

The Vehicle: A Workplace of the Future

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Abstract

In this position paper, we challenge the vision of office work being difficult, if not impossible, in a manually operated vehicle. We present a use case from a study, in which the habits of short-distance private car commuters to work and home were assessed and analyzed. The use case shows that there are many opportunities and strategies to do office work in a manually driven vehicle. We argue that not only autonomous vehicles, but even current manual vehicles are already suitable for office work and therefore are worth for fully exploring their potentials. It is reasonable to expect that even more potentials for office work in the vehicle will open up, once autonomous driving is fully realized, which is why it is all the more important to progress and be ready, when these potentials are available.

1 Introduction and Related Work

According to the vision of autonomous driving, passengers will no longer have to (continuously) focus on driving, leaving them with extra time for other activities or engagement such as doing office work in the car. The current manual driving context does not allow for work to be done by the driver (either at all or to a satisfactory degree). This will be remarkably improved by the future development of ADAS as well as autonomous driving.

While the argument is an easy one to make, if one focuses only on the periods of actively driving, it omits the reality of everyday commuting. Commutes also consist of e.g., waiting at traffic lights, being in congestions which are all potentials for tertiary tasks (e.g., office work) in the vehicle. It all depends on how that time is used, so that these potentials can be used, until the vision of autonomous driving is realized.

Collaboration will be an important aspect of in-car technology. Some questions that have to be answered are: Who has to take over the control? How does the collaboration change, if the driver does not have to pay attention on the street? Can the driver lean back and do office

work? Can new technologies such as augmented reality based on large head-up displays can support office work during driving?

In this paper, we argue that office work in the vehicle is not impossible until autonomous driving is fully realized. Using one example from a series of studies (e.g., Perterer et al. 2016), we can show that the manual traffic of today already provides many potentials and opportunities for work in the car, which do not interfere with the primary driving task. We argue that we should explore and refine these phases and not simply wait until every car is an autonomous one (which, incidentally, might take a bit longer than we optimistically assume¹). This way, we can make the most out of what is available today and are ready, when autonomous driving will finally be fully realized and offers even more work opportunities than today's traffic already does.

1.1 Driving while working

For many people the car has become a home away from home, 'a place to perform business, romance, or family' (Ury 2006, p. 9). People such as commuters, lorry- or bus-drivers perform many other simultaneous tasks and actions such as talking to customers by phone. Taking work-related aspects of car journeys into account, Watson (1999) explored why young and temporary forest service personal frequently have accidents. Laurier (2004) investigated how driving, talking and office work are interwoven as a practical real-time matter by focusing on risk evaluation and risk-management. The shift towards conceptualizing the commute as 'productive' or the 'matter of utility' (e.g., Adey 2013) had led to several studies (e.g., Perry et al. 2001; Normak & Esbjörson 2004) aiming to use the time spent in a car as mobile office. O'Hara et al. (2002) described how mobile professionals communicate (i.e., through phone) and document their activities during business trips.

2 Study

In order to develop a deeper understanding of how private short-distance (PSD) car commuters spend their time and what technologies they use in their cars, we conducted a Contextual Inquiry (Holzblatt et al. 2004). We define PSD commuters as drivers who use their private car to and from work. In comparison to long or medium-distance travelers who drive more than 50 km (one-way, door-to-door distance) PSD car commuters drive up to 20 kilometers (one-way) or more than 60 minutes alone in the car.

We collected data from observations with casual and work-related conversations during the trip, took notes on a tablet PC, logged GPS tracks, as well as interviewed the participants after the trip. The study took place over a period of two months and was conducted in two central European cities. Participants were 8 male and 5 female car commuters (aged between 27 and 44 years) who travelled more than three times a week by car during rush hour to work. For the

¹ <https://www.technologyreview.com/s/520431/driverless-cars-are-further-away-than-you-think/>

study, a researcher joined the commuters on two daily journeys (i.e., one to and one from work) during an ordinary week. Over 15 hours of footage from both cameras were synced and arranged side-by-side for a reflection on a qualitative and quantitative level.

3 Use Case

In the following we describe a use case as a part of a series of studies (e.g., Perterer et al 2016). This use case underpins how private short-distance car commuters used their daily travelling time for collaborative work-related tasks, or to detach from work in general while being in traffic congestions, and especially how they used the various waiting periods to successfully achieve work related tasks. The protagonist of this use case are Mr. Cortez, the commuter, and Mr. Reiss, a researcher (both fictional names). Mr. Cortez, a manager of a national company, drives to work five times a week with a company car. Typically, Mr. Cortez faces daily traffic jams on this route. At the moment, Mr. Cortez is driving to work. Today's traffic jam is horrible on the highway (normally occurs around Munich in the morning). Currently, he is talking with his office assistant via the hands-free kit.

***Mr. Cortez** is slowly driving forward, stopping every now. In the meantime, he says to his office assistant, 'Please wait, I will look at my pocket PC.' Mr. Cortez searches for his Pocket PC in the glove box. Then, Mr. Cortez continues, 'Now I am coming forward. I will call you back within the next five minutes then I have to turn off at the exit.' Due to staying in place afterwards for two minutes Mr. Cortez recalls his office assistant and says, 'You can fix the date with (blinded company). I have not arrived at the exit yet; you can brief me for today. He seems to be really relaxed. Then, Mr. Cortez asks his office assistant to wait until, he has opened the calendar in his pocket PC. In the meantime, he places his pocket PC in front of him on the steering wheel and adds, 'We can start!' During the next two minutes Mr. Cortez obtains meeting details by simultaneously taking notes on his pocket PC during the short stops; During the shared activity he makes always a short break to look on the road.*

Then, he adds to his office assistant, 'Next, please.' Afterwards, he enters a note into his pocket PC. Approximately three minutes later, the car in front of him switches the hazard lights on to indicate a traffic jam. From that moment on, Mr. Cortez is more focused on the road. Continually, he looks outside the car to be certain of a longer waiting period to come. Nevertheless, Mr. Cortez is still on the phone with his assistant and mentions, 'Please send me the contract! I will take a look on it.' In the meantime, some people got off their cars. So, he adds, 'Now, we have time to go over it.' Then Mr. Cortez turns back to the backseat to get his tablet from the backseat and leans back to work. Again and again, Mr. Cortez is looking at the road to reinsure that the situation has not changed. As soon as he notices that the other cars begin to drive again, he stops the shared activity with his assistant. Then Mr. Cortez bends to Mr. Reiss and restarts the casual conversation, 'I hope I am not rude? You have to know, I normally use that periods to do office work with my assistant. In the morning, we have developed our personal strategy. He grins and adds to Mr. Reiss, 'I am a busy man. I also discuss the agenda for upcoming project meetings with my work colleagues. Afterwards, Mr.

Cortez looks to Mr. Reiss and emphasizes, 'In the evening, I like to relax and avoid thinking of work.' He adds, 'Why shouldn't I start that separation during the commute home?'

Of special interest was, as seen in the use case described above, that Mr. Cortez took advantage of the slow-moving traffic phase that normally occurs before taking the highway exit to downtown. This specific time was used by him to do office work, i.e., to talk with his office assistant via a hands-free device in order to fix the appointments for the whole week. Depending on the waiting period the car commuter chose whether to share work-related information as well as to use different technology while being caught in congested traffic (using a pocket PC or a tablet). For instance, by putting his pocket PC to the left side of the steering wheel, Mr. Cortez ensured that he was not distracted too much, and which, increased the practical suitability as well as the perceived safety during the shared activity with his office assistant. Short waiting periods were mainly used for short notes (i.e., entering notes into a pocket PC or reading/writing emails).

Instead of this, car commuters used longer waiting periods (e.g., due to an accident) to work on a document (i.e., to go through a contract), to update power point slides, or to skype with work colleagues on the tablet (both are described above). With this use case we could also see how the private short-distance car commuter initiated collaborative office work. To achieve their shared goal (i.e., to exchange information about contemporary meetings during the congested period), both of them had to be aware of the current context. On that account, Mr. Cortez made short breaks (perhaps to indicate that he needed time to enter the note into this pocket PC or to signal the office assistant that his eyes had to be on the road).

Mr. Cortez also stated in the discussion, *'My office assistant and I have developed our personal strategy in order to work during short stops. Sometimes I also enter random letters into Skype in order to signal that I have no time.'* As soon as Mr. Cortez noticed that the traffic jam would take longer, he continued the conversation with his office assistant by making her aware about the current situation *'Now we have time to go over it'*. This set the trigger to use another technology that was brought by himself into the car (in this case a tablet that was placed at the back-seat mentioned by Mr. Cortez after the trip).

As seen in the last part of the use case, Mr. Cortez used the daily commute as 'transition time' between work and leisure by emphasizing, *'Why shouldn't I start that separation during the commute home?'* In both situations, he used the commute time for different purposes. While driving to work is dominated by doing office work cooperatively, e.g., stated by him, *'I often talk to my work colleagues in the morning and discuss the agenda for upcoming project meetings'*, in the evening he appreciated to relax and avoid thinking of work. As suggested by Pfleging et al. (2013), we state that driving-related context information allows to create situation awareness for the caller outside (i.e., the office assistant) of the car.

4 Conclusion

By presenting this use case from our study, we hope to motivate the automotive HCI community to explore the potentials of today's manual and semiautonomous traffic. Derived

from our use case, we could identify the following relevant challenges for work-related driving activities: (1) the working procedure should be context-dependent, allowing to be interrupted, (2) information should adapt automatically depending on the type of trip (i.e., work vs. leisure), (3) remote users should also have access to driving information in order to have a common understanding of the current traffic situation, and (4) the car interior should provide an environment in which the adaption of various technologies may be possible as well as full access to work-related data guaranteed.

Keeping the third point in mind and looking at the caller's perspective (Pfleging, Schneegaß & Schmidt 2013), our data revealed the need to integrate driving-related context information for the caller outside (i.e., the office assistant) in order to create situation awareness. We argue that a deeper look into these four topics could also extend and inspire future autonomous research towards utilizing the time spent in a car to do office work or just to detach from work.

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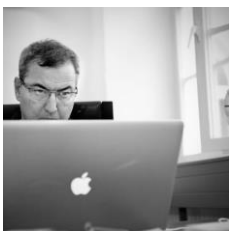
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