



TREASURE

D4.5: Report on ethnography of CE in the automotive industry (1st version)

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EXECUTIVE SUMMARY

This is the first version of TREASURE's ethnographic study of the circular economy in the automotive industry. It was authored by Veronica Davidov and Alberto Cottica, with support from Sirin Knecht, Jos Soldo and Ivan Cukeric (members of Edgeryders team).

It is structured as follows. We first describe the methodological framework and research design of TREASURE. Next, we review the ethnographic insights that have emerged from the data so far, and connect them with visualizations derived from the same data. We conclude with a short overview of the steps ahead, as we proceed with the project in the coming months.



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1. Introduction

This report is a contribution to the TREASURE project under WP4 (platform design, development and integration) and WP2 (TREASURE assessment methodology definition).

1.1. 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. Data collection is ongoing; this report addresses only 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 visualize them in network form for additional clarity and intuitiveness of presentation.

1.2. Research Team

The research team is led by Veronica Davidov, and includes Alberto Cottica (data processing and visualizations); Ivan Cukerić (transcriptions); Sirin Knecht (coding); Jos Soldo (interviews). Davidov is this report's principal author; Cottica is its co-author.

2. Methodology and Research Design

2.1 The Ethnographic Method and semantic 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 centers around interviews in an “event ethnography” (Campbell et al 2014) setting.

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 analyzed, reduced and visualized, using techniques from network science. This approach gives us a bird’s eye view into structuration of discourses and meaning. Ethnography explores what people say and how they say it, with attention and sensitivity to cultural context. Visualizations help us see the patterns of co-occurrences of those codes and identify when those co-occurrences are prevalent enough that their association also signifies something about 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

To produce the corpus discussed in this version of the report, we focused on ethnographic interviews to help us map the conceptual space around circular economy and sustainability practices in the electric car sector. Jos, a native German-speaking researcher conducted structured interviews at 5 car industry events, all located in Germany. Below is the overview of the events themselves, and the information about the number of interviews each yielded.

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.”





Image 1. 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 winter time). The vintage car exhibition in the 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 men, 2 women).



Image 2. 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 men, 2 women).



Image 3. TopCareerStuttgart2022

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 men, 19 women)



Image 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 men, 12 women), (2 were partially completed).



Image 5. Allstedt Cars Meet Photographer

2.3 The interview script.

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. The most up-to-date version of the interview script is as follows:

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 expound 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?

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 degree of disposable income and/or leisure time to dedicate to cars as a hobby, and to attending such hobby events. Most of the events yielded interviews with more men than women, 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.” (Wilson 2003, Landstrom 2006).

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 that are relevant for understanding how car owners/users are conceptualizing and affectively relating 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 pertaining to 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. Results

3.1 Ethnographic Insights

This section covers the insights of the ethnographic team based on analyzing the data – so, notable concepts emerged in the process of interview transcription and coding before SSNA visualization and reduction techniques were applied. These insights, combined with visualizations, help us understand holistically the discourses and perspectives of our informants. The combination of qualitative and quantitative methods achieved by combining the ethnographic insights with code visualization can offer us either validation or deepening of the ethnographic insights through the visualizations, or can reveal a divergence between ethnographic insights and emergent visualizations, 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 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 gleaned from interview data processing reveals that informants treat **sustainability as a cross-scale phenomenon and a collective phenomenon**. Ethnographic engagement reveals that sustainability practices are conceptualized on micro and macro level; 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 visualizations



below, where we will see a cluster of codes around individual choice and behavior, and another one 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 behavior, 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 be only 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. Among other things, it is a process that is conceptualized when a social actor considers themselves a part of something larger, and may think about and speculate about 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 electromobile mobility.](#)”

The second preliminary insight highlights pervasive ambivalence about car electronics.

Interviews revealed a certain ambivalence about the development of electronics in the car sector and the question to what extent electronics can be a blessing and a curse at the same time. This is also in line with recent social science scholarship on “ambivalent technology” and the “need to find balance between the positive opportunities of technology and the negative impacts and risks” (Dorrestijn 2020 :14). While 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 way that was more affective (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 as such and more about lack of their own expertise: “Because simply I 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 to 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 that: “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 offer a segue into our third preliminary insight – into the issue of **fragmented agency**. Agency, in social sciences, 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. Structure generally refers to an interconnected set of social forces, institutions, and relations that together shape, constrain, and/or enable human actors' thoughts, behaviors, experiences, and choices. (see, for example, Giddens, 1986). One's own ability to act in connection with political decisions is questioned or emphasized. The issues of electric cars and electric components in cars, and circular economy focused behaviors 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 own 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 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 calipers 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 in general (so, beyond just the environmental or just the automotive sector) has been a 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 skepticism and suspicion. Some informants critically invoked the logic of “planned obsolescence”, that is, “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 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.” A 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 behavior 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-labeled 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.”

Issues of privacy and surveillance – this was hypothesized by us as a salient issue that is a likely barrier to embrace of recycling/circular economy in the electric car sector, and indeed our informants aired a number of concerns, though they are not shared by all of 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 “modernization” projects, and studies in social uptake of technological innovations, for example “smart homes” have shown that user acceptance of technology “has been shown to be linked to perceptions of privacy.” (Hesse-Biber 2011)

3.2 Visualizations

Below, we move to the preliminary visualizations of the corpus of data gathered from these five “event ethnography” sets of interviews. The TREASURE corpus at the moment of this report consists of 3,149 posts in 71 topics, for a total of almost 100,000 words. There are 111 participants. This corpus was enriched with 5,036 annotations, which use 285 codes. The 285 codes are connected by 11,468 co-occurrence edges, many of them parallel (which means that the same two codes co-occur multiple times). Unique co-occurrences are 3,999. The



association between perception of recycling and modification is the strongest one in the corpus, with 98 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 visualization. We therefore need to reduce it before visualization. In what follows, we present this network reduced according to different criteria, in order to support different types of inference (Cottica et al 2012).

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

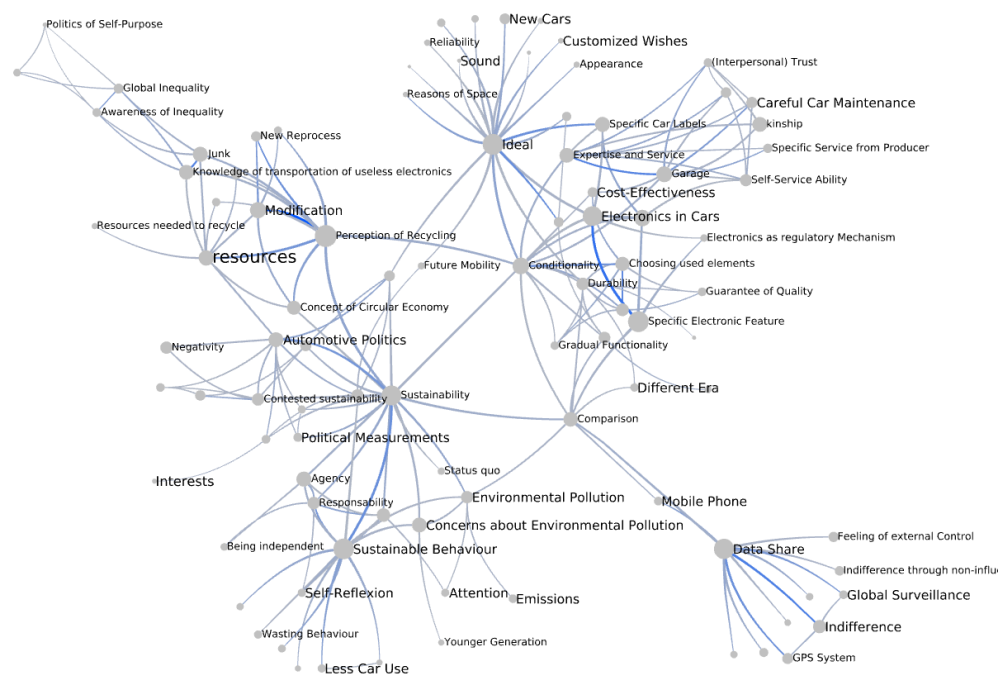


Figure 1. The reduced codes co-occurrence network of the TREASURE corpus (97 codes, 191 edges). Only the edges between codes that co-occur 10 times or more are represented. Brighter blue edges indicate higher numbers of co-occurrences, so deeper associations.

Figure 1 shows the code concept of circular economy (to the west of the graph) situated midway 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 behavior. 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 visualizations), 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, 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 electric 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 are analyzed 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 visualization 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 didn’t 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 0.96). This is shown in Figure 2. a reduction with $b \geq 7$. 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)

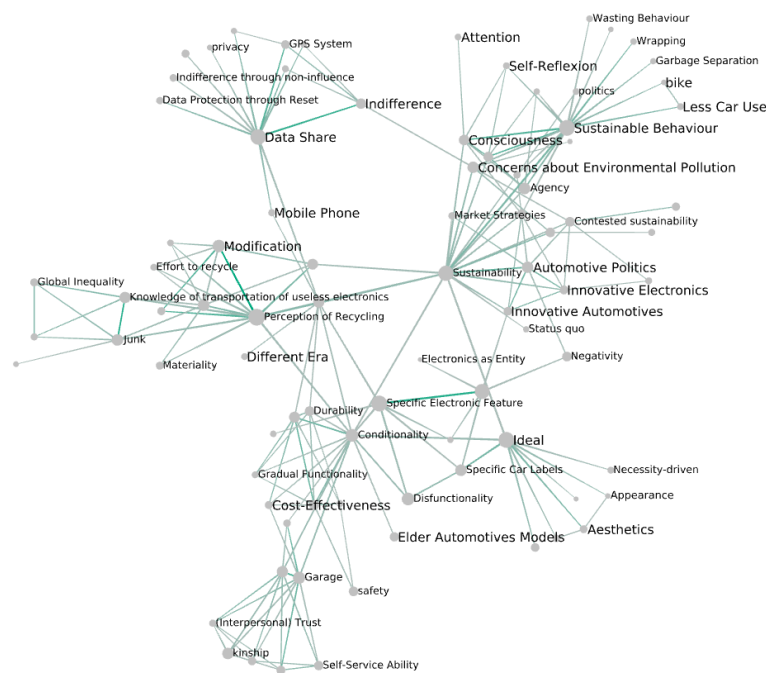


Figure 2. The reduced codes co-occurrence network of the TREASURE corpus (83 codes, 87 edges). Only the edges between codes that co-occur in the interviews of 7 or more informants are represented. Brighter green edges indicate higher numbers of informants, so broader associations.

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, six 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).

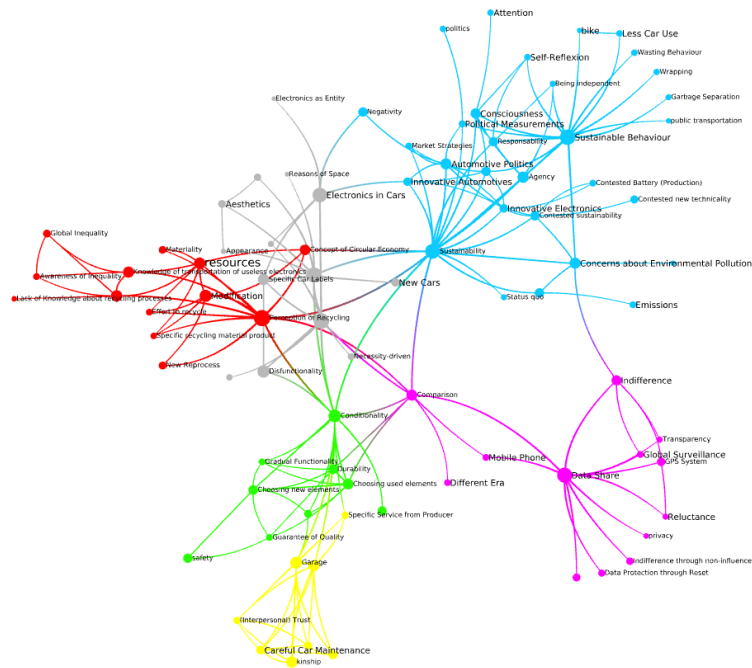


Figure 3. Modularity analysis of the network of Figure 2. The network resolves quite naturally into six communities of codes, coded by color.

The communities are semantically quite coherent. What follows is a list of all codes by community. Bold indicates the highest occurring code in each community.

- The grey community includes codes related to *pros and cons of electronics in cars*. These are: New Cars, Electronics as Comfort, Disfunctionality, Electronics in Cars, **Ideal**, Appearance, Aesthetics, Necessity-driven, Specific Electronic Feature, Electronics as regulatory Mechanism, Specific Car Labels, Electronics as Entity, Reasons of Space, Relevant Features.
- The red community includes codes related to *materiality and the circular economy*. They are: resources, **Perception of Recycling**, Materiality, Modification, Concept of Circular Economy, Global Inequality, Junk, New Reprocess, Knowledge of transportation of useless electronics, Awareness of Inequality, Specific recycling material product, Lack of Knowledge about recycling processes, Effort to recycle.
- The yellow community includes codes related to *personal expertise networks*. They include: Self-Service Ability, **Garage**, Careful Car Maintenance, Expertise and Service, (Interpersonal) Trust, kinship, Specific Service from Producer, Expertise and Knowledge.
- The green community includes codes related to *deliberation/consideration by drivers*. They include: Cost-Effectiveness, Gradual Functionality, Choosing used elements, **Conditionality**, Choosing new

elements, Guarantee of Quality, safety, Durability, Elder Automotives Models.

- The purple community includes codes related to *data sharing and surveillance*. They include: GPS System, Indifference, Transparency, **Data Share**, Global Surveillance, Mobile Phone, privacy, Comparison, Indifference through non-influence, Reluctance, Data Protection through Reset, Feeling of external Control, Different Era.
- The blue community includes codes related to *systemic consideration of sustainability*. They include: Agency, Wasting Behaviour, Sustainable Behaviour, development, **Sustainability**, Environmental Pollution, Negativity, Status quo, Responsibility, Wrapping, Concerns about Environmental Pollution, Automotive Politics, Innovative Electronics, Innovative Automotives, Consciousness, Being independent, climate change, Emissions, Market Strategies, bike, Garbage Separation, Contested sustainability, Contested Battery (Production), Self-Reflexion, public transportation, Attention, Less Car Use, Political Measurements, politics, Contested new technicality.

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 visualization, 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 behavior, 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 yellow 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 visualization is the blue group, which contains codes that are more global and conceptual – consciousness, automotive politics, political measurements. Interestingly, this group also includes sustainable behavior which as a meta-category might contain concrete behaviors that belong in the red group, but as a concept in and of itself is linked to larger institutional and political forces that shape the contours of what, exactly, sustainable behavior 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 gray 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 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 purple group contains the codes pertaining to data sharing and surveillance. This visualization 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.

4. Looking Ahead

This report marks the halfway point of the Treasure project. In the next 18 months the ethnographic team will build on insights achieved to date in the following ways:

- Ethnographic data will continue to be gathered from appropriate events, which may be additional car shows / industry events, and will also be onboarding events/workshops dedicated to success stories of circular economy in the automotive sector
- In continuing to gather ethnographic data, we will refine our methodology in an ongoing way by iterating the achieved insights into future interviews, and using them to inform research design going forward.
- In terms of actionable insights this project is positioned to yield, we will work towards identifying concrete micro, meso, and macro level insights relevant for promoting the circular economy in the automotive sector. In social science literature, that tripartite model of scales generally associates the micro level with the individual (as a social actor); the meso level with the immediate/local community and institutions within which the individual is situated; and the macro level with the global sociopolitical and economic forces that shape the possibilities and limitations of the micro and meso scales.



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