# *Design anthropology for emerging technologies: Trust and sharing in autonomous driving futures*

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*In this article we demonstrate how design anthropology theory, methodology and practice can be mobilised to create interventions in how possible human futures with emerging technologies are understood and imagined. Drawing on our research into Human Experience and Expectations of Autonomous Driving (AD) cars we show how: we engaged ethnographic insights to redefine concepts of trust and sharing which contest dominant problem-solution narratives; and we mobilised these insights in applied contexts, through our* AD Futures *cards which employ ethnographic quotes and examples to disrupt common assumptions, align stakeholders with everyday experience, and pose new questions.*


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In this article we propose and outline how design anthropology theory, methodology and practice can be mobilised to create interventions in how possible human futures with emerging technologies are understood and imagined. In doing so we respond to the need identified in a recent *Design Studies* article, to 'develop more holistic approaches for moving beyond user participation and technology design, towards ways of engaging people in the complex acts and networks involved in contemporary social and technological transformations' (Smith & Iversen, 2018, p. 10). A design anthropological

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approach has a significant role to contribute in such debate and practice because it brings a critical theoretical anthropological agenda together with in-depth ethnography and an exploratory, future-focused design research practice. It is thus equipped both to critically reveal how dominant narratives have informed design, engineering and policy relating to emerging technologies, and to invite the generation of plausible future design concepts and agendas through attention to how emerging technologies will become part of possible human futures. Design Anthropology is not a single unified field, but has developed in relation to different theoretical and methodological waves across anthropology and design (Pink et al., 2017a). It involves a commitment to ethnographic research that is coherent with discussions of using ethnography to research 'in the wild' (Ball & Christensen, 2018), but is guided by anthropological theory. Our approach aligns with the Danish design anthropology tradition, developed by Smith and Otto (2016) and Gunn et al. (2013), drawing on the phenomenological anthropology of Ingold (eg Ingold, 2013). Thus we engage a set of concepts which frame our approach and interpretation: *emergence*, referring to the ongoingly emergent configurations of things and processes, or in other words the state of affairs in which we live, in which technology is designed and technology becomes part of our present and future everyday lives; *improvisation,* referring to the ongoing ways that humans improvise to take the next steps within the contingent circumstances of the everyday, to establish and accomplish routines in both design and use of technologies; and the sensory and embodied ways of *knowing* and *learning* that characterise everyday experience, again for both tech designers and users.

To discuss how Design Anthropology can be mobilised, we draw on our research into Autonomous Driving (AD) cars, which due to both their hype and current design and development offer an ideal example. We discuss research undertaken within the Human Experiences and Expectations of Autonomous Driving (HEAD) project, where we collaborated between our Universities and Volvo Cars. Volvo's core values of People and Safety underpinned our work and coincided with our design anthropological focus on people. We draw on three of HEAD's ethnographic sub-projects: understanding AD futures through everyday commuting (15 participants) (Pink et al., 2018a); ethnographies of experimental testing in Wizard of Oz (WOz) cars, simulated AD cars with a safety driver (8 participants) (Osz, Raats, Fors, Pink, & Lindgren, 2018); and DriveME (2017–2019), a pilot project in AD on public roads in Gothenburg, Sweden where 5 families received research cars with AD features. Our design anthropology research team learned about the families' commuting and driving routines before and after receiving the cars. Through this example we demonstrate how our ethnographic research supported our redefinition of dominant concepts in this field, and how we engaged ethnographic findings to create

interventions, including a set of design cards, which can be used to shift thinking through these concepts in design workshops. We focus on the concepts of *trust* and *sharing*, selected because: they are dominant concepts in business and policy narratives about technological futures; they are part of future mobilities research in social science and Human-Computer-Interaction (HCI) literatures; and reflect enduring anthropological concerns relating to uncertainty and reciprocity. We emphasise this article is a theoretical and methodological contribution, which demonstrates how anthropologically interpreted ethnographic findings can enable new insights, critique and modes of intervention. While we outline ethnographic findings about trust and sharing relating to AD cars, this is intended primarily to support our argument regarding the mobilisation of Design Anthropology, rather than to present empirical knowledge about AD cars. We refer readers requiring deeper ethnographic discussion to our publications these insights are drawn from.

Below, we first outline how AD cars are represented in dominant societal narratives and the relationship of this to HCI research and technology design. We account for Science and Technology Studies (STS) and design anthropological critiques of such narratives, and apply a design anthropological theory of how emerging technologies might participate in human futures to AD cars. We introduce how concepts of trust and sharing are discussed in HCI approaches to AD cars and dominant narratives, how design anthropological concepts of trust and sharing contest these definitions and how this is manifested in ethnographically. We then explore how design anthropological definitions and ethnographic insights might be mobilised in applied contexts, through a discussion of our *AD Futures* design cards which employ ethnographic quotes and examples to disrupt common assumptions, bring stakeholders close to everyday experience, and pose new questions.

## *1 From solutions to possibilities*

AD cars were the most hyped emerging technology in 2015 (http://fortune.-com/2015/08/20/self-driving-car-hype/). In business, government and research and innovation agendas they have been pitched as a solution to a range of societal problems, as long as publics will accept them. For instance: in 2017 the Australian government commissioned a report Social issues relating to land-based automated vehicles in Australia which emphasised 'the importance of public engagement in *building acceptance* of driverless vehicles' (emphasis added), noting that 'Driverless vehicles have the capacity to bring about substantial social benefits' but 'without adequate public engagement, those may never be fully realised in Australia'; in 2017 report on 'Social and behavioural questions associated with automated vehicles' which was a scoping study by UCL Transport Institute for the London Department for Transport asked '*What will consumers accept* and what will they require in order to feel they

trust the technology?' (Cohen, Jones, & Cavoli, 2017, p. 28); and a 2018 EU H2020 funding call listed amongst the 'expected impact' of projects concerned with AD vehicles that they would 'Contribute to *a better user acceptance* of innovative, cooperative, connected and highly automated transport systems' (emphasis added) (http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/mg-3-3-2018.html). However, the American Automobile Association's annual automated vehicle survey reported in 2019 that 71% of Americans were afraid to ride in fully AD vehicles and only one in five were comfortable with them transporting loved ones (https://newsroom.aaa.com/2019/03/americans-fear-self-driving-cars-survey/) suggesting significant public scepticism (Hengstler, Enkel, & Duelli, 2016). Amongst the problems it has been predicted could be solved, if only publics were docile and accepted AD cars, are those of: eliminating human error and increasing road safety (Winkle, 2016); improving quality of life by freeing up driving time for infotainment or work (Kun, Boll, & Schmidt, 2016); decreasing emissions (Taiebat, Brown, Safford, Qu, & Xu, 2018); and increasing energy efficiency (Davila & Nombela, 2012); and in Australia, reinvigorating the automotive industry and related service industries (Milford, 2018).

Thus, AD cars present an example of what Callon (2008) sees as a discursively constructed and performatively defined innovation, framed within a 'solutionism' paradigm (Morozov, 2013), whereby it is assumed that technologically driven societal change will solve social and individual problems, and resonates with 'solutionist' narratives about smart cities (Tironi, 2018). Recent social science and humanities scholarship questions these supposed future problem-solving possibilities of AD cars, from the perspectives of Science and Technology Studies (STS) and Design Anthropology.

First, with regard to the question of whose 'problems' would be solved and where? This raises two sets of issues. One is that the global and national inequalities in economy, road and digital infrastructure and other conditions of driving. As we have shown ethnographically (Pink et al., 2018b; Pink, Fors, & Glöss, 2018a) p. 2019) or as Stilgoe, (2018b: p33) expresses from a STS perspective, this 'global unevenness' means 'self-driving cars can without paradox, be both complicated and straightforward, implausible and probable, distant and just-around-the-corner'. The other is if the problems and solutions posed bear any reference to the experienced contingencies of everyday life as faced by possible future users of AD cars, even in those global sites where they are likely to become accessible. Our ethnographic research has revealed the complexities of the everyday require that future transport is designed to fit with human needs and feelings, and to acknowledge that people are unlikely to use self-driving cars as intended (Pink et al., 2018b; Pink, Fors, & Glöss, 2017b, 2018a). Thus, the idea that publics should or will 'accept' AD cars and their future benefits as promoted by governments and influential EU research funding streams appears naive.

Second, STS scholars have questioned how self-driving cars will become part of technological systems. Stilgoe has proposed that 'Rather than seeing the technology as fixed and looking to plug the deficits of law or public understanding that are imagined around it, policy makers should instead see self-driving cars as an opportunity for more active engagement in the shaping of technological systems, prioritizing social learning' (Stilgoe, 2018b: p44). These scholars offer significant critical perspectives, focused on governance and society. However to advance further the question regarding whose futures self driving cars might participate in, we need to investigate closely how they might participate in everyday lives, to understand their significance for people as well as for society.

Both issues, we argue, require deeper academic engagement with existing processes in AD car design and testing that already attend to people. In the STS literature User Experience (UX) research and testing is understood as implicit in the experiment by which AD cars - as a fixed technology - are launched into society. For instance, seeing street testing potentially threatening democracy when it is engaged for the 'public communication of an innovation, and as part of strategies for promoting "social acceptance" of technology' (Marres, 2018). This has led STS scholars who define self driving cars as a social experiment and an experimental technology, to argue that testing processes should be used for social learning regarding their governance (Stilgoe, 2018a; 2018b) and call for 'more active form of governance for responsible innovation' (Cohen et al., 2018: abstract). Or more pragmatically, in the re-purposing of street trials through methods designed to elicit societal elements of innovation, through experimental methodologies (Marres, 2018).

Much HCI research is indeed complicit with the solutionism paradigm (Morozov, 2013) critiqued above, through for instance approaches such as the Technology Acceptance Model (Hornbæk & Hertzum, 2017; Koul & Eydgahi, 2018), based on psychological theories of trust and acceptance, and involving testing which can be aligned to narratives of performative innovation. Stilgoe's (2018a, 2018b) urge towards social learning, and Marres' (2018) appropriations of street testing experiments, offer key insights into societal issues raised by AD cars. However we need to pay closer attention to two issues: to how automotive companies are attending to designing for and with people, beyond strictly engineering focused street trials, rather than simply assuming that solutionist narratives are always played out in the practice of design; and to the opportunities that design anthropological collaborations with AD testing offer us to generate new ethnographically based insights and understandings, and as such to seek to shift the narratives that shape the innovation processes critiqued above by investing new meanings in the concepts they engage.

## Design anthropology for emerging technologies

Within design anthropological research, analysis and intervention selected concepts can also be useful for thinking about the relationship between experienced realities, dominant societal narratives and theories of innovation. Such concepts can be mobilised to both: illuminate how certain assumptions are mobilised within dominant narratives, and performative visions of innovation; and reveal how ethnographic realities contest these versions of reality. For these purposes in this article we use the concepts of *trust* and *sharing* as containers where the meanings that are associated with them from quite different perspectives are discussed and contested empirically and theoretically.

Trust and sharing are complementary since they can be seen as belonging to different categories. Trust is a concept that stands for an anticipatory feeling which is sensed when engaging in a practice, while sharing is a practice which might become associated with various feelings. We were particularly interested in trust and sharing because both concepts have figured in discussion of AD cars in HCI and business research and become connected in their narratives. In HCI literatures, trust in automation is commonly defined as 'the attitude that an agent will help achieve an individual's goals in a situation characterized by uncertainty and vulnerability' (Lee & See, 2004), and as determining both people's willingness to rely on automation in contexts of uncertainty (Hoff & Bashir, 2015), and people's perceived usefulness and behavioural intention to use an autonomous vehicle (Choi & Ji. 2015). In HCI research human trust in technology is thought to be required for people to accept the technology (Choi & Ji, 2015), and in turn acceptance is thought to be required so that the predicted benefits of AD can come into being. Sharing is seen as one of the phenomenon or practices that will arise from trust and acceptance. Thus the possible human and environmental benefits associated with sharing (Dowling & Simpson, 2013; Taiebat et al., 2018) appear more reachable. However while designers and developers seek to make car and ride-sharing technologically possible in ways that are firmly embedded in the solutionist innovation paradigm outlined above, as we show below, ethnographic insights reveal that things are more complicated.

## 2 *Narratives and ethnographies of trust*

Dominant methodologies for researching human trust in AD cars involve using simulations to test for trust, and questionnaires that focus on human–technology interaction (Hergeth, Lorenz, and Krems, 2016; Hergeth, Lorenz, Vilimek, & Krems, 2016; Körber, 2018; Lee, Kim, Lee, & Shin, 2015; Wan & Wu, 2017). The logic of this perspective, summed up by Choi and Ji who developed this approach in AD research employs three dimensions of trust, related to specific 'interpersonal trusting' beliefs, which are: 'the belief that the system is predictable and understandable'; 'the belief that the system performs tasks accurately and correctly'; and 'the belief that the system provides adequate, effective, and responsive assistance'. They

suggest that in AD research these dimensions of trust could represent 'system transparency' (relating to user prediction and understanding of how ADs operate), 'technical competence' (relating to 'user perception on the performance of the autonomous vehicles') and 'situation management' ('the user's belief that he or she can recover control in a situation whenever desired') (Choi & Ji, 2015, p. 694). In each of these dimensions, the interaction between the individual and the vehicle is central to how trust is conceptualised and thought to play out in any given circumstances. In this HCI rendering trust is mobilised to support the design of technologies which are expected to impact on humans by engaging them in trusting relationships with machines and technological systems, generating acceptance of new technology (Lüders, Andreassen, Clatworthy, & Hillestad, 2017) and driving its success (Lee et al., 2015; Wintersberger & Riener, 2016) and leading to innovation. Moreover in these positionings technologies are assumed to have agency to both engage people in interactional relationships of trust and to change society.

The design of interfaces and technologies that people will engage with on the terms that this notion of trust stands for are significant, not least for ensuring technical dimensions of safety. However we insist that it is necessary to redefine trust in order to be able to comprehend how human engagement with technologies comes about in the contingent circumstances of everyday life. Critical voices in design disciplines which call for contextual and dynamic understandings of trust in human–machine relationships (eg. Harper, 2014; Hoff & Bashir, 2015; Norman, 2007) have begun to expand the debate. Design anthropology takes this further. There is existing anthropological scholarship regarding how societies deal with uncertainty (Samimian-Darash & Rabinow, 2015). Anthropological critique has also been developed of interactional and transactional concepts of trust, as 'accounts of trust as a form of moral commitment, a character disposition, or a dynamic of "encapsulated interests", where trust emerges as a mutual co-implication of interests on all transacting parties' and where 'Trust emerges as an epiphenomenon of social knowledge: what people's relationships look like after the fact of cognitive reappraisals' (Corsin, 2011, p. 178). A design anthropological concept of emergence likewise critiques such after-the-event definitions, towards understanding trust as an ongoing and continually evolving feeling, and is aligned with critiques of performative innovation discourses (Callon, 2008), whereby innovations are defined after-the-event as finished things (Ingold & Hallam, 2007). If we see trust, like innovation, as ongoingly emerging, then we can better understand, that trust is not so much invested in an entity that a person interacts with, but that trust is a feeling that is experienced within emergent configurations of circumstances (Pink, Lanzeni, & Horst, 2018d).

The key findings and a series of significant illustrative moments in our research sum up how trust might be re-thought through ethnographic research. Our participants talked about trust in a range of different ways in relation to their

experiences of being in their own cars, simulated AD cars and in cars with AD features such as autopilot mode. What is striking from the findings across the three projects within the HEAD project is how when prompted by the circumstances in which trust was experienced, participants consistently talked about trust as a feeling. For example, in our study of everyday commuting, as we drove with him, a participant described to us how he felt confident when driving through his trust in a small toy hanging from his steering wheel. While he compared this with 'superstition', he explained that his trust was rooted a driving incident that had taken place several years ago, just after acquiring the toy, whereby he was driving fast to get his son to hospital and narrowly missed colliding with a Moose. In contrast he pointed out that he did not trust other drivers, but had also found confidence, based on his experience of success of the autobrake feature in 'saving' him when speaking on the phone when driving. Thus we can being to see how trust emerges as a sense of comfort and familiarity, which reinforced through personal experience, but that can be derived from multiple sources, which are not necessarily exclusively related to the human-machine interaction, and that therefore indicate that there is much that is missed in quantitative and questionnaire based testing for trust. In our further studies with simulated WOz car testing, we likewise found that trust was expressed as a feeling. For instance, one participant emphasised how, as for when being driven by a taxi driver, it was 'just the *feeling*' that the person responsible 'knows what he or she is doing', suggesting that 'if you have a driver and it's the first time he is driving, you'd *sense* that. Its bumpy and not smooth'. Likewise he proposed that for AD 'once it *feels* like it's able to take decisions and handle situations in a good way that's trust for me'. Other participants in the WOz tests stressed this embodied nature of a sense of trust, which was emphasised when one participant described how she would have liked the car 'to drive a bit more like me' and would 'read my way of driving'. The question of how AD cars would engage in particular ways of driving that reflected what it was like to drive oneself or to be in the car when others drove endured throughout the studies and was also reflected in the DriveME families' experiences. One participant, imitating a car, enacted how it would drive fast 'bruuum', but commented that 'perhaps I would drive like that' but 'being driven' in the same way would be different, and concluded that 'maybe it [the car] should not learn everything from me'. He equated the 'feeling with a self-driving car' with the idea that 'its driving you'. However in this study likewise the contingency of trust as an emergent feeling rather than as a fixed state was suggested. For instance, a husband and wife in one family described how feelings of trust varied on different stretches of road, suggesting that trust is not invested in the relationship between the car and the driver but in the wider circumstances of the materiality and sociality of driving, and another participant described how his feelings of trust had evolved over the period of use.

Our ethnographic study thus suggested that feelings of trust in future self driving cars might therefore be associated with the sensory experience of being

in a car that drives in such a way that a particular person is comfortable with. It might be associated with a feeling of familiarity, and routine-based ways of coping with possible anxieties about not arriving on time, accidents, or using the phone when driving. Trust therefore in relation to if and how people use future AD cars will be established at least in large part in relation to how people learn, improvise and feel in cars in the contingent circumstances of everyday life, it is not necessarily a rational or evaluative transactional process or thought. This rendering of trust therefore disrupts those HCI definitions of trust and its relationship to acceptance that the solutionist and performative innovation narratives critiqued above depend on. However a design anthropological approach, because it gets under the surface, puts people at the centre, and participates in the experiment of AD cars, enables us to develop the critique from the perspective of the possible future user and within the design process.

## 3 *Narratives and ethnographies of sharing*

There is a growing literature about car sharing services, and the benefits of car sharing as a business model in a post-car ownership or mixed ownership economy are discussed in consultancy circles (eg Deloitte, 2017; Flannery, 2018) where AD car sharing is thought to bring certain benefits. For instance, Monitor Deloitte suggests in an era where AD cars are accessible they could become combined with car sharing services to extend the customer base of urban car sharing by bringing it to more distant suburbs Eliaz, Kumpf, & Aldred (2018), and OECD Insights (2015) suggests 'that shared self-driving fleets could significantly reduce congestion. In terms of environmental impact, only 2% more vehicles would be needed for a fleet of cleaner, electric, shared self-driving vehicles, to compensate for reduced range and battery charging time'. Shared autonomous vehicles (SAV) and ride-sharing services are also discussed within an environmental agenda which would reduce costs for travellers and lower emissions per passenger-mile (Kang, Feinberg, & Papalambros, 2017).

However sharing is a complex concept in terms of the meanings and values invested in it. The anthropologist, Widlock (2017) defines sharing as 'enabling others to access what is valued' as distinguished from market exchange, gift exchange and reciprocity. In contrast the sharing economy, which AD future car sharing is assumed to participate in, has been defined as 'a socio-technical system for the exchange of goods and services' and which 'refers to a collection of services that enable private and commercial owners of particular resources to make them available to others', whereby 'Internet-based services aggregate assets and services for access' (Kennedy, 2016, p. 466). In the social sciences and humanities, there are calls for closer studies of practices of sharing (Kennedy, 2016), and recognition of the affective modes through which digital sharing occurs through social media and how these are related to neo-liberal

economies (Banning, 2016). In design research Light & Miskelly (2019) argue for considering the local dimensions of sharing economies that exhibit a caring mode of sharing, as a response to inequalities of wealth and access that might be generated by those sharing economies that are scaled up to accrue commercial benefits. Social scientists see car sharing as transforming 'the notion of hegemonic automobility through the ways in which cars are used, thought about and promoted' (Dowling & Simpson, 2013, p. 428) and 'a type of market exchange where access and use rights are purchased' (Widlok, 2017). They are however critical of the politics and inequalities associated with car sharing (Dowling & Simpson, 2013), which could emerge increasingly in scaled up (Light & Miskelly, 2019) versions, and Widlock (2017) suggests that 'calling it [car sharing] "sharing" is a euphemism at best and mystification of commercial market relations, at worst'. The concept of sharing therefore is challenged through these arguments, inviting us to therefore conceptualise AD car sharing from the user perspective as the practice of *using AD car sharing services* as opposed to sharing in itself.

In contrast to the enthusiasm for future AD car sharing in business news and commentary, and recent studies which have simulated the environmental and economic impact of implementing a SAV fleet in a specified area using agent-based models rather than empirical data (Chen, Kockelman, & Hanna, 2016; Lu, Taiebat, Xu, & Hsu, 2018), research into human aspects of AD car sharing (services) in UX or HCI research about AD is nascent. An exception is an HCI interview-based psychological study of participants' feelings of personal attachment to their cars, finding these 'were grounded on either self-empowering reasons, memories with the car, increased status, or a loving friendship towards their car' (Braun et al., 2018, p. 175), to suggest attending to personal attachment within a traditional technology design process to 'help designers understand users' motivations, to develop valid personas and create to future concepts for vehicle attachment' in the context of AD and car sharing (Braun et al., 2018, p. 178). While we concur that people express affective relationships with their cars, we wish to go beyond the psychological and interactive notions of attachment which assume interaction between two finished fixed entities - a car and a persona (an abstracted, objectifying, crystallised version of a human). Through a design anthropological focus we have instead asked how imagined future AD car sharing might feel when embedded in the ongoingness of everyday life, people's material, embodied, sensory and affective relationships with cars. Our collaboration with Volvo Cars' DriveMe project offered both indirect and direct opportunities to explore this. We explored the families' car history and everyday use of the car before receiving the research car, and once they had it, we learned how AD features became part of everyday driving routines and commuting environments.

Our research during the first stage of DriveMe revealed the families' participation in the project had encouraged them to consider the possibilities of

car sharing. Our methods, built on a Getting To Know You (GTKY) method (Pink et al., 2017a), entailed a visit during which researchers and the families sat together to discuss research questions and undertaking mapping activities, over a takeout meal in each family's home. For example, during one of these visits one participant - a husband and father of two daughters - reflected on how he likes fiddling with and setting up technology, but once set up considers it finished. He speculated about this in relation to the idea of a car that you can 'kind of rent' wondering 'how many profiles can a car have, or can you take a profile with you, it's really tedious to get a new car all the time and you have the seat, the things, everything you now, to start all over'. Having changed car several times at the beginning of the trial he reflected on how they had not started to accumulate things in the car, so 'you never get too cosy' and it doesn't become like your 'second home'. Another participant contemplated how she would navigate the relationship between ownership and sharing, and what modes of sharing might work. Thus participants' first weeks with a DriveMe car invoked some of the challenges and opportunities they could imagine around what they imagined sharing might entail.

Later in April 2019 the DriveMe families participated in WOz drivealongs in which, a level 4 driving experience (where the driving system notifies the driver when conditions are safe for the car to take over) was simulated in a Volvo XC90 research car in a real urban traffic environment. We combined WOz and design ethnography to speculatively explore how shared level 5 (fully autonomous) AD services might fit with families' existing driving and commuting routines. We collected the family members from home or work and drove them to their preferred destination and back. By speculating on future pick-up, in-car and drop-off experiences in shared AD rides, participants touched, felt, interacted with and elaborated on possible shared futures and explored where it might be socially acceptable, unacceptable, desirable, uncomfortable or intrusive to share. Scheduling, availability and freedom became central in how families anticipated shared level 5 AD services could provide families with mobility needed for accomplishing everyday tasks and routines. All families contemplated a mixture of planned and unplanned occasions within their everyday lives. They defined switching to a service car as a positive trade-off for weekdays and schedules that can be rigorously planned ahead. However for weekends and leisure times and events that are more ad hoc, disruptive or unplanned not owning a car felt like a complete 'loss of freedom'. Paula, a professional women and mother of two children reflected on giving up owning a car. She pointed out that not owning car and having to schedule using shared car would limit her freedom, both in her social life, and being able pick up groceries when she had missing ingredients when cooking at home, she concluded that 'Now I think we could just have one car in the family instead of three and I could order a car for other things I can schedule'. Another participant, Sasko, a professional father of two young children,

reflecting on the similarities between car sharing, balancing the need between immediacy and planning pointed out that for him flexibility was for both adults in the family to own cars in that 'what I'm used to today is more instant and ad hoc decision making. I go wherever I want whenever I want, immediately'.

Existing ethnographic studies suggest that (non AD) car pooling and sharing services fit into people's everyday lives in cities and urban mobility landscapes that are characterised by increasing demand for flexibility and freedom (eg. Zavyalova, 2017) and that emerging ride hailing services like Uber and Lyft can potentially reduce individual car dependency and lead to lower parking capacity in the future (Henao & Marshall, 2019). Monitor Deloitte, suggest that in the case of car sharing markets driven by demand of younger people, 'Car sharing extends the benefits of automobility to individuals without them having to bear the cost and effort of car ownership' (Deloitte, 2017, pp. 1-2). However when we consider the contributions of anthropological theory, and of ethnographic findings, to a discussion of future AD car sharing things are more complex: we encounter both the critique that car sharing is not really 'sharing' at all, and that families who have experienced simulated car sharing services feel that car sharing will decrease their flexibility and freedom. Our research insights suggest that becoming less reliant on private cars in urban environments indicates a shifting balance between independence, instant and ad hoc decision making, planning and scheduling, ownership, immediacy, control and flexibility. In order for shared AD mobility services to become convenient and beneficial, we need to understand where in families' routines shared services would generate more rides, longer rides or different types of rides. This means using anthropological definitions to disrupt what is meant by sharing, and acknowledge in our research designs that AD car sharing services might have little to do with sentiments of sharing and more to do with how to create a way of coping with the contingencies and complexities of (culturally and generationally varied) everyday logistics. It is precisely a 'focus on the socialities and complexities of car use and networked technologies' that Dowling and Simpson (2013: p431) suggest 'opens up possible paths heading … to a post-private-car society' that we need to focus on ethnographically. In our research sharing emerged as something that might not be a fixed way of engaging with future AD cars, but rather might be contingent on what services best suited a family or individual at a particular moment. A design anthropological focus on the complexities of imagined and simulated future AD car sharing, understands the concept of sharing in AD car sharing as standing not for local or caring sharing in a post-ownership society but as one amongst other modes of accessing future AD services, that people will weave into the contingent circumstances of everyday life as lived. This as we show below can be effectively engaged to invite re-thinking of how AD car sharing as a service might be designed.

## 4 *Contested concepts work as disruptive devices*

In the previous two sections we have outlined how a design anthropological approach and ethnographic research undertaken in collaboration with technology experiments can connect human experience with concepts that have tended to be associated with rational actions or emotional attachments in HCI research. We have also argued that design anthropological research disrupts solutionist and performative innovation narratives, in ways that complement the STS focus on social learning and governance, through attending to everyday human experience and possible future users. Therefore assumptions that relate trust and sharing to objectifiable or fixed categories of feeling or action are limited, and it would be impossible to make a finished technology that has the ability to impact on people and society by engendering trust or making people accept sharing. In line with this we have therefore sought to disrupt the concepts that are conventionally used in technology design to instead call for attention to the unfinishedness of technology, the ways that people improvise with technology to create circumstances in which they feel comfortable and familiar and the need to engage with the messiness that characterises how people will use and experience AD cars. We have published more detailed theoretical versions of these arguments in scholarly journals and books (Pink et al., 2018c), of which we have little difficulty convincing social science and humanities scholars. However as design anthropology our approach is interventional, seeks to contest the categories of trust and sharing (and others not discussed here) and to disrupt how they are understood and mobilised in technology design, engineering and policy fields.

To do this we created dissemination materials for use across presentations and design ethnography workshops, designed to introduce ethnographic insights and to also disrupt existing narratives and assumptions about the societal impact of technology. Design ethnography workshops can create and harness circumstances of uncertainty, to successfully disrupt assumptions and produce new future visions (Akama, Pink, & Sumartojo, 2018). Card decks such as the design company IDEO's Method Cards and Nature Cards, https://www.ideo.-com/tools), have become fashionable, used to rapidly communicate insights within cross-functional teams and organisations and for ideation and brainstorming sessions. For example cards with field materials printed on them have been used for workshop participants to use and write on (Halse & Clark, 2008), or to make video ethnography available to design teams (Buur & Soendergaard, 2000). To disseminate ethnographic findings in an applied research environment, we created the *Autonomous Driving Futures* cards, inspired by the *Home Life Insight* cards (https://repository.lboro.ac.uk/articles/Home_Life_Insight_Cards/4996541) which represent ethnographic insights (Pink et al., 2017a, b) and have been used in industry workshops (Mitchell et al., 2015). The *Autonomous Driving Futures* cards were constructed across a set of themes and intentions, which together sought to disrupt

conventional thinking. The themes each responded to the academic concepts that had driven our research and that coalesced in our key findings. However on the cards, these were translated in concepts that made sense to industry and policy stakeholders. The themes were: tricks, trust, learning, expectation, sharing, routines, stuff, other technologies and a final category of wild cards to represent pertinent findings that did not fit other categories. Each theme was represented by six types of card: powerful quotes, images and person profiles; insights; implications; questions; futures. Examples of the cards developed for the two concepts discussed above - trust and sharing - are shown in Figures 1 and 2.

The *Autonomous Driving Futures* cards have been mobilised across mixed stakeholder and industry contexts. In design anthropological stakeholder workshops developed within our subsequent project 'Co-designing future smart urban mobility services: a human approach' (AHA), they have been used alongside presentations, video clips and other materials. The cards have brought ethnographic findings, incisive images and the words and experiences of research participants, directly to bear on activities undertaken with industry, policy and other stakeholders. In these workshops inviting participants to engage with the cards has enabled us to situate and make present human experience in stakeholder discussions in new ways. The cards have also been used in Volvo Cars in internal workshops, in development of features or car functionalities and in learning events. In internal workshops, the cards have showcased insights for colleagues in other departments to gain a new perspective and spark discussions. When functionalities are developed, the cards have been used in cross−functional interaction design and UX research teams as starting points. When agile teams select a feature to work with, insight cards can help to anchor the ideation process into already existing commuting experiences and everyday driving routines. This orients and navigates the feature development from a more human-centric perspective from the outset. In learning events, the cards were a way to encourage other departments to try new approaches and methodologies that make the design process socially informed from the beginning. Thus the cards offer new ways to engage different stakeholders in new understandings of concepts and experiences, such as those of trust and sharing in AD by providing alternative and possibly disruptive accounts that both correspond with the concepts associated with dominant narratives, but complicate existing assumptions and solutions by bringing the realities of everyday experience to the fore.

Interdisciplinary and experimental ways of bringing ethnography into stakeholder workshops thus, we argue, demonstrate where design anthropology can advance cross-sectoral and industry discussions in ways that other disciplines do not. STS approaches to AD cars as experimental technologies discussed above focus on social learning, to generate responsible innovation and governance. Following this approach Cohen et al. (2018) developed a


*Figure 1 AD Futures Cards, the Trust theme*

workshop methodology focused on the sociotechnical systems that will form around future self-driving cars, holding two workshops composed of approximately 40 participants from the transport sector, government officials, industry and the third sector along with University researchers (Cohen et al.,

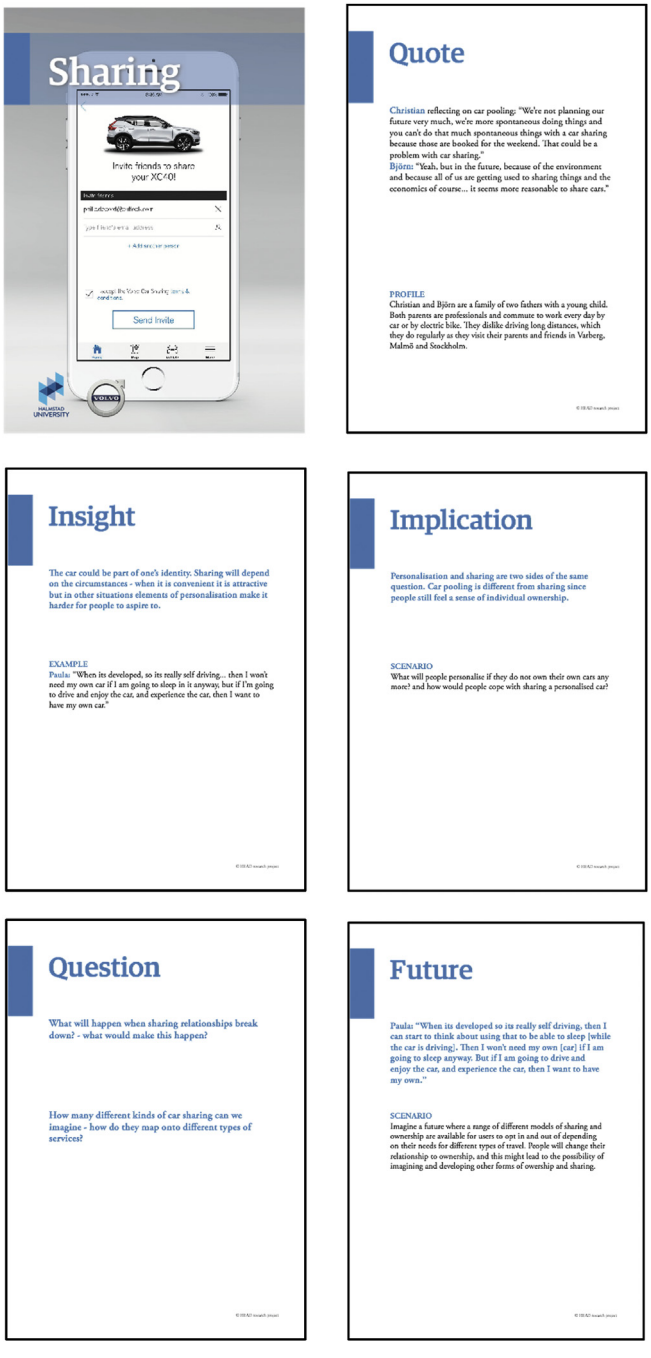


*Figure 2 AD Futures Cards, the Sharing theme*

2018, p. 263). While such approaches bring together certain stakeholders, the focus on social learning, governance and sociotechnical systems creates new knowledge about society and publics, rather than about or with people. Thus omitting the very human experience and everyday activity that our research shows will shape how and why people, as possible future users, may trust and share AD cars. Without attention to such insights that design anthropological research reveals (by combining anthropological theory and innovative experimental design ethnographic methods), the question of to whom responsibility in responsible innovation is directed remains blurred. The societal level is important and we concur that shifting the narratives through which AD futures are defined in dominant discourses and in policy and governance is essential. Yet, society is nothing without people. Thus attention to people, and to developing interventional methodologies that make everyday human experience present in the debate is equally important in considerations of how AD cars might responsibly and ethically participate in human futures.

## 5 *Conclusion*

The future of AD cars is uncertain, and there are various existing ways of addressing this uncertainty, across government and policy, industry and academia. A Design Anthropological approach promotes alternative perspectives that build on human approaches to AD cars and anthropological theory about trust and sharing. Design anthropology, we argue has a particular role to play in this debate, as well as in parallel debates concerning emerging technologies such as drones, robots, and health technologies in and wider debates about the participation of emerging technological capabilities, including Artificial Intelligence (AI) and Automated Decision Making (ADM) in human futures. Design anthropology takes us well beyond existing approaches that involve using 'ethnography in design' or undertaking 'research in the wild' which are still followed in some versions of HCI and design research. As a critical, empirical and interventional approach Design Anthropological theory, concepts and practice contest assumptions that underpin dominant narratives about how technology will impact on our lives. The Design Anthropological approach demonstrated in this article, does so by working with the very same concepts used to create the certainties that align with dominant narratives. When our ethnographic findings contest the foundations of knowledge, that inform the use of such concepts - like trust or sharing - we gain a basis through which to bring critical new knowledge not only to technology design in industry contexts, but to the policy and governance debates.

To develop such work design anthropological collaborations with industry partners who are likewise interested in creating deeper understandings of what people do with emerging technologies present a way forward. They enable us to collaboratively build new understandings of how emerging

technologies might be designed to be sufficiently open to acknowledge how people will improvise to include them in their future lives.

## *Declaration of Competing Interest*

There is no conflict of interest.

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