DRIVE SWEDEN

**Co-designing future smart mobility services
– a human approach (AHA)**

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1. Summary

'Co-designing future smart urban mobility services: A Human Approach project'(AHA) was undertaken in Sweden in 2018-19. This project was a collaboration between Halmstad University, Volvo Cars and the Cities of Gothenburg and Helsingborg (Sweden) with Monash University (Australia) and Aarhus University (Denmark).

The project brought together academic, industry and public sector stakeholders to create an interdisciplinary team of university researchers (ethnographers, interaction designers, design anthropologists), user experience (UX) designers and city planners. Using a design anthropological approach, based on ethnographic research insights, expert knowledge in city planning, UX design, mobility futures and the automotive industry, the project created new human-centred methods for and modes of visioning future intelligent mobility systems, or Mobility as a Service (MaaS).

As a-proof-of-concept project, AHA's goal was to produce a new transferable and scalable methodology for the design of effective and plausible future mobilities that would be sustainable, safe and would respond to the everyday needs of people living and working in cities. This was achieved and has been used to shape a new project – AHA II. AHA II will produce new research and design results and prototypes that can be used for future planning. This report outlines the key findings and outcomes of AHA which includes of integrated principles for developing strategies for urban planning and AD city technologies and services . The transferable and scalable methodology is available for use at the *Future Urban Mobilities: A Human Approach* website: http://aha.hh.se/.

2. Swedish Summary

"Designa smarta tjänster för den smarta staden med människan i centrum" (AHA) var utformat som ett pilotprojekt för att skräddarsy och prova en metod som kombinerar etnografisk forskning med experimentell testmetodik av AD-teknologier, design av intelligenta tjänster samt strategisk stadsplanering. Detta koncept ligger i linje med Drive Swedens vision att öka medvetenhet och engagemang för hur AV (Automated Vehicles) och MaaS (Mobility as a Service) kan vara en del av stadsutveckling och hållbar livsstil och samtidigt föra samman olika parter för att åstadkomma detta. Genom att samla olika aktörer såsom teknikutvecklare/designers från Volvo Cars, stadsplanerare från Göteborg och Helsingborg, samt forskare inom etnografi och design från Högskolan i Halmstad, Monash University och Aarhus University, skapade och provade projektet ut en överförbar och skalbar samarbetsmodell för gemensam utveckling, design och utvärdering av användarcentrerad och integrerad stadsplanering och teknikutveckling. Samarbetsmodellens användbarhet bevisades genom hur den resulterade i ett utvecklat och breddat innovationsprojekt (AHA II) där nya mobilitetslösningar skall utvecklas i Living Labs i utvalda stadsdelar genom att engagera och involvera de boende i områdena i prototyparbetet. Projektet resulterade också i designriktlinjer och planeringsverktyg för framtida stadsdelar integrerat med utveckling av AV och MaaS. Själva samarbetsmodellen beskrivs i detalj på *Future Urban Mobilities: A Human Approach* website: http://aha.hh.se/

3. Background

Current agendas behind Autonomous Driving Vehicles and Smart City technologies often take the view that technologically-driven change will create improvements to benefit society, individuals, business and government. An underlying assumption within these approaches is that, as long as people accept the technologies and use them as intended, the predicted benefits will come about. However, the problem with this approach is that, as social science research has consistently shown, people do not always use technologies as intended: they give up using them because they have not been designed to adequately fulfil their everyday needs and desires; or they adapt and appropriate their use to fit their own routines and to accomplish their everyday objectives. Research findings from the FFI (Swedish strategic vehicle research and innovation programme) funded Human Expectations and Experiences of Autonomous Driving (HEAD) project in which Halmstad University and Volvo Cars collaborate, demonstrates that such activity is integral to how people use cars. Hence, to be sustainable, a shift is needed in the way that Smart City technologies are designed; designing *with* rather than *for* their user communities and future users.

Cities and the Automotive industry need to ensure that Autonomous Driving (AD) technology design and urban planning can work together to account for human needs, anxieties and expectations. It is not only what is effective or possible from an urban management or system development perspective, but how different people and perspectives can contribute to developing vision of desirable and sustainable futures. Such a human-centered approach challenges us to bring together urban planners and AD technology design to form a genuine human-centred agenda in order to ensure a smooth transition towards effective and possibly alternative digital services and its implications for industry, policy and city development. This project addressed this challenge through an innovative design anthropological methodology. This approach was based in rigorous in depth ethnographic research and design processes that bring together industry and City stakeholders in collaborative research, prototyping and evaluation of possible AD scenarios and services.

Drive Sweden's mission is "to drive the development towards sustainable mobility solutions for people and goods by creating and demonstrating efficient, cooperative and automated transport systems." In Drive Sweden's action plan for 2019-2021 it was identified that the program had so far prioritised technical aspects of this mission, and that there was a need to develop initiatives that emphasised societal and human-centric aspects of future mobility solutions. The AHA-project was developed as a proof of concept in response to this call, to investigate and demonstrate how societal and human-centric aspects can be designed into the core of multi-stakeholder innovation projects, and what could be learned through this project to be able to, in the next step, engage more directly with citizens and end-users.

4. Project set up

4.1 Purpose
This project aimed at raising awareness and engagement for how human-centred perspectives on how the use of (Automated Vehicles (AVs) and Mobility as a Service (MaaS) in commuting can be part of city development and planning in a multi-stakeholder context that involves the car manufacturing industry, cities and social scientists. It would do so by developing a transferable and scalable design anthropological methodology template (that uses design ethnography and design futures methods) and an online dissemination platform for this to share insights and mind set to create similar projects in other contexts.

4.2 Objectives

This project was designed as a Proof-of-Concept project to tailor and demonstrate a methodology that combines experimental prototyping and testing of intelligent services for urban development and autonomous vehicles, with participatory and human centred research. The project aimed at bringing together diverse stakeholders of technology designers, urban planners, citizens and social researchers to create a transferable and scalable design anthropological approach to research, co-design and evaluation for future projects. By doing this, the project demonstrated how urban planning and technology development within the Drive Sweden framework can benefit from a user-centred co-design approach.

In the beginning of the project the management group decided that it was too early in the process to bring in citizens directly into the workshops, but instead use ethnographic insights from the research done with citizens as trigger material and probes to align the work in relation to peoples anticipations, anxieties and everyday routines and habits.

4.3 Project period

The project was running between 1st April 2018 – 30th October 2019.

4.4 Partners

Halmstad University, Volvo Cars Corporation, City of Gothenburg, Helsingborg City

5. Method and activities

The project was set up through five work packages, through which the different perspectives on future mobility solutions present in the project were represented, connected and jointly developed. Two of the work packages (WP 1 and 5) were led by a multi-stakeholder management group, and aimed at connecting agendas, visions and plans for the project and more specifically for AD features and services connected to commuting. It also aimed at analysing and evaluating the outcomes from the project to develop an agenda for the development of future co-design of services, technologies and space for Intelligent Cities and potential impact of a larger scale research and design agenda across autonomous vehicles and smart city technology. The other three work packages were led by the three partners respectively; WP 2 was led by HU and VCC to co-produce findings from ethnographic fieldwork and experimental testing on people's commuting and develop these findings into insights to be used in WP 3; WP 3 was led by Gothenburg and Helsingborg City to bring together experiences and insights from WP2 with visions for urban planning and policy making to create integrated principles for urban planning with recommendations for new intelligent services to bring into WP 4; and finally WP 4 was led by VCC to try out new strategies for bringing together AD design and urban planning through joint prototyping and explorations of new directions and technological solutions for user experience and interaction design in relation to AV and MaaS (see picture 1).

Co-designing future smart mobility services – a human approach (AHA)
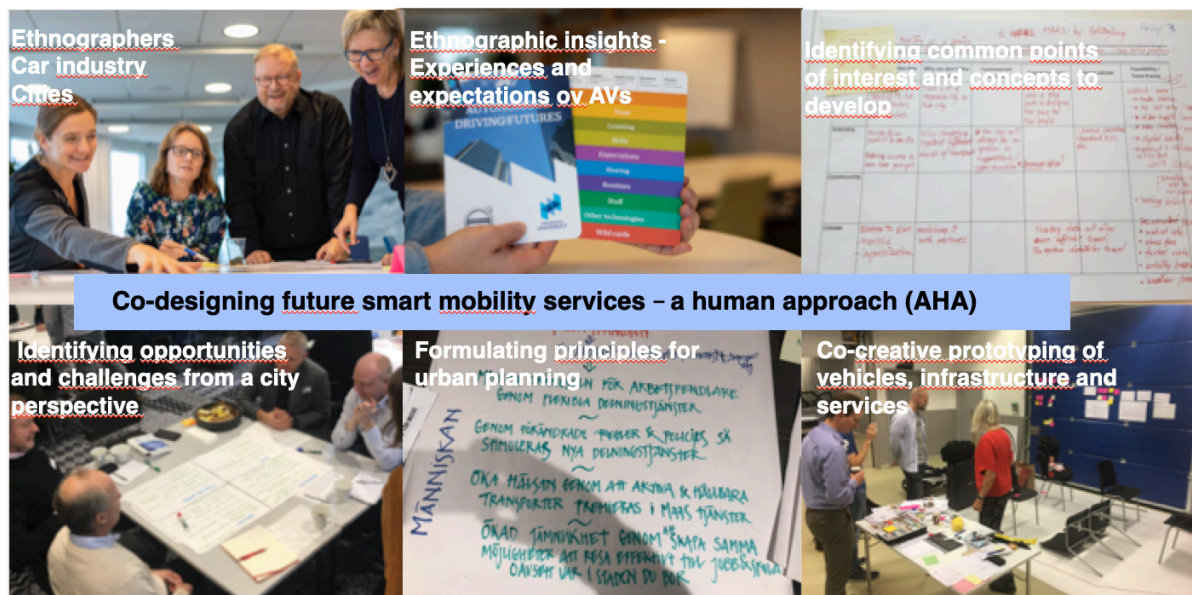
Picture 1: The picture shows outcomes from each work package. These outcomes were aligned through a methodology that was designed as a linear process, through which each work package created insights to be pushes further and developed in the next work package.

The responsibility for co-creating insights, city guidelines and prototyping mobility solutions was distributed between the partners through a participatory design approach that consisted of six inter-connected collaborative workshops, that was co-created by the project participants. The project was guided by a common agenda that was produced through a continuous process of aligning ideas and discourse, and the workshops brought together a mix of professionals from the different stakeholders through a joint focus on people-centric perspectives based in ethnographic fieldwork. The collaborative workshops resulted in a) a joint agenda for multi-stakeholder projects, b) points of interests and concepts particularly interesting to develop together, c) opportunities and challenges for city development with future mobility solutions, d) principles for urban planning, and e) recommendations for a shared agenda for future Smart City development with connected and automated vehicles and mobility services. See more about the methodology at www.aha.hh.se

6. Results and Deliverables

The main findings from the project was proof of the success of the methodology concept that was tried out; a transferable and scalable methodology for bringing together diverse stakeholders of technology designers, urban planners, and social researchers for co-design and evaluations of future multi-stakeholder projects from a people-centric perspective brought in by ethnographic insights. This methodology demonstrated how urban planning and technology development within the Drive Sweden framework can benefit from a people-centred service design approach, by the way the design ethnographic approach in this methodology disrupts what is known and well-established in the different stakeholder practices and thereby creates a common ground to create a joint agenda. This disruption sets the scene for advancing an integrated human-centred research and innovation agenda that takes people's everyday lives and routines seriously and moves the discussion beyond thinking about people as merely citizens and/or end-users, but also as part of communities with local concerns, aspirations, values and knowledge. To bring in these perspectives created realistic discussions of how future mobility solutions can be played out beyond the common utopian/dystopian views of what the future will look like when fleets of fully autonomous vehicles are rolled out in public traffic.

The project also pointed out that two major trends within the future mobility discourse, mobility hubs and MaaS, are particularly relevant to re-think through multi-stakeholder and human-centric projects because of how they so far have been primarily technological innovations that need to be anchored in local knowledge and community values to be included in realistic and sustainable future city scenarios.

The project has delivered:

1. A transferable and scalable design anthropological methodology template (that uses design ethnography and design futures methods) and an online dissemination platform for this.

- This project developed a new design anthropological methodology, which involves three steps: Ethnographic research, analysis and insight generation to create knowledge about how people actually engage with and experience everyday life circumstances (in the case of the project relating to transport)
- Translation of ethnographic insights into accessible dissemination materials for policy and industry stakeholder audiences
- A co-design process of futures workshops in which insights and materials are used to bring together different stakeholders to collaboratively solve complex problems, and imagine plausible futures by putting realistic everyday life situations at the centre.
- This methodology is scalable in that it can be used to address larger samples and projects within the transport mobilities futures field (see AHA II below) and transferable in that it can be applied to similar problems in different sectors where industry and policy stakeholders are active.

    The process for this methodology is demonstrated on the Future Urban Mobilities website at http://aha.hh.se/

2. A report on recommendations and a framework for a larger scale research and design agenda centred on creating co-design solutions towards the integration of autonomous vehicles and smart city technologies with urban planning.

Based on the key successful outcomes of AHA, a framework for a larger scale research and design agenda has been developed focusing on co-designing solutions, integrating autonomous vehicles and smart city technologies with urban planning. The follow up project, *Design Ethnographic Living Labs for Future Urban Mobility - AHA II*, addresses the need for integrating citizens and communities in the development of future urban mobility solutions. This methodology and approach established in the AHA project has enabled the foundations for bringing together city planners, industry partners and academic stakeholders with citizens, communities and public transport in order to create mobility services in everyday life 'Living Lab' scenarios.

The Living Lab approach is closely related to human-centred and co-design approaches to cross-sector development, and support the integration of research and innovation processes in real life communities and settings. It is being applied to investigate future mobility solutions and Smart City services in diverse urban settings, but often used as testbeds for safety functions and usability in technologies or for trying out business cases. In AHA II we will

redefine the Living Lab methodology through the developed human-centric approach, by creating test scenarios in already existing social communities and networks. Combining a human-centred and design ethnographic approach with iterative prototyping and technology testing, we will put the social and human dimension of everyday life before technological innovation and usability. As such, the project will both create ideas for iteratively designing, as well as evaluate and develop new MaaS solutions together with people and citizens as part of their everyday life activities and environments in the Design Ethnographic Living Lab.

Based on the outcomes of the AHA project, it is recommended that the larger scale research and design agenda focuses on:

- Development of integrated AV and Smart City technology and urban planning based on deep ethnographic insights and direct engagement with targeted people and communities. This should be done in the form of design ethnographic living labs that integrate a human-centric and design ethnographic approaches to developing future scenarios, iterative prototyping and technology testing as part of people's everyday life.

- Further exploration, development and prototyping of key MaaS services and concepts relating particularly to the 'first and last mile challenges' and the 'mobility hub'; the 'first mile challenge' referring to access and service quality at the outset of users' journeys; the 'last mile challenge' to the quality, accessibility, range and level of existing and potential integration of transport options used during the 'last mile' of urban commuting. The concept of the 'mobility hub' integrates connected and automated vehicles in city-based (both physical and digital) "hubs" through value adding digital and physical services for citizens.

- Continuous development and scaling of the design anthropological methodology in which both local communities and industry partners, transportation and urban stakeholder are able to engage in exploration and co-design of future mobilitysolutions, based on human-centred visions, principles and values.

AHA II will contribute to the development of Drive Sweden's new strategic themes Society Planning and Public Engagement, by targeting the 2021 goals for these themes in the Program Plan.

3. A set of principles for developing strategies for urban planning in relation to the core issues in the project.

In total 36 principles were created through the project activities. The principles were analysed, developed and condensed into the following 7 principles and recommendations for urban city planning

- Planning for social values - Everyone who lives in the city should be able to feel that they are part of it and that they can influence and be involved in the planning and development of the city.
  - o New shared mobility solutions should contribute to increased equality and accessibility, they should be possible to use independently of the socio-economic situation.

- Planning for simpler everyday life - We plan for good quality of life at all levels; individual, family, community, neighbourhood, the whole city, with mobility solutions and services that contribute to making everyday life easier for more people and leaving a sustainable footprint.
    - Mobility solutions should contribute to flexibility and freedom in daily mobility.
    - The services should be individualized and contribute to increased health with active mobility.

- Planning for shared and combined mobility - The transport system must be robust and work for both people and goods.
    - To obtain sustainable mobility city planning need to support combined mobility: shared, connected and automated.
    - It must offer different services and vehicles in a shared economy, with the possibility to adopt for different needs.
    - Physical locations, for example mobility hubs and train stations, need to be attractive places to spend time at while changing from one means of transportation to another.

- Planning for accessibility and flexibility. - Accessibility and flexibility are central to achieving attractive and effective mobility and a sense of freedom for the individual.
    - The physical infrastructure for transport needs to provide access to various functions and services in the city.
    - How we use surfaces to stay, travel and transport need to be flexible so that we can change the distribution in the street space when new mobility solutions are developed.
    - Flexibility means that the city needs to support changing transport habits, new technological solutions and welcome development and innovation

- Planning for transparency - Attractive mobility requires coordination of different modes of transportation in an efficient way.
    - Mobility solutions need to be presented and made available to a wide audience.
    - The city must support systems for open, shared data, new digital platforms and artificial intelligence (AI) for development and adaptation of mobility services.

- Planning for collaboration and a holistic approach - Future mobility is based on cooperation of several actors and that a holistic approach can be applied.
    - Cities needs to seek and support new types of collaborations and have an organization that can handle and prioritize the holistic approach

- Planning for integrated city use - In the city, existing constantly meet new. To some extent, the existing sets the framework and / or conditions for the new. Future access to land, electricity and fossil-free fuels also provides prerequisites for future mobility.

- o Future mobility needs to be able to co-exist with parts of today's transportation systems, both geographically and functionally.
- o Today's public spaces must be rearranged in a way that takes into account future mobility needs and solutions.

4. A set of tentative design guidelines converted from the urban development principles for the development of AD city technologies and services.

- **Increased health and well-being** for decreased commute time, reduced stress and easy access to modalities that promote physical activity and correlate with increased well-being.
- **Flexible, seamless and personalised** mobility services that are intelligent, contextual and use real-time data on unintrusive ways to create more relevancy and unique experiences in addition to making interactions faster and easier.
- **Shared mobility** (ride or car sharing) to easily shift from ownership to access and encourage multimodal integration within first and last mile solutions.
- **Availability & Accessibility** for enhancing or making modalities easy to approach, enter or use by as many people as possible but also obtaining services and information that are needed available. Mobility is less about the means of transportation but more about the convenience of accessing destinations.
- **Feeling of freedom** for introducing more control over one's commute by increased travel opportunities available.
- **Integrity & Privacy** for handling and sharing personal data on a safe way, taking into account the generational differences and perceptions on what that might entail
- **Empowering people & Collaboration** for maintaining an ongoing dialogue and giving communities the opportunity to be co-creators in order to collaboratively develop and improve ideas and mobility service design concepts.

5. A set of "design cards" tailored for use in human-centred integrated urban planning and technology development for intelligent city futures. The design cards can be used to guide ideation of new intelligent solutions in ways that these supports tangible value based on insights from the AHA project. Furthermore, the design cards can be used to evaluate the development of new intelligent city solutions, as well as evaluate existing mobility solutions. The lay-out of these design cards facilitate an easy change of perspectives between urban planning and technology development so they can be used in workshops where a holistic perspective is needed. The design cards are available at the AHA webpage.

6. Drive Sweden round-tables, on human approaches to future urban mobility services. During the life of the project, two Drive Sweden events have been set up, one round table on the 19th June, 2018, that focused on imagining everyday life in automated future cities. The second event was the conference "City of the Future with automated transports - Scenarios, social benefits and collaboration" the 11th September 2019. The project has also been presented on the two Drive Sweden Forums in 2019.

The project has contributed to Drive Sweden's overall goals for Society Planning and Public Engagement with regards to the developed tools, processes and methodology for how relevant actors can be a part of societal development processes aiming at sustainable mobility solutions, and how this can be achieved from a human-centred perspective.

7. Conclusions, Lessons Learnt and Next Steps

Existing research emphasises that we need to be able to make visible the political and economic interests that are already participating in the way that the potential of AVs and MaaS in cities is imagined (Legacy et al 2018: 15). This means that to succeed we need to both bring into view, and bring together into collaboration the public and private sector interests that participate in planning, design and implementation in this sphere. Our design anthropological approach to this problem offers a way in which to achieve this by offering a framework which focuses both interests on the reality of everyday life and human experience - which is the key question that both sets of stakeholders need to account for in order for any future intelligent mobility system to be successful.

Our project introduced everyday human experiences of commuting through ethnographic materials which encouraged discussion, perspective sharing and co-creative activities between stakeholders. This enabled stakeholders to collaborate to develop plausible understandings of how their different interests might intersect and come together in the design of future MaaS systems, that put people and everyday life concerns at their centre.

The AHA project did not aim to create future mobility solutions, rather it aimed to prototype a methodology through which this could be achieved, by using available resources. It indicated that future research should take the following directions:

The multi-stakeholder methodology developed in AHA should be applied through a Living Lab model in which project-specific ethnographic materials and insights will be produced in order to create a new design and prototyping process for possible MaaS solutions. The human-centred approach developed in AHA demonstrated its power in bringing the different stakeholder together according to one aligned and common agenda: to take people's local knowledge, values, habits and routines seriously to together create realistic future mobility scenarios and solutions.

The key assumptions that tend to underpin future visions of MaaS - such as the emergence of transportation hubs and a service-based sector - need to be interrogated for their viability and their coherence with wider emerging business models, everyday life routines and future technologies including Artificial Intelligence and Automated Decision-Making.

8. Dissemination and Publications

- The project has developed workshops by invitation for the multi-disciplinary applied conference: Why the World Need Anthropologists on Lisbon in 2018 and in Oslo 2019.

- The project organised a workshop at the Participatory Design Conference in Genk in 2018

- During the life of the project, two Drive Sweden events have been set up, one round table on the 19th June, 2018, that focused on imagining everyday life in automated future cities. The second event was the conference "City of the Future with automated transports - Scenarios, social benefits and collaboration" the 11th September 2019. The project has also been presented on the two Drive Sweden Forums in 2019.

- The project will be presented at the VTI Transportforum in January 2020

- The project was presented at the City of Gothenburg, Innovation project cavalcade day Oct 2019

- The project was presented at the City of Gothenburg, information to Urban Transport Committee Feb 2020

- The project was presented at the VolvoLean UX design sprint review, June 2019

Publications:

Pink, S., V. Fors, R. C. Smith, J. Lund, K. Raats, K. Osz, T. Lindgren (under peer review) Mobility as a Service through Design: A Human Approach S. Coxton and R. Napper (eds) *Advancing a Design Approach to Enriching Public Transport*

Pink, S., K. Osz, K. Raats, T. Lindgren & V. Fors (under peer review) 'Design Anthropology for Emerging Technologies: trust and sharing in Autonomous Driving futures' *Design Studies*

Pink, S., Osz, K., Fors, V. & Lanzeni, D. (under peer review), Simulating and Trusting in Automated Futures: Anthropology and the Wizard of Oz. In: M. Kazubowski-Houston (Ed.), *Studying future worlds, imagined and unimaginable: Pushing the boundaries of ethnography*.

Fors, V., Smith, R. C., Pink, S., Lund, J., Osz, K., Raats, K. (forthcoming). Disrupting future mobilities: ethnography in multi-stakeholder innovation projects. Paper for submission to the EPIC conference 2020 in Melbourne.