Exploring the Impact of Transparency on the Interaction with an In-Car Digital AI Assistant

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Abstract
Nowadays, intelligent assistants, such as Amazon's Alexa, are widely available. Unsurprisingly, intelligent assistants find their way into cars, in some cases as a major way to interact with the car. We conducted a user enactment exploring the impact of transparency on a possible future user experience with a digital AI assistant in the car. The focus is on whether tasks should be performed in an opaque way, only involving the user when it is necessary, or in a transparent way, always offering the user insights into what is being done and how. We present initial findings indicating a slight preference towards more transparency.

Author Keywords
Transparency; human AI interaction; explainability.

CCS Concepts
• Human-centered computing~User studies • Human-centered computing~Empirical studies in HCI • Human-centered computing~Interaction design

Introduction
Recent progress in machine learning and other forms of artificial intelligence (AI) impacts the way we interact with technology. Nowadays, digital assistants, such as

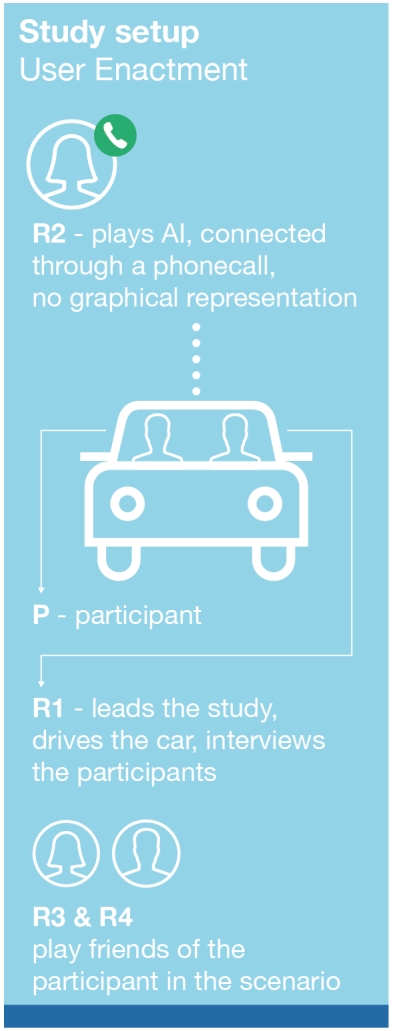

Figure 1: Schematic depiction of the study setup.

Amazon's Alexa, are widely available. Unsurprisingly, they find their way into the car quickly, especially as car manufacturers take the opportunity to introduce their own digital assistants. These in-car digital assistants begin to go beyond simple voice recognition to input a destination for navigation and become a more general way of interacting with the car. They learn recurring user behavior, predict and suggest functions [3] or explain functions of the car [1]. Concept cars already present scenarios, such as changing the car's "behavior" based on user emotions [9], or follow a general vision of the car as a digital companion that befriends its owner and user [15].

While it is crucial to further improve the technology underlying AI assistants, it is just as important to explore and better understand how users will and should interact with them. This is especially important, since interaction designers are still unfamiliar with designing interactions and user experiences for machine learning and AI [4]. In a future where digital AI assistants become the major means of interaction with the car, their quality and acceptance is crucial. Transparent and explainable AI is a first promising approach, albeit emphasizing quality aspects akin to the usability of more traditional interactive systems. In parallel to the traditional dialogue principle of self-descriptiveness (ISO 9241-10), transparency has a number of advantages for intelligent systems. Providing explanations can improve performance and learning [7], transparency can have a mitigating effect in the event of trust violation [10], and increased transparency can lead to improved performance without adding workload or increasing response times [11]. There are different approaches to designing transparent intelligent systems. To name a few: there is ongoing research to create a framework of dimensions of transparency in intelligent systems [8] and calls for looking at the issue from the perspective of the user determining which explanations are needed in which situations [16]. Transparency can be achieved in different ways: natural language rationalizations for system decisions and actions [5] or responsive interfaces support users in forming assumptions about how a system works [12]. These are valuable starting points for exploring possible future interaction with AI assistants.

The focus of this study is to explore the consequences of different levels of transparency, as well as the advantages and disadvantages of transparent intelligent systems in the car. Should the AI be explicit towards the user about everything it does and how it does it? Or should the user be involved in crucial moments only? To explore these questions, we conducted a qualitative study simulating a possible future experience of having a sophisticated AI assistant in the car that interacts with the user in different situations. Our goal is to gain insights from users, highly relevant to the design of such systems, before the technology is available.

Study and Procedure

Studying complex technologies in a way that provides insights into how the everyday use would feel, before they are available, is a methodological challenge. We chose an approach close to "User Enactments" as described by Odom et al. [13]. With the help of Wizard-of-Oz techniques [2] and further confederate, we enabled our participants to experience interaction with a sophisticated AI in a number of scenarios acted out while driving a real car on public streets. During the study, we encouraged improvisation and left room for the participants to (co-)design the experience with us

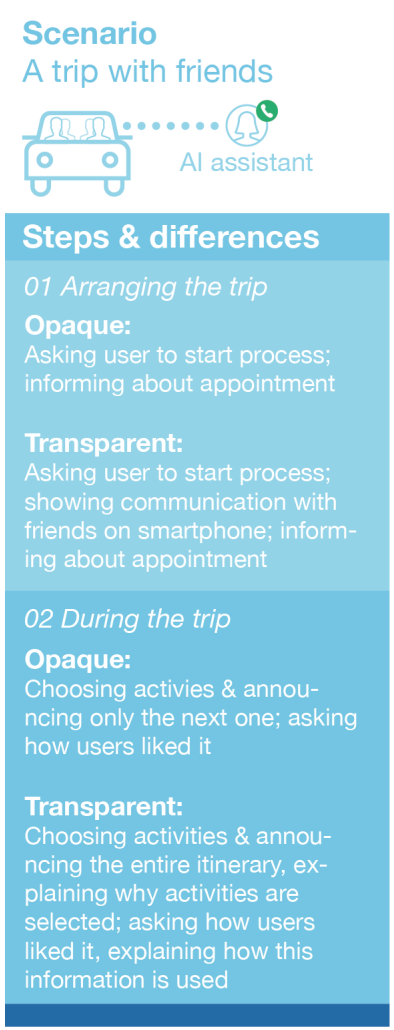

Figure 2: Scenario and differences between versions.

[6]. Four researchers (R1-R4) interacted with the participants (P) in different roles during the enactment. For a detailed view of the study setup, see figure 1. We expect automated driving to be available, so we asked participants to imagine being driven by the car instead of the researcher. To enact the role of the AI assistant, R2 followed certain rules of how to address the participants and interacted with them according to a predefined script. To achieve a believable vision of a future general AI however, improvisations and immediate reactions to the participants responses were allowed and vital.

We decided on a scenario of the in-car digital AI assistant supporting the user arranging and carrying out a trip with friends - a possible future function tied to the car. The AI assistant asks the participant if she wants it to arrange a meeting with friends (played by R3 & 4) she has not seen in a while. It arranges the appointment with the friends on behalf of the user. At the time of the trip, the participant picks up the friends and the AI assistant has prepared multiple activities (taking a walk, a museum, a restaurant). It guides the group through the trip, altering the itinerary if necessary. The scenario was performed twice with each participant. Once in an opaque version, offering little insight and explanation, and once in a transparent version, providing the user with insights and explanations of the AI's actions. Both versions consisted of the same steps, and differed only in the level of transparency. During the enactment we drove to real destinations, simulating the trip. For a detailed description of the steps and differences, see figure 2. The user enactment was conducted with four participants (Ages 39-49; one female). Each enactment included further scenarios such as the one described here, however addressing additional issues. Each enactment lasted about two and a half hours. After the participants gave consent, audio and video was recorded . The interviews and their analysis followed the logic of Interpretative Phenomenological Analysis (IPA) since our focus was on the individual experiences of the participants during the enactments [14].

Initial Findings and Discussion

Initial findings revealed a wide variety of responses towards the two versions of the scenario.

Opaque. In general, the opaque version was less preferred than the transparent one. Some of the participants had difficulties trusting the AI assistant and criticized a lack of information. Participant 4 for instance said that he did not trust the AI assistant to plan his appointments as well as he would: *"[…] It is not really an assistance, I have to coordinate even more, watch out even more."* He also thought that the opaque version did not provide enough background information to make informed decisions, especially when choosing activities with his friends: *"I would have liked to get some information, what it implies in each case. If I am even interested in it or how the ratings are…"* Similarly, participant 2 and 3 felt a lack of control and were worried about decisions being taken for them. In contrast to these responses, participant 1 felt that the opaque version had some advantages and enjoyed the experience: *"With the trip itself, we didn't get to decide at all. She arranged it and that's it. And that was okay, because she [the AI assistant] knows us."* She liked the feeling of having someone or something arranging everything for her and was sure that if she wanted to, she could always disagree and change plans.

Transparent. Having the opportunity to gain more insights into what, how and why the AI assistant does things for the user was generally seen as positive. Participant 4 liked the possibility to supervise and preferred the transparent version: *"The second time, because I was holding the smartphone in my hand and I could look and notice, I always had the feeling: okay, I can influence it. […] The control was always there I think. It wasn't like I had the feeling I was controlled by someone else, everything was coordinated with me."* Being able to see every step of the process gave him the feeling of being in control. Similarly, participant 3 showed an even stronger reaction: *"I liked it a lot more now on the second tour. When I had a lot of influence myself. […] She [the AI assistant] played by my rules. And this is how I want it to be."* Participant 1 however had some issues with the transparency. During her enactment, as the AI assistant presented the activities it had selected for the trip, she started discussing where to go with her friends (played by researchers). She prefers the opaque version: *"Because this need for discussion never came up. We managed it well, but this can end very differently. […] It could go over into a negative context."*

Participant 2 had great reservations towards both versions and did not trust the AI assistant at all. He was worried about the safety of his data and did not want the AI assistant to communicate with other people on his behalf. He made use of the room for improvisation in the user enactment and changed the versions in a way more appropriate for him. He did not allow the AI assistant to contact others on his behalf, he instructed it only to take action when he asked for it and even switched it off.

The enactment produced many different reactions and preferences. A tendency towards preferring the transparent version of the interactions seems to emerge, as some participants trusted the opaque version less and felt a lack of information. The opaque version has some advantages though, as it requires less involvement.

Future Work and Limitations

The focus of the study at hand is on individual experiences and is, of course, not representative of all potential users. Our participants can be thus best viewed as potential representatives of larger user groups, such as sceptics (P2) or believers (P4). Results have to be evaluated with larger groups in the future. Another step is to carry out similar studies about different functions in the car ranging from typical car (e.g. navigation) to outboard (e.g. connect with friends) functionalities. More research is needed to find out about finding the right amount of transparency at different times of use, and how the experiences and preferences change over a longer period of use, as trust has to be built over time.

Conclusion

We presented initial findings of a user enactment exploring the impact of transparency on the user experience of an in-car digital AI assistant. In the scenario shown, the digital assistant supported the user arranging and undertaking a trip with friends. A slight preference towards more transparency emerges. The study opens up a number of topics that require more research, however using transparency when designing interactions with intelligent systems in the car is a promising approach to build trust and involve the user.

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