

How to Integrate Human Aspects Into Engineering Science of Transport and Traffic? – A Workshop Report about Discussions on Social Contextualization of Mobility

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Abstract

This paper presents results from a workshop focusing on human demands of mobility that was conducted during the MFTS conference 2022. It shows, how the international participants, most of them male researchers with a background in engineering, dealt with concepts and findings from mobility research conducted by scholars of social sciences, humanities and cultural studies that focus on human mobility demands including gender and diversity aspects.

1 Introduction

1.1 (Auto)mobility as a Complex Socio-Technical Issue

Within a globalized world, there are highly diverse reasons why people move from one place to another and for their choices of vehicles which differ according to time, cultural, urban or rural context, technological development, individual purposes and socio-economic conditions.

Mobility is also influenced by events like the pandemic that has turned public transport into a health, or even life-threatening space. The lockdowns as means to prevent further spreads of COVID-19 infections forced people to work and learn from home that reduced business travels and daily commuting significantly.

People are willing to change their travel behaviour in case of other available and affordable mobility services. As a reaction to the energy crisis that is exacerbated by the current war situation between Russia and Ukraine, the German government temporarily introduced the 9€-ticket for public regional transport to relief citizens from expensive car travels due to the rising fuel prices. As a consequence, the usage of public transport massively increased. Nevertheless, private transport by car is still the dominant mode of mobility, not only in Western countries with a strong automotive industry like Germany or the U.S., but also in metropolitan regions of the global South. In former times, automobility was associated with autonomy and freedom. Today, however, private transport has reached its “peak”. We are facing overcrowded cities freezing in traffic jams at rush hours, high accident rates and the serious consequences for health and the natural environment. These problems caused by transport on the basis of fossil fuels require a fundamental change.

Engineers work hard to develop new solutions like energy-efficient propulsion systems, alternative fuels, high-efficient batteries or automated systems that foster energy-efficient and time-saving traffic together with its infrastructures. However, these developments, even if they provide evidence to increase safety, comfort and sustainability, are not appreciated by everyone.

Moreover, there is an obvious gap between knowing and doing: Even if people are aware of the negative impact of their mobility choices and have opportunities for change, they do not necessarily change them. (Auto-)mobility, as scholars from social sciences, humanities and cultural studies point out, is a highly individual and emotional topic that widely transcends the demand of efficient traffic from A to B.

Mobility patterns, habits and motivations differ according to gender and diversity aspects that shape people’s daily life circumstances, social roles and responsibilities, self-perceptions, feelings and behaviours. Furthermore, they influence people’s attitude that finally leads to acceptance or rejections of new mobility services and technologies. Following from social and cultural scientific research on human-car-relationships, it is the non-instrumental, non-functional or the non-transport-related aspects that are assumed to be the main obstacles for overcoming individual mass motorisation in favour for an ecological traffic transition. Therefore, mobility is a highly complex and multi-faceted issue that could not merely be addressed by technical solutions.

1.2 Structure of the Report

These thoughts provide reasons for setting up a workshop that puts (auto)mobility into a social context to contrast the predominant focus of the conference on algorithmic approaches for enhancing traffic flows in urban and motorway traffic systems.

The following paper is a workshop report. The workshop was a voluntary and additional item on the official conference programme that could be attended by the conference participants spontaneously and without any registration. The report describes the aim and intention of the organizers and outlines how it was conceived, structured and carried out.

It also shows how the international participants, most of them from universities abroad and with a background in engineering, dealt with the given tasks and content from research fields they were less familiar with.

The insights result from the organizers' observations, their analyses of the participants' posters prepared during group works and documented discussions of the final plenary session. The findings should not be considered and referred to as empirically validated results, because they were not discussed and consolidated by the workshop attendees. Instead, the organizers and authors of this paper share these observations in order to spark some thoughts or ideas about relevant research topics and perspectives that may open pathways to more inter- and transdisciplinary explorations or investigations in the field of engineering transport and traffic science or mobility research in general.

2 The Workshop: Human Aspects of (Auto)mobility

2.1 Structure and Procedure

The workshop titled "How to integrate human aspects into traffic modelling and simulations? A social contextualization of motorway and urban traffic systems" was attended by 31 international conference participants. Nine of them were female. Most participants were engineers focusing on efficient traffic flows as one basis for sustainable transport that represented a main topic of the conference. A few were psychologists.

The workshop was initiated and organized by one of the authors who is a research associate at the Chair of Traffic Process Automation and also the equal opportunity commissioner of the Faculty of Transport and Traffic Sciences at the Technische Universität Dresden.

The other workshop organizer and author currently holds the position as a guest professor at the Chair of Thermodynamics at the Faculty of Mechanical Science and Engineering at the TU Dresden. She was responsible for the workshop concept and content. As a feminist design researcher who previously worked in a similar context at Technische Universität Braunschweig, Germany, she aims at integrating theories and approaches from Gender Studies, Feminist Science and Technology Studies, human-centred and participatory design into engineering science to foster socially just and responsible practices and outcomes. At the TU Dresden, she follows the same mission by e.g. offering courses for engineering students.

With the workshop, the organizers aimed at contrasting or expanding engineering research perspectives by focusing on mobility from an explicit human perspective. Road users and their different mobility habits were considered according to gender and diversity aspects and corresponding life circumstances. Particular attention has been drawn to research results addressing symbolic and affective dimensions of human-car-relations. These insights might provide some inspirations and impulses to rethink pure rational and efficiency-oriented mobility and traffic concepts and spark ideas for integrating mobility aspects into existing traffic models and simulations that the workshop participants not considered yet.

The workshop lasted 90 minutes and was divided into following parts given in Table 1.

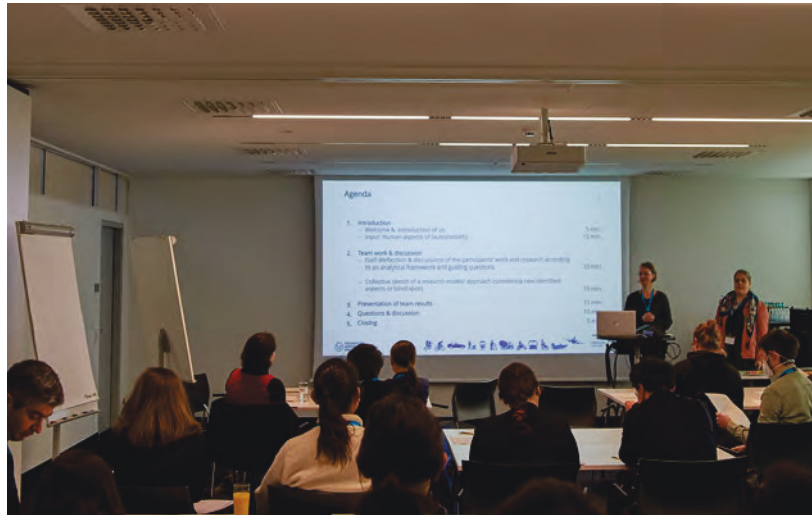


Figure 1: Input given by organizers.

Table 1: Structure of the workshop.

Part	Name	Description
Part 1	Introduction into human aspects of (auto)mobility	Brief overview of current mobility research from the social sciences, humanities and cultural studies with focus on gender and diversity aspects, symbolic and affective motives of (auto)mobility
Part 2	Teamwork and discussions	Joint reflections about the team members' research areas according to a classification regarding different human mobility motives and choices
Part 3	Presentation of the team results and plenary discussion	Synopsis of team's outcome based on the above mentioned classification, open discussion about the relevance of non-transport-related symbolic and affective human mobility motives for transport and traffic engineering research

At the beginning, the feminist design researcher provided insights into the basic research perspectives and concepts of Feminist Science and Technology Studies. Then she presented current results from mobility research from the social sciences, humanities and cultural studies (part 1, Figure 1). After the research input, the organizers divided the participants into six groups. They handed out working sheets and reference lists with an overview of the quoted research publications in the introducing presentation to each of the teams. The teams were then invited to follow the instructions and to accomplish the described task on the working sheet (part 2, Figure 2).

The first task referred to a classification of human mobility motives the organizers had already introduced in the presentation. This scheme (Table 2) and some additional questions (Section 2.3) should then be used to make the members of a team jointly reflect their own research according to the named categories and dimensions. By visually locating their



Figure 2: Team work and discussions.

research focuses on the classification map, they should introduce themselves to the others and discuss areas/categories on the map which were less covered or were even empty.

As a second task, the team members should discuss and develop a model or a new research approach based on the identified lacks or uncovered mobility motives that may be considered or integrated into their future research. Because of time constraints, the second task was postponed and discussed in the final plenary session (part 3, Figure 3).



Figure 3: Presentation of the team results and plenary discussion.

2.2 Introduction into Human Aspects of (Auto)mobility (Part 1)

The talk at the beginning of the workshop highlighted three topics. At first, basic theories and concepts from the field Feminist Sciences and Technologies were presented that describe, how technological research and development are entangled with the socio-political context it is embedded in, including gender and diversity aspects. Then findings from mobility research

of scholars from social sciences, humanities and cultural studies were referenced with an explicit focus on non-rational, non-functional human motives and corresponding mobility preferences besides efficient transport. As a final input, the impact of gender and diversity aspects on daily life circumstances and corresponding mobility habits and demands were presented.

Feminist Science and Technology Studies (FSTS) provide a huge body of knowledge, including theories, methodological approaches and empirical studies that focus on the mutual shaping between science, society and gender [Akr95; Coc93; Fau01; Suc09; Suc19; Waj91; Waj95; Waj00; Waj04]. Following these findings, technological research and development is embedded in a certain socio-cultural and economic context and base on decisions made by researchers and engineers who are mostly men. As a consequence, technology mirrors existing power structures and gender relations that Feminist Science and Technology researchers criticized as follows: “Designers and engineers – mostly men – often use the so called I-methodology, implying that they see themselves as potential users, thus creating a gender bias towards male dominated symbols and competencies. Furthermore, designers often test their products in their own – usually male-dominated – environment. In these cases, the user representation that designers generate is one-sided, emphasizing the characteristics of the designers themselves and neglecting the diversity of the envisioned user group. Configuring the user as ‘everybody’ in practice often leads to a product that is biased towards young, white, well-educated male users, reflecting the composition of the designers’ own group.” [Oos03, page 196]. Since most technological fields and professions are still dominated by men that also holds for automobile cultures and industries [Bal12a; Bal19a; Bal19b; Ben07; Red18], the described “I-methodology” is still widespread and in common.

The popular case study of safety belts and airbags in cars that were designed according to the average size of men represented by standardized crash test dummies is a striking example for the fact that technology is not neutral. Instead, it demonstrates that a gender- and diversity-blind design can have serious and even life-threatening consequences for people who do not fit the (male) norm that, in this case, endangers passengers with other bodily conditions like e.g. children or (pregnant) women [Sch13].

Findings from mobility research conducted by scholars from social sciences, humanities and cultural studies suggests that human mobility motives can be described by five categories or dimensions [Len15a; Len15b; Axs12; Axs19; Sov18; Vob16]. They emerged from several empirical studies and have therefore proven to be particularly relevant, although not all researchers use the same terms to differentiated human mobility motives. Later on in the workshop, these dimensions were used as an empirically verified classification (Table 2) scheme the participants should apply to reflect their own research focuses and practices.

Following these categories, people either decide according to instrumental/functional, symbolic or affective reasons which way of mobility they chose [Len15b; Axs12; Axs19; Sov18]. [Vob16] provide a classification that distinguishes between “transport-related motives” and “non-transport-related motives”. The first category covers what the other researchers label as instrumental or functional motives addressing choices according to daily

mobility demands and duties that are guided by rational aspects like time, cost, availability of offers, comfort, security and finally by judgements about an efficient transport from one place to another. The non-transport-related motives cover symbolic and affective reasons. Symbolic motives guide people's choices according to their personal values, gendered identity, political attitude or social status e.g. [Ave12; Bal12a; Bal19a; Ben07; Red08; Sac92; Sov18; Vob16]. Affective motives are subtle or (un-)conscious choices according to pleasures of other emotional dispositions. The reasons for e.g. possessing a Porsche can address both. On a symbolic level, it can indicate the owners belonging to upper social classes and express his or her personality or gendered identity as a sporty, style and design conscious person. On an affective level, it can address the person's passion for fast driving.

Additional to that, people make their choices according to private or societal benefits [Axs12, page 1048]. In this respect, the decisions for an electric vehicle can be motivated by individual expectations to save money or by promises of societal benefits for human health and ecological sustainability.

These findings that draw back to social scientific mobility research from the 2000s [Red08; Sac92; She04; She00] demonstrate that non-transport related motives are extremely important and powerful. They are supposed to be the main reasons for people's willingness to change their mobility behaviour or their acceptance, respectively rejection of new mobility services or technologies like e.g. sharing offers or autonomous vehicles [Axs19; Hoh16; Spe19].

[Wel15] e.g. investigated how the symbolic and affective meaning of changed over time and cultural context. The researchers summarized different inquiries of automobility cultures, including statistical surveys from England and major cities such as Beijing, Shenzhen, New Delhi and Nairobi. Their literature analysis begins with a cultural-historical comparison revealing that the car in the United States was first and foremost associated with personal freedom, while in Europe the issue of safety and security was emphasized. Following their analysis and conclusions for today, the car satisfies an increasing need of what the authors label as "cocooning". This phenomenon that is also mirrored by soft and cosy interior designs and increasing comfort and safety technologies provided by leading car manufacturers: "[...] features such as electric operation of windows, seat adjustments and in-seat heating and cooling, self-closing doors and boots, sunroofs, etc. all act to heighten the sense of individual control or power over the immediate environment. (...) double-glazing to cut out external noise; thermal glass; interior thermal management systems including climate zones for different occupants; pollen filters; in-car entertainment systems that render the external space increasingly irrelevant; mood lighting; electro-chromatic mirrors; and a wide array of soft-touch interior finishes to convey a tactile sense of well-being." [Wel15, page 114]. As confirmed by other researchers, the car is a room for relaxation and recreation, a comfortable mobile office or living room on wheels [Sac92]. There, people can get rid of their anger after work or can listen to their preferred radio shows and music and sing along their favourite songs [Vob16, page 336]. Especially in big cities where private areas are contested and the environment is considered as increasingly hostile with regard to noise, criminality,

physical and sexual assaults, the car provide a safe space, a shelter or refuge as Wells and Xenias point out [Wel15, pages 114, 115].

Consequently, they regard the identified phenomenon of “cocooning” therefore as a general societal trend “towards more interconnected, controlled, insulated but also pampering environments” [Wel15, page 116]. They even consider it as a main obstacle against the transition towards a more sustainable and public transport based mobility system, or generally, towards ecological and post-automobile societies. Their thesis is supported by current traffic statistics mirroring the dominance of automobility in Western countries, like e.g. Germany, but also in metropolises of the global South [Mel16].

Other social scientific mobility researchers have empirically found out that driving has a fascination in itself. Due to the tunnel vision, it contributes to the “enlargement of human significance” [Vob16, page 333], provides a feeling of power, control, self-determination and freedom by being at the same time comfortably and safe positioned in the centre of action. It simply provides fun. Especially fast and risky driving generates emotional arousal and a kind of thrill [Bal12b; Sac92; She04; Vob16] – a pleasure that is shared equally by men and women, but is differently practiced as the speaker explained later. The attractiveness of driving is considered as a main obstacle a transition to more public and autonomous transport [Bal19b; Bal18; Ber16].

Symbolic and affective motives of (auto)mobility, as the researchers mentioned, are difficult to investigate [Len15b]. This may be one reason, while a rationally oriented and efficiency-driven focus on mobility is another that societal discussions and technological research and developments mainly consider instrumental and functional aspects, while symbolic and affective aspects are left out [Sov18]. Interestingly, as social scientific scholars notice, it is the people themselves who tend to rationalize their non-instrumental-/non-functional mobility habits. This strategy is often applied for legitimizing the possession and use of cars [Len15b, page 690], [Vob16, page 413]. Facing the serious social and environmental consequences, people with an ecological and consumption-critical attitude often feel ashamed when they realize that they use or own a car not predominantly for functional, but for symbolic and emotional motives.

In the next part of the talk, the influence of gender and diversity aspects on mobility patterns and choices were. Expecting a preference for quantitative findings by the workshop audience, the speaker referred to statistics about gender and age-related mobility preferences and driving behaviours that were combined with qualitative insights from social sciences, humanities and cultural studies.

The statistics prove clear evidence whether they refer to Germany [Jan22a; Jan22b], the United States [Car22] or to traffic behaviours worldwide that young men are more likely to be involved in serious traffic accidents and commit far more traffic violations like speed override or drug abuse than females. “About three quarters (73 %) of all road traffic deaths occur among young males under the age of 25 years who are almost 3 times as likely to be killed in a road traffic crash as young females.” [WHO18].

Complementarily, results from social and cultural research provide qualitative reasons for these statistically significant gender and age-related mobility differences by showing how human mobility habits and driving styles relate to issues of gender, social roles, and corresponding life conditions. People who are involved in care work that is mostly done by women, travel often with and in the service of others, e.g. children, family members and for daily shopping duties. They have to cover shorter trips and distances and use public transport more often or walk by foot. In contrast to that, men travel more often alone either for their own or professional purposes. They often use a car to cover more linear and longer trips [CIV14, pages 19 – 21, page 44].

Additional to that, social researchers found out that fast and risky driving, particular of young men, does neither result from missing driving experiences nor does it simply demonstrate an irresponsible behaviour. Instead, it is a strategy to perform masculinity which is culturally defined by the demonstration of power, willingness to take risks, exceeding rules, courage and controlling dangerous situations [Bal12a; Bal12b; Ben07; Gra07; Red08; Red18]. Referring to this finding, researchers ask for its consequences on the acceptance on autonomous vehicles: What will happen when the human driver turns into a passenger? What does this imply for the relationship between men and cars? Is masculinity then in danger [Ber16]? Or is there a change for de-gendering the driver, pluralizing masculine mobility cultures and (auto)mobile masculinities [Web18]? Which consequences do autonomous trucks have for working-class-masculinity [Bal18]? And what about the relationship between women and cars?

Women have more fun in fast and risky driving in computer-simulated car races than men according to a study by [Kor10]. Considering the fact that women are much more involved in care and family duties, their tendency to drive more carefully in real traffic situations may result from their responsibility for others and not from the fact that they are more anxious, less skilled or less fascinated by fast and risky driving. On the contrary, men drive more often alone and for their own sake. Consequently, these differences are not related to gendered characteristics, but instead are linked to the structural inequalities between men and women like the gender division of labour, including different employment status and economic conditions [CIV14]. All this also affects their mobility behaviour and choices.

Further influences are age, income, education and cultural background as the following investigations about the acceptance of autonomous driving indicate. A survey of the Center of Automotive Management [CAM22] with 2100 participants in Germany shows that there is a significant decrease of the acceptance in autonomous vehicles with the increase of age mentioning general distrust (48 %), fears of hacker attacks (40 %), fear of accidents (39 %) and high purchase costs (31 %) to name the main concerns. 28 % of the respondents between 18-24 years can very well imagine to use an autonomous vehicle in future, 18 % of them between 35-54 years and just 11 % at the age of 55 and older.

A survey about the acceptance of self-driving buses conducted with 500 participants in Nanjing, China [Li22] shows that women are more sceptical than men. Respondents between 30-39 years old show the highest acceptance rate. It increases with regard to the

higher education levels and income, although the respondents evaluated a new form of public transport that probably should also address people with lower income. The results of the previously mentioned surveys were not part of the presentation, but kept as appendix in case there would have been demands on statistical data about the influence of gender and diversity aspects with regard to autonomous vehicles.

The qualitative findings of social mobility research, however, may provide some hints for predicting which target groups are likely to accept autonomous vehicle. People who are passionate about the pleasure of driving, who love to be in control and speed up whenever they want to, who associate driving with autonomy and freedom, and consider it as a way of self-expression and identity are supposed to reject autonomous vehicles as a threat and means of disempowerment. On the contrary, people who emphasize (auto)mobile aspects like comfort, privacy, safety and “cocooning” may accept autonomous vehicles. It is also likely that people who do not have sufficient driving skills or a driving licence will embrace autonomous vehicles as a welcome additional mobility option.

2.3 Team Work and Plenary Discussions (Part 2 and 3)

After the theoretical and empirical input, the participants worked in small teams of five to six members (Figure 2). They were offered the following classification scheme with definitions and examples for each field that were already introduced in the previous presentation.

The teams should use the scheme in order to jointly reflect, discuss and document each members’ research perspectives. For this purpose, they drew the scheme on a flipchart and allocated their research issues in relation the categories or fields that were addressed or covered by their current work.

As an additional offer, the teams could use and discuss the following questions on the working to think about and maybe discover further included or excluded human mobility issues in their work:

- Which mode of mobility, mobility patterns and scenarios are covered in my work/research?
- Which road users are addressed?
- Which motives are addressed by my work/research?
- Which assumptions and hypotheses about road users’ demands and mobility patterns are included in my work?
- Which and whose knowledge do I refer to? Which/whose data do I refer to?
- Who benefits from my research/work?
- Which mobility aspects, needs and demands are uncovered, excluded, overseen in my work? Which road users are excluded?

Table 2: Classification scheme of human mobility motives and dimensions.

	Private (Impact on the user/customer)	Societal (Impact on society)
Instrumental-functional motives (What it does/fulfils ...)	Personal purpose-led choices of means of transport to deal with daily mobility demands and duties according to time/duration, costs, availability, security, comfort etc.	Mobility choices according to societal benefits like ecological sustainability, e.g. using the bike instead of the car for short distances
Symbolic motives (What it represents ...)	Choices according to one's personality expressing a certain personal attitude, social status, belonging to a certain social class or social/gendered group	Choices according to expressing one's political attitude and social status, e.g. driving a Tesla as expression of one's ecological and innovative awareness; using an old bike as an explicit expression of an anti-capitalist, consumption critical attitude
Affective motives (How it feels ...)	Subtler or (un-)conscious choices according to certain emotions, pleasures, affective dispositions, e.g. driving as a way of feeling power, (self-)control, enjoying the thrill of speed	

At the end of the group work, each team had produced a collective poster that was presented to the workshop audience (Figure 3). In the plenary session, all participants were asked by the organizers what insights they gained during the team discussions and, in reference to the cancelled second task, how they might integrate some of the uncovered aspects in their future research in case they considered them relevant for their work. Some aspects were controversially discussed, some were confirmed or even enhanced by members of other teams.

3 Overall Results

The organizers reconstructed the workshop according to the documented team results on the posters, their observations and the workshop minutes that were prepared by a colleague of the organizers during the team presentations and discussions.

On the one hand, they investigated the insights with regard to the participants' research focuses and knowledge gaps according to the given scheme. In this respect, the insights verified to a great extend the organizers' previous hypothesis. As most of the workshop

participants had a background in engineering, the posters clearly demonstrated that their research mainly focused on instrumental and functional aspects of mobility, while symbolic and affective motives were rarely addressed.

On the other hand, the organizers analysed the documented results on the posters according to the way the teams dealt with the defined tasks, how they applied the given schemes and defined categories. In this respect, they provide information about the way the participants understood the tasks. At the same time, they can be considered as indicators to which extend the participants were familiar with interdisciplinary collaborations and were used to deal with terms and content from social sciences and cultural studies.

Some of the participants explicitly mentioned that they had difficulties in understanding the tasks which were mirrored in the different ways the teams documented their discussions and results. These uncertainties, as the organizers interpreted, might result not only from the fact that engineers have less touch points with terms, concepts and research findings from the social sciences, humanities and cultural studies. They might also derive from the task descriptions and used categories themselves that could ambiguously read and therefore gave a broad space for interpretation.

Moreover, the organizers did not actively support or intervene in the team discussions. Instead, they left the participants largely to their own devices. Furthermore, it must be taken into account that most of the participants, including the organizers, were researchers coming from different parts of the world and using English as a second language that also complicate communication and understanding.

In the following, the team results and plenary discussions were clustered according to identified research issues addressing human mobility demands and show the different ways the teams applied and discussed the given categories.

3.1 Reflections on Research Topics Addressing Instrumental Motives

The research topics, the participants assigned to private instrumental motives covered investigations of individual travel demands or mobility choices, inquiries of preferences for new mobility services, including autonomous vehicles on roads and/or on rails and considering costs, time and comfort as well as investigations of reducing delays of public transport. Further research allocated to this category dealt with comparative analyses between human-driven conventional versus autonomous vehicles in agent-based simulations and investigation of stabilization the traffic flow on highways in mixed mode traffic.

The research topics they mentioned according to societal instrumental motives dealt with energy- and time-efficiency of connected autonomous vehicles, the impact of ride pooling, traffic lights/intersection control on efficient and ecologically sustainable traffic flows, energy- and time-efficient railway operations, time and energy-savings by integrating automated vehicles in mixed traffic flows and the impact of truck platoons on the reduction of congestions and pollution. In the plenary discussions, researchers also mentioned the development and investigations of certain reward systems, political incentives or determined

traffic scenarios to steer the transport system into a more efficient and environmentally sustainable direction.

In some cases, the posters show difficulties in clearly deciding if a research topic addresses more private or societal mobility concerns. Moreover, some of the topics that were assigned to instrumental mobility motives were also allocated and discussed with regard to the symbolic level. In this respect, one team discussed certain reward systems for new and ecological mobility services that may change people's mobility habits by giving them the opportunity to publicly show their a certain socio-economic status and political attitude, e.g. demonstrating one's ecological awareness to others, an gain in return social attention.

A team allocated the topic of steadying the driving style on highways to the private-functional as well as to the private-symbolic and -affective dimension of mobility. Referring to the previously presented research insights, the group may have interpreted the "regulation and harmonization of traffic flows on highways" that force to drive according to the given rules and determined speed as a kind of disempowerment of drivers who consider driving as a tool for performing their power and (gendered) personality.

3.2 Reflections on Personal Mobility Habits

One team used the given task to think about their personal mobility habits. Interestingly, the team members did not seem to feel addressed as experts of a specific research field. Instead, they stripped away their professional roles and considered themselves as private individuals with certain mobility preferences and habits that were then analysed and evaluated according to the given scheme and categories.

All team members shared ecological and health conscious mobility habits. Three of them managed their way to work by foot or by bicycle, while another one used the tram or bus for his daily commuting. From an instrumental and personal point of view, they evaluated all three mentioned mobility modes as "fast, cheap and convenient". From a societal point of view, they considered their daily mobility habits as environmentally friendly and effective ways of transport that avoid congestion and pollution. In reference to the personal symbolic dimension of mobility, the pedestrians and cyclists of the team interpreted their mobility habits as expression of a sportive and health conscious life-style, in societal-symbolic respects, as expressions of "green transport". In contrast to the consensus that pedestrians and cyclists count as vulnerable road users in mobility research, the team members evaluated their mobility preferences in affective respects as safe transport modes.

Unfortunately, there was not enough time for deeper talks that would have revealed more about the team members' personal life and work contexts. Their evaluations suggest the assumption that all of them lived in urban areas where they just had to manage short distances and congestions determine the daily traffic situations. In this respect, it would have been very interesting to know on which research issues they worked professionally and how much their personal mobility habits and beliefs correspond or deviate from their professional attitudes and practices. Nevertheless, this example suggests that the provided scheme and

categories from social sciences and cultural studies make the participants reflect modes of mobility in a more complex ways than they do in reference to their professional disciplines.

3.3 Reflections According to a Certain Scenario

Another team discussed the offered scheme and categories according to a certain scenario that resulted from a member's current research project. Within this project, the impact of e-grocery/online-shopping is investigated with regard to the amount, hopefully reduction of daily trips in comparison to conventional shopping trips that are undertaken by every single consumer. The team discussed the advantages and disadvantages of e-grocery/online-shopping in reference to the given categories.

In private instrumental respects, they considered e-grocery as a contribution to daily comfort by saving time that could be used for other activities. They also discussed its contribution to gender equality emphasizing the trip- and time-saving effects especially for women who were mostly responsible for the daily food supply. In reference to the societal instrumental dimension, the team reflected the impact of e-grocery on local markets and critically speculated if online-shopping really save trips in future or may instead just opening up more opportunities for leisure travels.

With regard to the private affective dimension, the team considered e-grocery as an opportunity to be lazy. In affective societal respects, it might offer the feeling of contributing to less emissions by avoiding private shopping trips. The organizers expanded the team members' critical reflection of e-grocery by reminding them of symbolic and affective aspects of analogue shopping activities that were particularly revealed during the COVID-19 crisis. Shopping activities in this sense do not only satisfy the basic need of daily food supply. It makes people feel to belong to a social context or neighbourhood. It is also an expression of taking part in the consumer society or is simply a leisure activity that would be diminished by e-grocery activities.

3.4 Reflections on Research Approaches

The last team used the scheme and offered categories to think about mobility dimensions in a more general and abstract way. The members started their reflection from an instrumental point of view focusing on route choice models that may refer to one or more team members' current research activity and discuss it in interrelation with private mode and departure time choices.

The poster the members prepared during the team work can be read as the sketch of a research model or approach as required by the second task the other teams did not accomplish within the given time. Within this sketch, the team members clearly documented the necessity to consider gender and diversity aspects in order to incorporate people's different mobility preferences and needs in instrumental, symbolical and affective respects in their mobility models.

3.5 Plenary Session

After the team presentations, the participants discussed controversially how much non-functional aspects or mobility demands referring to gender and diversity aspects should be integrated in their work. Some of them advocated for more interdisciplinary research and the expansion of their research scope by integrating the missing or less covered symbolic and affective human mobility motives in future work. In this respect, one participant referred to road users with disabilities who, in his opinion, were given too little consideration.

Especially female researchers and one male researcher who outed himself as a traffic psychologist considered these aspects, including mobility differences relating to gender and diversity aspects, as crucially important to be covered within engineering research on transport. Other participants contradicted by referring to their expert domain of doing engineering research that is characterized by its instrumental focus on time and energy-saving traffic flows. Nevertheless, the participants considered interdisciplinary collaborations relevant for future research.

4 Summary and Outlook

The workshop used mobility research from social sciences, humanities and cultural studies to show that people are not purely rational subjects. Correspondingly, the research results introduced at the beginning revealed non-instrumental, symbolic and affective dimensions as crucially important for people's mobility choices and future acceptance of new technologies or mobility offers. In this respect, also gender and diversity aspects matter, not in the sense of natural given traits or properties, but as social roles that shape people's daily life circumstances, duties, identity concepts and behaviours and as a consequence, their mobility demands and choices. These demands and choices change over time and cultural contexts.

With regard to gender roles and differences, there is an ongoing tendency in Western societies that the life circumstances between men and women become more and more similar to each other. Since women have equal access to educational institutions and careers, their employment rates and economic independency increase. In turn, men are taking on more and more family responsibilities. These changes will also affect, perhaps even reverse gendered mobility patterns and behaviours. In that sense, fast and risky driving styles may turn into expressions of an emancipated and skilled femininity, while careful driving manners may turn into expressions of responsible masculinity.

In contrast to that and as expected by the organizers of the workshop, engineering mobility research is focusing on instrumental aspects of mobility addressing people as primarily rational subjects who want to move efficiently from one place to another. However, the results of the workshop definitely show that the participants confronted with findings from other disciplines started to rethink their efficiency-oriented research approaches.

By combining quantitative findings referring to statistics about human traffic behaviours with qualitative findings about symbolic and affective gendered mobility motives, the orga-

nizers aimed at illustrating the complementary gain in knowledge. While quantitative research shows frequencies and distribution of phenomena (e.g. young men lead the statistics of traffic accidents), qualitative research provides explanations and rationales for them (fast and risky driving is a strategy to express masculinity). Interdisciplinary mobility research therefore offers the potential to provide new instrumental as well as non-instrumental qualitative aspects that can be quantitatively measured and considered in data driven traffic and mobility simulations.

The results of the teamwork and the plenary discussions revealed opponent attitudes towards interdisciplinary research. In this respect, the participants could be divided into two main groups: There are those who considered interdisciplinary team work as very important and advocate for the an expansion of engineering perspectives and approaches to include new or undiscovered mobility aspects into their research. And there is the second group who considered cross-disciplinary cooperation useful in order to continue to concentrate on engineering research perspectives and approaches and to leave investigation of the non-transport-related, symbolic-affective aspects to humanities, social and cultural scientific scholars. Some of these researchers explicitly indicated that they were uncomfortable with social topics and found it difficult to consider various human aspects of mobility in their research. In addition to that, the instrumental focus on time and energy-saving mobility issues was highlighted as disciplinary core perspective characterizing engineering science.

The workshop was an experiment, for the participants as well as for the organizers who conducted it for the first time. The unexpectedly high number of participants and their investment of extra time for participation showed that the topic was interesting enough to arouse curiosity amongst engineering researchers. One female researcher even stated that the workshop was a major reason for her to visit the conference. For being able to attend, she decided for an inconvenient flight route that took an additional travel day. All participants showed a high willingness to engage with non-disciplinary content and research fields. Moreover, despite existing relationships to other participating researchers, they were willing to respectfully collaborated with researchers they did not know before and to openly share research deficits or blind spots they discovered during the team work and discussions. These examples mirror the constructive, open minded and trustworthy working atmosphere throughout the workshop.

From an organizational and conceptional point of view, 90 minutes were, however, a very limited time frame to make sensitize researchers sensitize for other disciplinary field and findings that are close to their main subjects, but qualitatively different to their own research. Some of the participants explicitly mentioned that they had difficulties in understanding the tasks that were also mirrored in the different results of the team work. Consequently, the organizers should have expanded the duration of the workshop to give the participants more time for a better understanding of the tasks, opportunities to ask questions and make them deal better with terms and insights from other disciplinary fields in English that for some researchers was a second language.

From a scientific point of view, the overall results presented in this paper would definitely be more profound if the participants had been involved in the analysis and interpretation of the team results and overall discussions, especially with regard to the named and documented research issues on the posters.

Nevertheless, the organizers considered the workshop as a success. It proved clear evidence for an interest in mobility research from other disciplinary fields that provide new insights in human mobility motives and choices that have to be made available, discussed and maybe even integrated in engineering mobility research.

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