Review E*, 69(2), 026113. https://doi.org/10.1103/PhysRevE.69.026113.

Ortner, S.B. (1984). Theory in Anthropology since the Sixties. Comparative Studies in Society and History 26(1): 126–166.
- ed. (2006). Introduction. Updating Practice Theory. In *Anthropology and Social Theory*. Durham: Duke University Press: 1–18.

Papaoikonomou, E. & Alarcon, A. (2017). Revisiting consumer empowerment: An exploration of ethical consumption communities. *Journal of Macromarketing*, 37(1), 40-56.

Pfaffenberger, B. (1992). Social anthropology of technology. *Annual review of Anthropology*, 21(1), 491-516.

Pflugfelder, E. H. (2018). Autonomous Vehicles and Gender: A Commentary. *Transfers*, 8(1), 104-111. https://doi.org/10.3167/TRANS.2018.080108.

Quastel, N. (2008). Ethical consumption, consumer self-governance, and the later Foucault. *Dialogue: Canadian Philosophical Review/Revue canadienne de philosophie*, 47(1), 25-52.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003587

Stewart, J. (2013) Electric cars: Big data helps designs shift gears. BBC.com, October 15, https://www.bbc.com/future/article/20131015-hidden-habits-your-car-is-sharing (accessed on August 30, 2022).

Rodney, W. (2018 [1972]): *How Europe Underdeveloped Africa*. London: Verso.

Thompson, E.P. (1971). The Moral Economy of the English Crowd in the Eighteenth Century. *Past and Present*, 50, 76-136.

- (1980). *Plebeische Kultur Und Moralische Ökonomie. Aufsätze zur englischen Sozialgeschichte des 18. und 19. Jahrhunderts*. 35046. Berlin, Frankfurt, Wien: Ullstein.

Kimberly, R., Suiseeya, M. & Zanotti, L. (2019). Making Influence Visible: Innovating Ethnography at the Paris Climate Summit. *Global Environmental Politics* 2019; 19(2), 38–60.

Wilson, L. (2003). *Gender and technology: A reader*. Baltimore: John Hopkins University Press.

Landstrøm, C. (2006) A Gendered Economy of Pleasure: Representations of Cars and Humans in Motoring Magazines. *Science Studies* 19(2), 31-53.

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