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Thesis (27.5 ECTS)

Car, call me by my name:

Effectiveness of using the driver´s own name for in-car voice alerts

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Abstract

With increasing automation in vehicles, drivers will mainly focus on non-driving related activities and alerts that demand human intervention in driving must therefore be effective to quickly direct attention on the road. This study evaluates the effectiveness in terms of reaction time, accuracy and subjective experience, of in-car voice alerts that are preceded by the driver´s own name. In a set-up with driving videos, 23 participants played a mobile game as a non-driving task and were required to execute actions on the steering wheel and on the brakes when hearing a voice alert. The alerts were always preceded by either participant´s own name or a random (not own) name. An alert with the own name resulted in significant faster reaction time to the instructions and generally received positive subjective ratings. The driving task was executed accurately most of the time, regardless which name preceded the alert. The own name triggers attention and accelerates reaction, which makes it a highly effective and appreciated addition to an alert. Hence, alerts with the driver´s own name should be included in the design and development of safety-critical systems with automation.

Keywords: subject´s own name (SON), in-car alerts, artificial voice, voice assistant, transition of control, automated vehicles, attention, personalization, customization, human – automation interaction

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1. Introduction

Semi-automated vehicles (i.e. SAE-Level 3), have the capacity to drive independently under specific road conditions. However, if safety cannot be guaranteed, they require human assistance and potentially manual driving (SAE International, 2014). It remains unclear which way is the best possible to enable a safe transit of control during moments when human handling is needed (Kun, 2018).

One possible way to demand a transition of control is through an auditory alert. Such auditory signals (e.g. beep tone or speech) can be used as a warning to inform the driver about an imminent critical occurrence (Janssen, Iqbal, Kun, & Donker, 2019). They play a crucial intermediary role in supporting drivers shifting from a non-driving to the driving task. During automated driving, the non-driving task has an impact the effectiveness of such an alert (in terms of response time to the alert) (e.g. Caird, Johnston, Willness, Asbridge, & Steel, 2014; Gold, Berisha, & Bengler, 2015) and it might consume most of the drivers` attention (Hancock, 2013). However, humans` available attention capacity is not sufficient to attend everything in the current environment (Leonard & Wogalter, 1999) and therefore, it cannot be expected that a provided alert is entirely processed by the driver (Janssen, Iqbal, et al., 2019). In fact, according to current neuroscience studies, during driving and automated driving, the brain is less susceptible to unpredicted auditory indications (Janssen, van der Heiden, Donker, & Kenemans, 2019; Wester, Böcker, Volkerts, Verster, & Kenemans, 2008). However, special salient features in alerts can attract attention (Murphy, Groeger, & Greene, 2016). Those can be seeing faces (when it comes to visual stimuli) as well as hearing one's own name (Murphy et al., 2016).

In this research, we investigate how powerful a vocal alert is when the driver´s own name is mentioned prior to the indication of the required driving activity. In a dual-task- driving simulation study, we compare the performance of participants when hearing their own-name within an alert with their performance when hearing random names within alerts.

In the remainder parts of the thesis, we will first review literature related to the peculiarity of one´s own name and why it is suitable to include it in a warning. Literature on personalization in cars, as well as on voice, and on in-car voice alerts is provided. We will then describe our study in detail and subsequently head to our results and findings. We discuss them in relation to the relevant literature and finally mention our limitations and implications for future work.

2. Related Work

2.1 One´s own name as a potent attractor of attention

It is suggested that an effective attractor of attention consists of the subject`s own name. In his research Cherry (1953) reported experiments dedicated to speech recognition when people are presented with different messages at once.

Two different messages are either emanated at the same time to both ears or one message to the left and another different one to the right ear (Cherry, 1953).

The research showed that despite the presence of multiple auditory stimuli in the form of speech, people can adhere to only one particular voice. It paved the way for Moray (1959) to discover that the subject`s own name spoken by an unattended subject consists of a highly effective stimulus to obtain the focus of attention, a phenomenon known as the "cocktail party effect". Indeed, Moray (1959) replicated the experiments of Cherry (1953) and extended them. He conducted experiments where participants were required to attend to a message they heard in one ear while ignoring the message emanated to the other ear. The ignored message included participants` own name sometimes. Results successfully showed that unattended instructions preceded by participants` name are recognized more frequently than unattended instructions without the name. The author (1959) concluded that unlike usual unattended verbal content which is banned from the subject`s attention, unattended but subjectively important content, such as the own name, can overcome this barrier to enter the subject`s focus of attention.

In addition, neuroscience studies also investigated the powerful position of using a person´s own name within auditory stimuli (e.g. Holeckova et al., 2008; Berlad & Pratt, 1995; Folmer & Yingling, 1997; Holeckova, Fischer, Giard, Delpuech, & Morlet, 2006; Müller & Kutas, 1997; Perrin, Schnakers, Schabus, Degueldre, Goldman, Brèdart, Faymonville, Lamy, Moonen, Luxen, Maquet, Laureys, 2006; Perrin, García-Larrea, Mauguière, & Bastuji, 1999; Perrin et al., 2005; Pratt, Berlad, & Lavie, 1999). The neural mechanism responsible for the processing of the own name seems to develop already during childhood (Key, Jones, & Peters, 2016). Dedicated brain circuits respond to hearing one´s own name while being engaged in a visual task (Holeckova et al., 2006; Pratt et al., 1999) or while participants` attention is focused elsewhere (Berlad & Pratt, 1995; Folmer & Yingling, 1997; Müller & Kutas, 1997; Perrin et al., 1999, 2005; Pratt et al., 1999; Perrin et. al., 2006). Moreover, there can even be a specific brain response to one´s own name during sleep (Perrin et al., 1999; Portas, Bjorvatn, & Ursin, 2000; Pratt et al., 1999) and while being in a coma or vegetative state (e.g. Fischer, Dailler, & Morlet, 2008; Fischer, Luaute, & Morlet, 2010; Perrin et. al., 2006; Schnakers et al., 2008).

2.2 Personalization and auditory interfaces in advanced vehicles

Using a person´s own name is one potential way of personalizing the interfaces. Indeed, in the context of human-machine interaction, including automated driving, personalization and customization is already well known. It can be seen as a mean to make technologies both more acceptable and useful for people and as such contribute to better driving experience and safety (Hasenjaeger & Wersing, 2017). In today´s research on vehicles, personalization evolves mainly in the area of user interfaces of the in-vehicle infotainment systems and in the area of driver assistance systems (Hasenjaeger & Wersing, 2017). As an example to the latter, the study of Orth et al. (2017), show that a personalized Assistance on Demand concept (AOD) is highly beneficial. The AOD informs drivers about suitable time gaps to enter an urban intersection and perform a left turn. As a result in their study, personalized assistance has been perceived as more reliable and helpful for the decision to enter an intersection (Orth et al., 2017).

Orth et. al. (2017) emanated the information of the AOD though a speech interface, which generally seems to be an effective and safe way to display in-vehicle information (Nees & Walker, 2011; Sterkenburg, Landry, & Jeon, 2017). Current in-car speech interfaces like Ford SYNC, Chrysler UConnect, GM MyLink, and Hyundai Genesis are mainly used for navigation, music selection, or applications concerning cellular phones (Lo & Green, 2013).

2.3 In-car voice alerts

Information such as an alert that demands a transit of control can also be communicated via a pre-recorded voice (Bazilinskyy & De Winter, 2017; Politis, Brewster, & Pollick, 2015).

The use of voice presents several advantages. First, the human auditory system is most sensitive to frequencies of the human voice that are frequencies ranging between 1000 - 4000 Hz (Coren & Ward, 1989). Second, an alert containing an abstract tone requires people to first understand its relation to a certain kind of critical event. When it comes to speech alerts, plain language makes the purpose and meaning of the alarm immediately clear without a learning process (e.g. Bazilinskyy & De Winter, 2015; Nees, Helbein, & Porter, 2016; Wogalter, Leonard, & Otani, 1999). Third, people, including drivers, intuitively respond in a social and emotional manner even to an artificial voice (Large & Burnett, 2013).

A crucial factor for an auditory warning in driving is perceived urgency (Baldwin, 2011), which is influenced by acoustic and semantic elements (Edworthy, Hellier, Walters, Clift-Mathews, & Crowther, 2003; Baldwin, 2011). Acoustic parameters such as pitch, speed, and level/loudness are sufficient to modify perceptions in urgency (Hellier, Edworthy, Weedon, Walters, & Adams, 2002). Indeed, urgently spoken signal words are louder and dispose of a higher pitch and larger pitch range compared to a non-urgent adaptation (Hellier et al., 2002). Several studies indicate that female voices are able to convey higher perceived urgency compared to a male voice (Baldwin, 2011; Edworthy et al., 2003; Hellier et al., 2002; Machado, Duarte, Teles, Reis, & Rebelo, 2012). However, regardless of the speaker`s gender, literature suggests that a higher speech rate leads to higher ratings of perceived urgency (Bazilinskyy & De Winter, 2017; Hollander & Wogalter, 2000; Jang, 2007; Park & Jang, 1999). Another acoustic parameter involved is the sound intensity, which is perceived as more urgent at a higher signal to noise ratio (Baldwin, 2011).

As mentioned before, semantics influence perceived urgency (Arrabito, 2009; Baldwin, 2011; Edworthy et al., 2003; Hellier et al., 2002; Wogalter, Conzola, & Smith-Jackson, 2002; Wogalter & Silver, 1995). Research has shown that some signal words are perceived as being more urgent, believable, and appropriate than others. For instance, the word “danger” is perceived significantly more urgent than the words “attention” or “caution” (Barzegar & Wogalter, 1998, 2000; Edworthy et al., 2003; Hellier et al., 2002; Hollander & Wogalter, 2000; Weedon, Hellier, Edworthy, & Walters, 2000).

To be perceived as urgent, suitable and convincing it is also important that these utterances are spoken in an urgent acoustic style (Barzegar & Wogalter, 1998, 2000; Bazilinskyy & De Winter, 2017; Edworthy et al., 2003; Hellier et al., 2002; Hollander & Wogalter, 2000; Ljungberg & Parmentier, 2012; Weedon et al., 2000).

Overall, it is crucial that warning statements are trustworthy (Edworthy et al., 2003). People might find a voice more trustworthy when it is assertive (Large & Burnett, 2013). Therefore words like “definitely”, “must” and “needed” are believed to contribute to assertiveness in messages (Shechtman, 2002).

Another word that might contribute to effective warnings is one´s own name. Indeed, the literature on warning states that personally important stimuli, such as the own name, have the tendency to provoke attentional processes (Leonard & Wogalter, 1999). Given the strong evidence for using one´s own name as an attention grabber, it has also been proposed for use in advanced warning systems (Leonard & Wogalter, 1999). However, despite their potential, auditory alerts in vehicles, that contain a personal name have only been investigated by a few studies.

In the context of manual driving, Almén (2002) investigated the effectiveness of in-car alerts while participants were disturbed by a secondary task. She compared four different conditions, namely, an audio alert with the own name, a vibration as a tactile alert, the combination of these two and a control group with no alerts at all. However, there was no significant difference in response time between these conditions (Almén, 2002). Even though not significantly, response times for alerts that combine the own name with a vibration tended to be somewhat faster (Almén, 2002).

In another study, Tobias, Su, Kolburg, & Lathrop (2013) explored the use of a personal name compared to a warning tone in a semi-automated driving set-up where participants also performed a secondary task. The study showed that participants in a semi-automated driving mode who were alerted with the name reacted faster than participants who heard the tone as an alert. However, significance was marginal. Therefore, authors suggest that a name cue has a minor advantage over the tone cue. The own name warning of Tobias et al. (2013) consisted of just the name with no additional utterance. As a recommendation for future research the authors propose to combine a personal name with other directional speech cues as an idea for an potentially effective alert in a car (Tobias et al., 2013).

Directional cues that vocally express the required action to a driver of a semi-automated car, have recently been investigated by Wong, Brumby, Babu, & Kobayashi (2019). The authors (2019) used such directional cues to assess people´s reaction time and accuracy in response to voice commands informing of low-level hazards that require human assistance. They report high overall accuracy and successfully show that assertive voice commands lead to significantly faster reaction time compared to more friendly, non-assertive, voice commands.

Hence, the assertive condition was more effective in attracting people`s attention from the non-driving task to the ongoing of the road and in addition, was perceived as more urgent.

However, the level of immersion in a non-driving task (i.e. mobile games) did not impact reaction time since participants did not react quicker while engaged in a less immersive mobile game compared to a more immersive mobile game.

All in all, an important implication for design however consists in the authors (2019) finding that an assertively spoken voice command is an effective way to attract drivers´ attention on the road. Equally important than worrying is the outcome that a non-driving task, regardless of how immersive, is always harmful to people´s attention. In the present study, we will build on the authors´ (2019) methodologies.

2.4 Non-driving task

It is impossible to imagine the world of automated driving without drivers engaging in other non-driving related activities. Nor can one ignore the potentially precarious consequences of conducting a non-driving task while driving (Caird, Willness, Steel, & Scialfa, 2008; De Winter, Happee, Martens, & Stanton, 2014; Large, Burnett, Salanitri, Lawson, & Box, 2019). One of the most frequent non-driving activities consists of interaction with a mobile phone. The consequences of such an activity are well reported in literature (Caird et al., 2014, 2008; Flach, Hancock, Caird, & Vicente, 2018). Indeed, studies show that a conversation over the cell phone is a factor that prolongs reaction time to events and stimuli (Caird et al., 2008). Other research claims the negative impact of typing and reading text messages while driving on eye movements, stimulus detection, reaction time, collisions, lane positioning, speed and headway (Caird et al., 2014).

Driving can be automatic up to the point that pursuing two tasks simultaneously is not perceived as dangerous anymore (Hancock, 2013). It might even be that non-driving activities such a business calls, or playing a mobile game become the most important activity at hand (Hancock, 2013). People in the car continuously interleave between a driving and a non-driving task (Janssen, Iqbal, Kun, & Donker, 2019) while perhaps prioritizing the non-driving task (Hancock, 2013). Indeed, selective attention enhances the person to attend to what is subjectively considered the most salient stimuli present in the external environment or in the internal thought process (Leonard & Wogalter, 1999). Hence, we must strive for a way to give drivers an adequate stimulus which motivates them to leave their main non-driving activity in favour of the driving task and initiates the shift of attention towards the road.

The following research attempts to contribute to this major challenge by testing assertive speech alerts that nominate the driver´s own name. As mentioned, research has shown that the own name consists of a peculiar attractor of attention (e.g. Moray, 1959; Murphy et al., 2016) even while asleep (Perrin et al., 1999; Pratt et al., 1999). Therefore, it is promising to believe that the own name will work as an effective addition to an alert in the car which will quickly draw attention to the road.

3. Goals and Hypothesis

To follow the idea of Tobias et al. (2013) we will use participants` names in combination with voice commands expressing the required action. We will base this study on the work of Wong et al. (2019) and their directional cues. The authors (2019) successfully show that an assertive voice in an alert leads to faster reaction time. Thus, we only use their assertive voice commands with some modifications for a smother spelling. Wong et. al., (2019) observe that assertive voice commands tend to be lengthier than non-assertive voice commands. Applying only the assertive condition we also control for length of alerts in our experiment. With the addition of the person`s name as a conversational element in our voice commands we also partly overcome the limitations of Wong et al. (2019) who claim the lack of human-like traits in their voice commands. Similarly to Wong et al. (2019) we also use a mobile game in this study as a realistic non-driving task. As the authors (2019) did not find any significant effect of the level of immersiveness on response time to an alert, we make use of one game only. The game is called "Bubble Shooter Ball Bust" and requires both mental effort and manual movements.

In this research participants´ first names are used. To that end, the study of Ceynar & Stewart (2014) demonstrates that participants had a greater preference and fondness for their first name compared to their last name. Besides, we argue that people hear their first name since their infancy and usually have a more personal relationship with it.

In lieu of the own first name, the baseline condition in our study consists of random first names retrieved from the statistics of the most popular female and male baby names of the UK and Wales in 2019 (Office for National Statistics, 2019).

Literature findings support the decision for this study to rely on an artificial voice of a text-to-speech programme and not a voice actor. Indeed, we wanted to test how effective voice warning systems are with currently available technology. Our choice of the artificial voice fell on "Samantha", a female American-English text-to-speech voice launched by MacOS. Commands spoken by "Samantha" were displayed distinctively louder than the driving noise to ensure more urgent circumstances.

As an outcome of this study, we expect, that the salient feature of the person`s name will overcome the limits of regular alerts. Regular alerts might not be perceived as the most salient stimuli in the environment given the range of engaging non-driving tasks the driver`s attention can be focused on. Consequently, we assume that drivers will direct their attention faster towards the driving task hearing their own name in the alert compared to alerts that do contain a different name.

People also demonstrate openness towards the use of a personal name within an in-car alert as the study of Tobias et al. (2013) reveals. Hence, if personalized voice alerts in our study turn out to be effective, it might also provide a useful intervention for practice.

4. Research Questions

In summary, the current study addresses the following research questions:

RQ1: Do people perform better, in terms of faster reaction time and higher response accuracy, when an in-car voice alert contains the own name compared to when an alert contains a random name?

RQ2: How do participants experience the use of their own name in voice alerts?

To answer these questions, we carried out a user study in a driving set-up where participants engage in a non-driving task on a phone and were required to intervene in the driving-task whenever there was an in-car voice alert. For RQ1, we measured reaction time to the alert, and accuracy to the alert. For RQ2, we asked participants what they thought about their performances with different alerts. Furthermore, we examined participants´ concern, their openness, and preference as well as the helpfulness and annoyance of an alert containing their own name. Finally, we also assessed a rating specifically about the voice, measuring participants` attitudes, preferences, and feelings about it.

5. Methods

5.1 Participants

Twenty-three drivers were recruited through opportunity sampling (4 Males, 19 Females). We aimed to have 24 participants for a balanced design but had to stop testing after 23 participants due to university closure in response to the Covid-19 pandemic. The age range was from 19 to 27 years old (*M* = 23.7 years of age, *SD* = 1.94). All participants were in possession of a valid driving licence. The majority (20 out of 23) were students and they were rewarded with either 6 Euro or a participant credit point. The experiment was approved by the ethics committee of the Faculty of Social and Behavioural Sciences of Utrecht University (approval number FETC16-042). All participants gave written informed consent prior to taking part.

5.2 Apparatus and Materials

Participants were positioned in a driving simulator set-up similar to Wong et. al. (2019). The set-up (see Figures 1 and 2) consisted of a Logitech G27 racing set-up (steering wheel, shifter unit, and pedals) and of a 31" Dell 3007 WFP monitor. Logitech Z150 speakers were used to play voice alerts that indicated the required actions for participants.

Figure 1: Close up of Driving Simulator Set up.

Figure 2: Driving Simulator Set up.

Driving Task: Participants watched four unique driving videos, that were taken from Wong et. al. (2019) and played using the JavaScript Software from Wong et. al. (2019). This software plays the videos, keeps track of time, and logs user actions (e.g. when the brake is pressed). The videos were recordings of four drives through British landscape (i.e. driving on the left). The duration of the videos varied between five and two and a half minutes. Each video had six scenarios which were alerted with an appropriate voice command, described in more detail below.

The driving-related task consisted of common driving actions that are indicating left or right on the steering wheel and braking on the brake pedal. Participants were required to act out what they heard through a voice alert. The commands were taken from the assertive voice commands by Wong et. al. (2019) and are provided in Table 1. We made modifications on the wordings of Wong et. al. (2019) and replaced the word "immediately" with "right now" and we used the sentences "There is traffic coming up" instead of "There is traffic ahead" and "Red traffic light coming up" instead of "Red traffic light ahead". Our versions sounded smoother with the text-to-speech programme we used (see below for details on the programme). All voice alerts contained a sequence of (1) a name to attract attention (e.g. Caterina), (2) a scenario command that described the road situation (e.g. "There is traffic coming up") and (3) an execution command that gave instruction on the required action (e.g. "Watch out! Break right now!"). The frequency of each command varied. Participants had to indicate six times right and eight times left. In total they had to push the brake pedal ten times, six times the command was to slow down and four times the voice requested to brake. Care was taken, that the action word in each command (e.g. brake) was emanated 5 s before the incident took place on the road. This ensured that all scenarios across videos are standardized. Literature review propose a mean time of 2.72 s people need to transit control to the driving (Zhang, De Winter, Varotto, Happee, & Martens, 2019) and several studies suggest that a minimum warning time of 5 s – 8 s could be sufficient in some scenarios (e.g Gold, Damböck, Lorenz, & Bengler, 2013; Mok, B., Johns, M., Miller, D., & Ju, 2017). Figure 3 sketches an example of a driving scenario, its related voice command, and the respective activity of the driver.

Scenario Commands	**Executive Commands**
Moving towards the right lane.	
Beware of the oncoming vehicles ahead.	
There is traffic coming up.	
Exiting round about ahead.	
Narrow road ahead. Beware of oncoming vehicles.	Watch out! *Brake* right now.
Red traffic light coming up.	You need to *slow down* right now.
Moving towards the left lane.	Look up! Action to indicate *right* is needed.
Two-way road being blocked on the side.	Look up! Action to indicate *left* is needed.
Beware of the car exiting on your left.	
Beware of T-junction ahead.	
Beware of the car exiting on your right.	

Table 1: Scenario and executive commands, that were used. For the executive commands, the command that is the onset of measurement has been indicated in italics.

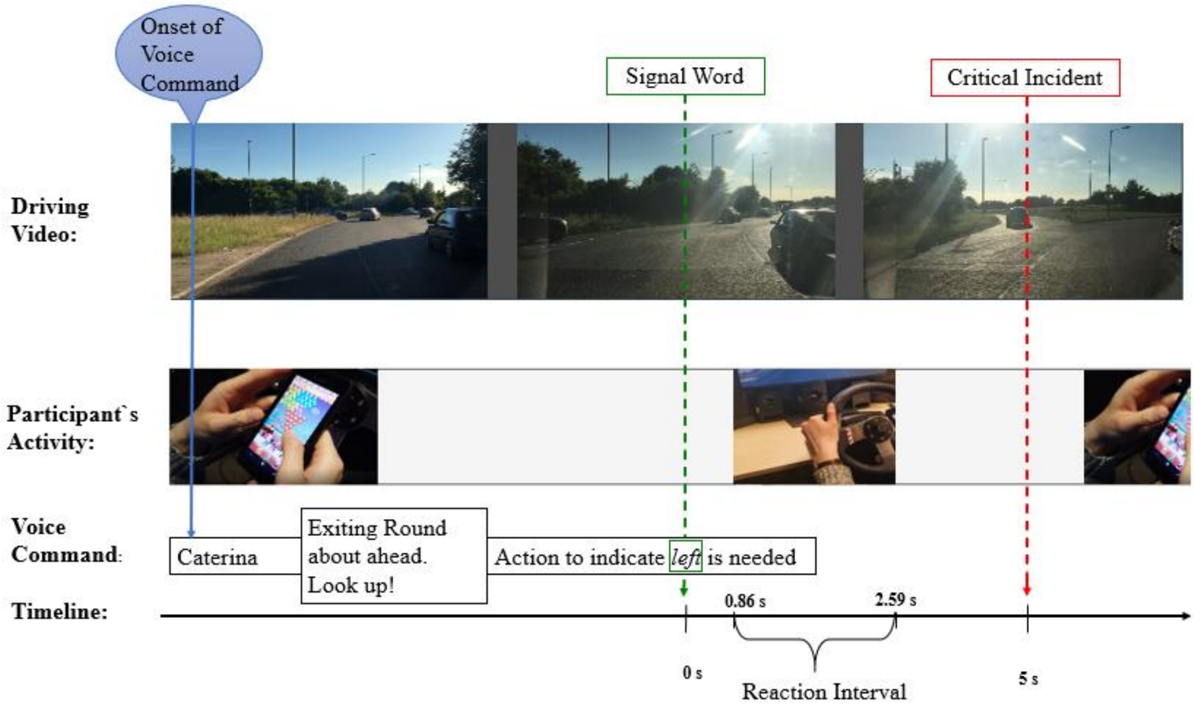

Figure 3: A schematic representation of a voice command and the related subsequent driving activity of the participant. The Reaction Interval ranges from the fastest to the slowest mean response time among participants.

To have a consistent speech experience that is realistic of current in-car systems, all commands were generated by Apple's text-to-speech "Samantha" voice (female, English) at normal speed with default parameters, as generated on a Mac with operating system "Mojave" version 10.14.4. For the name, the participant either heard their own name (e.g. Caterina) or a random name (e.g. George) (depending on condition, see Design). These names were also pronounced using the "Samantha" voice, except if the name phonetically could not be created with this English voice. In these cases, we relayed on the same text-to-speech programme but used female voices of suitable other languages to pronounce the name natively (P2, P12, P21 with Dutch voice "Claire", P7 and P11 with Italian voice "Paola" and P18 with Greek voice "Melina").

For the random name condition, we retrieved the most recent list of the most popular first names for baby boys and girls in 2018 using birth registration data in England and Wales. We retrieved the data from United Kingdom`s Office of National Statistics (Office for National Statistics, 2019). The top twelve names of both sexes were used.

Non-driving Task: The mobile game "Bubble shooter ball bust" was used as a non-driving task (Janssen, Iqbal, et al., 2019). This game was played on a Nokia Lumia 1520 phone with Windows 8.1. Bubble shooter requires players to shoot a coloured bubble in such a way that other coloured bubbles on the screen explode. To create an explosion, the player`s bubble needs to hit a section with three or more bubbles of the same colour as the player´s bubble. The game aims to explode all bubbles within one minute. Participants were asked to restart the game each time it was over. We did not keep track of participants` performances.

Subjective Ratings: Similar to Wong et. al. (2019) we used the voice rating questionnaire (VQR) by Large and Burnett (2013), including the addition of Wong et. al. (2019) to rate urgency (see Appendix A). However, in contrast to Wong`s use of a 7-point scale, in our version of the VRQ, we used a 5-point Likert Scaling with 1 meaning "not at all" and 5 meaning "completely".

With the final questionnaire (see Appendix B) we examined demographic data and also obtained more information about participants´ attitudes towards the name within the warning and about how participants think they performed in the different conditions. If not stated otherwise, a 5-point scale ranging from "strongly disagree" to "strongly agree" was used to assess the questions. Participants´ concern about privacy matters regarding their own name was assessed on a 5-point scale ranging from "very concerned" (1) to "not concerned at all" (5) (Q13). Finally, participants were asked open questions about their driving performance (Q19). The final question consisted in asking about remarks regarding the experiment (Q20).

5.3 Design

A one-way within subjects design was used: the name used before the voice command was either the own name or a random (not own) name.

There were four videos, with six alerts in each video. Within each video, either the own name was used consistently, or six random names were used. Participants alternated between a video with their own name and a video with the other random names. Twelve participants started a video with their own name, whereas eleven started a video with random names (our last participant, who wasn`t examined would have started with the random name condition as well). In this manner, we fully balanced whether participants started with the own name condition or with the random name condition.

The four videos were named "Video A", "Video B", "Video C" and "Video D". We semi-randomized the order within each string of videos (i.e. the order of Videos A, B, C, D) to provide a unique order to each participant. Given the rule that name conditions have to be alternated, there are thirty-two unique ways to assign two name conditions to a string of four videos. From the list of thirty-two options we randomly selected twelve video strings. In a second step we added the same list in inversed order and obtained a list of twenty-four unique strings of videos. To ensure the uniqueness, we replaced four doubles with strings of the original list of thirty-two options.

A random name was only used once per participant. As mentioned above twelve of the most popular girls and twelve of the most popular boy names in the UK of 2018 were retrieved (Office for National Statistics, 2019). From that list, we casually picked names to create two lists of six names each. Each list contained three randomly selected female names and three randomly selected male names. The order in the lists followed the order of the casual selection.

We named these lists "Random Names 1" and "Random Names 2". We reversed the order of the names in each list and like this created the following two lists "Inverse Random Names 1" and "Inverse Random Names 2". There had to be two videos with random names for each participant, therefore we paired the lists. Under the condition that the inverse version of a list could never be paired with its original version, eight possible pairs can be created. We randomly assigned a pair to each of the twenty-four unique strings of videos.

For instance, the video string of our first participant (P1) was "(1) Video D, Other Name Condition, (2) Video B, Own Name Condition, (3) Video C, Other Name Condition, (4) Video A, Own Name Condition". The random name pair that was casually assigned to P1 consisted of "Inverse Random Names 1" for the first random name video (i.e. (1) Video D, Other Name Condition) and "Inverse Random Names 2" for the second random name video (i.e. (3) Video C, Other Name Condition).

5.4 Procedure

Upon arrival, participants took place in front of the driving set-up (see Figure 1 and 2) and received instructions. Specifically, participants were told that in the task they were the driver of a semi-automated car and that in-car voice alerts would inform them when to intervene in the driving. This voice would tell them to operate either on the brake pedal or on the indicators of the steering wheel to imply left or right. They were further told to react as fast as possible after receiving a clear indication to do so. Participants were also told that the voice alert would make use of their own name or of other names to announce the warning. They were instructed that they were always the driver of the car regardless of which name preceded the alert.

After the instructions, participants signed the informed consent and proceeded to the practice trial to get acquainted with the set up as well as the commands of all actions (i.e. indicating left, indicating right, brake, slow down). More explicit, there were three response options (indicate left, indicate right, or press the brake), which could be made in response to four types of requests (see Table 1). The wordings of the practice trial slightly differed from the commands in the actual experiment (see Table 1 for the wordings of the actual experiment). During the practice trial (approximately 1.5 minutes), the examiner stayed nearby in case there were questions.

After the practice trial, participants were introduced and familiarized with the mobile game "Bubble shooter" as a non-driving task.

In the main experiment, participants completed four driving videos. Each of them was equipped with six voice commands asking participants to intervene with the corresponding action. During all driving sessions, participants had to react to the instruction of the voice commands while they played the mobile game. After each video, participants were asked to fill in a voice rating questionnaire. To conclude the experiment, participants had to fill in the final questionnaire. In total, the experiment lasted approximately 45 minutes.

5.5 Measures

Reaction Time (RQ1) Participants´ reaction time consists of the time interval they needed to respond (i.e. press a button on the steering wheel or brake) after hearing the clear indication of the required action. Therefore, we documented every first gamepad response after the onset of the in-car alert. To determine the time interval, we always set the start time to the beginning of the word that clearly describes the required action in the command (i.e. left, right, slow down, brake, see Table 1). For instance, in the command, adapted from Wong et. al. (2019), "Exiting roundabout ahead. Look up! Action to indicate left is needed. ". The start time was set at the onset of the word "left". For statistical analysis, we used a paired t-test with alpha at .05 and report the mean response time for each condition.

Accuracy (RQ1) The accuracy of the response consists of a measure whether a response matches with the required action given in the in-car alert. We count the number of accurate and inaccurate responses (e.g. pressing right, when the correct action was to press left). Missing responses were counted as inaccurate. We report the frequency distribution of both conditions.

Subjective Performance ratings (RQ2) With three final open questions, we wanted to know what participants thought about their general performance, their performance when hearing their own name as well as about their performance when hearing another name. Furthermore, we asked participants if they had any remarks about their own name within a warning. We used a thematic analysis to report common emerging thoughts.

Preference for an alert including the own name (RQ2) Similar to Tobias et al. (2013), we used the measurement of participants` preference. Participants had to indicate to what extent they agreed to the following statement "I don`t like systems using my own name in a warning" (Q10). The question used a five-point scale ranging from "completely disagree" (1) to "completely agree" (5). The question was asked as a negative statement. Prior to analysis, the question and the scale have been reversed to be in the same order than all other questions. We counted the answers for each score and report a frequency distribution of the metric. Generally, all ratings on a five-point scale are summarized in ratings of agreement (ratings of 4 or 5) and ratings of disagreement (ratings of 1 or 2).

Openness towards an alert including the own name (RQ2) The measurement of openness towards a personalized warning system was also taken into consideration, similar to Tobias et al. (2013). Therefore, participants had to rate the following question on a five-point scale ranging from "completely disagree" (1) to "completely agree" (5): "I like it when my car uses my own name within a warning" (Q11). We report the frequency distribution of participants´ responses similarly to above.

Helpfulness and annoyance of an alert including the own name (RQ2) Comparable to Bazilinskyy and De Winter (2017), we also addressed a practical issue by asking if hearing the own name in a car warning is helpful (Q12.1) or rather annoying (Q12.2). We assessed that on a five-point scale ranging from “completely disagree” (1) to “completely agree” (5). Similar to previous metrics, we provide a frequency distribution of participants´ answers.

Concern about alerts including the own name (RQ2) This topic cannot be sufficiently investigated within one question. However, to obtain a tendency, we chose to tackle it, nonetheless. We measured how concerned participants were about systems registering and asking their own name. Therefore, we used a five-point scale ranging from “very concerned” (1) to “not concerned at all” (5). A frequency distribution is reported, alike previous metrics.

Subjective Voice Rating (RQ2) After each video, participants had to rate several parameters regarding the voice throughout a voice rating questionnaire (Large &Burnett; Wong.et. al. 2019). The questions used a five-point scale ranging from “not at all” (1) to “completely” (5). The first question (Q1) concerning participants perception and feelings about the commands asked participants to rate to what extent they think the voice is "Clear", "Distracting from the game", "Trustworthy", "Assertive", "Friendly", "Annoying", "Entertaining" and "Urgent". To measure the anthropomorphism of the voices the second question (Q2) asks if, due to the voice, participants had had the feeling that there was somebody with them. Additionally, participants´ preference for the voice was investigated with asking them if they would use it as an everyday car assistant voice (Q3) and how likely they would be to use it on a one-off occasion such as a day off (Q4). The last question (Q5) consisted of asking the overall rating of the voice. Unlike Wong et al. (2019) we only used one type of voice. Hence, a comparison of preference for different voices is impossible. However, we want to investigate how much participants prefer an artificial voice overall and whether there is a difference when the same voice says participants´ names or other (not own) names. For each participant, we calculated the mean score per video type (own name or random name) by averaging the scores of the two associated videos per condition. Subsequently, we grouped participants´ mean scores according to their condition (own name, random name) and calculated the mean score of each condition by averaging the scores. A paired t-test with alpha at .05 was used to compare the means between conditions. We report statistical analysis as well as a representation of the means for all means except for ratings of “annoyance” and “distraction from the game”. In the section above we already treated “annoyance” in a more relevant context for this study. The question regarding “distraction of the game” was unclear to a greater number of participants, therefore, results might be distorted.

6. Results

RQ1: Comparison of Reaction Times and response accuracy

Reaction Times: Mean reaction to in-car alerts preceded by the own name (M = 1.25, SD = 0.29) was significantly faster compared to when alerts were preceded by a random name (M = 1.46, SD = 0.36) (Figure 4), $t(22) = 3.84$, $p = 0.01$, $d = 0.655$ illustrates the main effect.

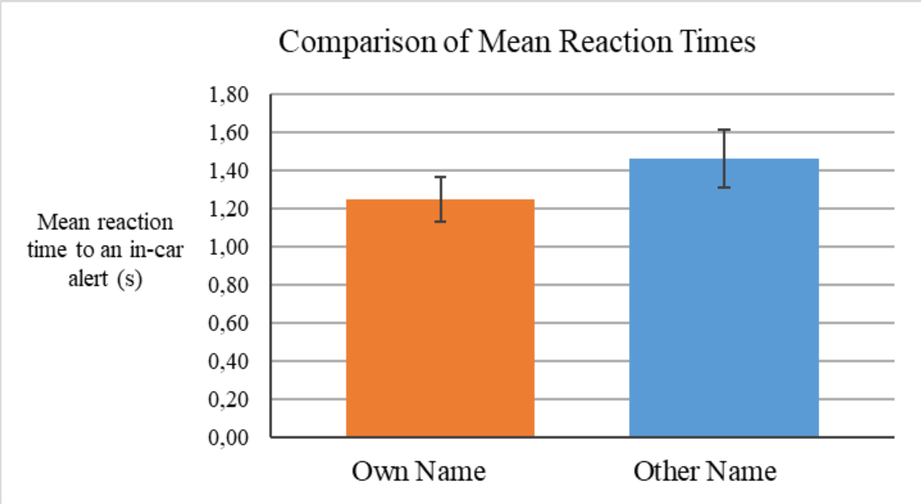

Figure 4: Reaction Time for different name conditions. The error bars represent confidence intervals of the means.

Accuracy: Overall, accuracy was high in both conditions. In the own name condition, 98.19 % of responses (271 out of 276) were correct. In the other name condition, this was 97.10 % (268 out of 276).

RQ2: Subjective Experiences

Subjective performance ratings: The results of the thematic analysis deal with common emerging themes and first reveal what participants thought of their overall performance and of their performance in each name condition. 18 out of 23 esteemed their overall performance positively (e.g. "fine", "good", "well" or "very good"). Only 5 participants gave themselves decent evaluations such as "ok" or "so so".

When asked how they rated their performance in the own name condition (and when later asked to rate their performance in the other name condition), the majority of participants (15 out of 23 in the own name condition, e.g. "better than not hearing my own name", "quicker response than with random name"; and 16 out of 23 in the other name condition, e.g. "Okay, but worse than with my own name", "less well than with hearing my name") stated to have performed better in the own name condition. The remaining participants did not value their performances as better or worse but gave answers such as "good", "normal", "very well". Interestingly, no participant valued the performance with the random name condition as the better one.

A theme that emerges is a stronger situational awareness in the own name condition. Indeed, P1 answered the question about the performance in the own name with: "I think I have performed better, or at least [I was] more aware of the traffic". P19 stated in the answer about performance in the other name condition: "I knew I had to react even if it was another name, but I think I got more alert when it said my name". P2 said, “I was more relaxed [in the own name condition]” and P13 wrote. “I was more annoyed [in the other name condition].”. These might be potential factors that contribute to a more distinctive situational awareness when hearing their own name.

Another emerging theme consists of the urge to action due to their own name. Therefore, P22 mentions the following: "I think [I performed] better [in the own name condition] because I felt more like I need to do something". Likewise, P15 stated in the remarks: “I think it [the own name] helps the reaction time […]”. At the same place, P21 answered: “It makes me feel that the situation is more urgent when it [the alert] is using my own name”.

Generally, when participants were asked if they had remarks about warnings that contain their own name, only 7 responded. P12 shares that “it feels more personal”. Correct pronunciation seems to be important. This has been remarked by P2 and P15 (the name of P15 was not pronounced “exactly as it should” (P15)). P7 suggests limiting the use of the own name to only urgent situations since “being called by name all the times may be annoying” (P7). P5 shares that “It was nice, hearing my name but in comparison of hearing another name I would prefer [the alert] to just say no name instead of George for example.”.

Preference for an alert including the own name: Figure 5 shows a histogram of responses to the question (statement has been reversed prior to analysis): “I like systems using my own name in a warning”. Participants consistently showed a strong affinity for alerts with their own name (*M* = 4.43, *SD* =0.79). Indeed, only 1 person claimed the opposite (score 2) and another one remained neutral (score 3). The person claiming the opposite was also not open towards warnings with the own name but remained neutral in the remaining questions.

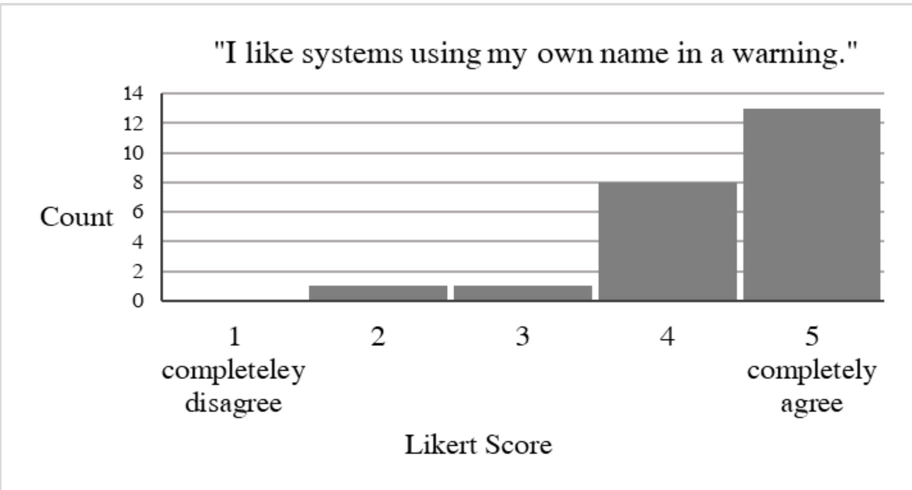

Figure 5: Frequency distribution of the subjective rating of preference for the own name in a warning.

Openness towards an alert including the own name: Figure 6 shows a histogram of responses to the question: “I like it when my car uses my own name within a warning”. Results seem to be largely positive (*M* = 4.17, *SD* = 1.23), but bimodal. While the majority (20 participants) would like it when their car would use their name in a warning, another 3 participants opposed the statement. Besides the participant who also opposed the previous metric (see above), participants` response to other questions did not give further insight into why they opposed it.

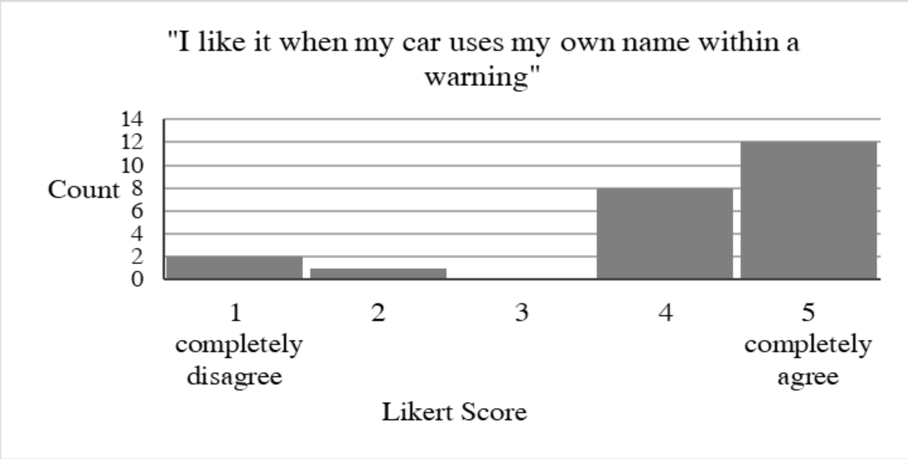

Figure 6: Frequency distribution of the subjective rating of openness for the own name in a warning.

Helpfulness and annoyance of an alert including the own name: Figures 7.1 shows participants response to the question: “Hearing my own name in a warning is helpful” whereas Figure 7.2 demonstrates participants response to the question: “Hearing my own name in a warning is annoying”. The majority stated that an alert with the own name was helpful (*M* = 4.25, *SD* = 0.67) with no participants opposing it (i.e., scores >2). The ratings regarding annoyance were slightly more diverse (*M* = 2.09, *SD* = 1.20). Although a large majority (15 participants) did not find the alert annoying, 3 did find it annoying and 5 were neutral about it. Since all 3 participants who found the own name annoying rated metrics of preference and openness positively (scores of 4 or 5) participants` response to other questions did not provide further understanding into the reason of annoyance.

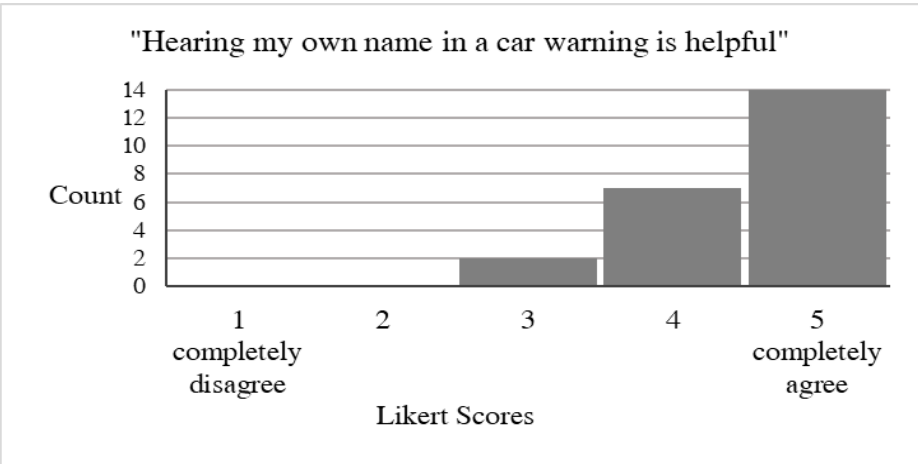

Figure 7.1 Frequency distribution of the subjective rating of helpfulness of the own name in a warning.

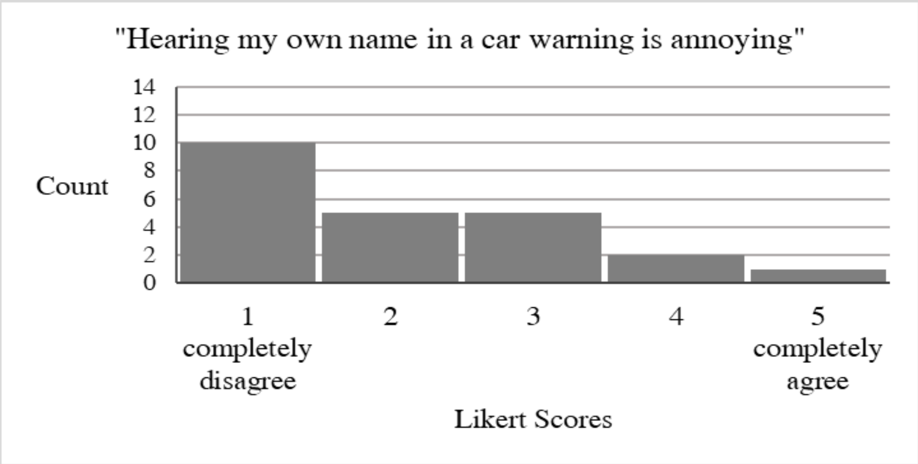

Figure 7.2: Frequency distribution of the subjective rating of annoyance of the own name in a warning.

Concern about alerts including the own name: Participants were also asked how much it would worry them that a system could register and ask their own name within a warning. Figure 8 shows that results are mixed (M = 3.39, SD = 1.23). While the majority (12 participants) did not worry about it, 7 participants indicated to be concerned. The remaining 4 participants stayed neutral (score 3). One concerned person indicated not be open towards the own name in the warning (score 1). However, the person scored high (score 5) on preference and helpfulness and considered the own name not annoying (score 5). Apart from this, participants` response to other questions did not give more insight into the reason for concern.

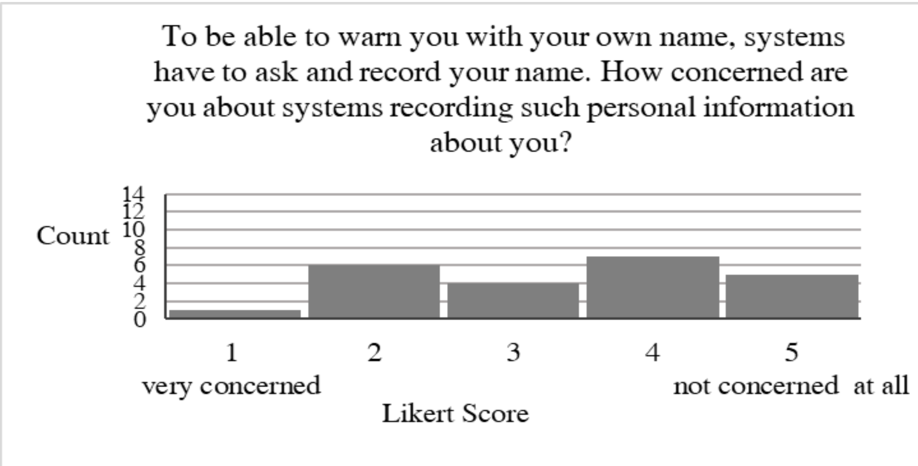

Figure 8: Frequency distribution of the subjective rating of concern regarding the registration and use of the own name in a warning.

Subjective voice ratings: Similar to Wong et. al. (2019), we also asked participants about their feelings and perceptions regarding the voice after each trial. Figure 9 shows the mean data on all relevant scores. Table 2 provides the statistical analysis of each aspect.

There were statistically significant differences between overall ratings, preference, urgency, and assertiveness. Except for entertainment, the own name condition scored higher in all other cases.

Looking at Figure 9, despite that there are significant differences, the scores of the two conditions are mostly close to each other. This is perhaps not surprising, given that they only differed in what name was used and not in other qualities of the voice. In general, all scores seem to be on the more positive end of the spectrum (i.e., with mean scores higher than 3) besides scores for Entertainment which seem to be very low (scores between 2 and 3). Both alerts score particularly high on assertiveness, trustworthiness, and clarity).

	t (22)	***p***	***d***
Overall	-3.226	0.004*	0.786
Preference	-3.685	0.001*	0.634
Urgency	-2.967	0.007*	0.422
Assertiveness	-2.997	0.007*	0.507
Trustworthiness	-1.775	0.090	0.450
Clarity	-1.632	0.117	0.421
Friendliness	-1.769	0.091	0.313
Entertainment	0.188	0.852	0.026
Anthropomorphism	-1.667	0.110	0.245

Table 2: Results of two-tailed paired t-test for the subjective voice ratings *indicates significant difference

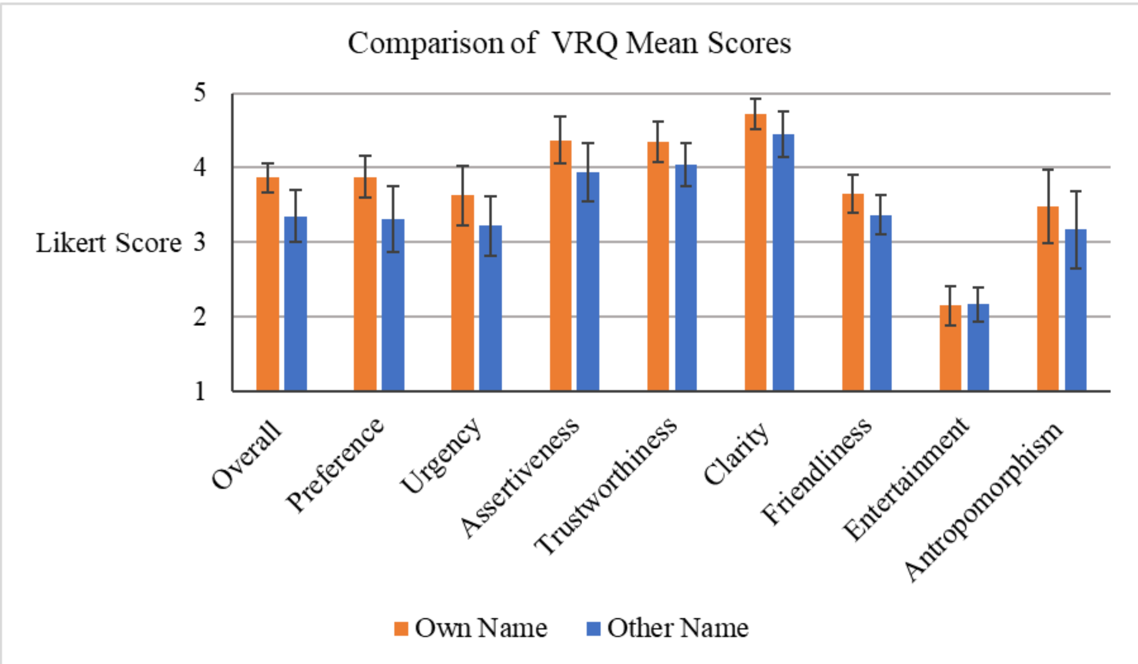

Figure 9: Likert Scale Ratings of Questions related to the voice in the command. The error bars represent confidence intervals of the means.

7. Discussion

7.1 Summary of Results

This study aimed to investigate whether an alert preceded by one´s own name leads to faster and more accurate responses compared to a control condition that is preceded by a random name.

In line with suggestions in the literature (e.g. Holeckova et al., 2008; Moray, 1959; Murphy et al., 2016) we successfully show that the own name consists of a powerful attractor of attention also in the context of semi-automated driving. Specifically, the in-car alerts preceded by participants´ own names resulted in a significantly faster reaction time compared to in-car alerts that were preceded by a random name. There was no difference in the accuracy with which an action was handled between conditions: overall the accuracy was high in both conditions. Our finding of a significant faster reaction time to an alert with the own name resolves a discussion in the literature whether the own name influences attention to the driving task (Almén, 2002; Tobias et al., 2013). While we found significant evidence, previous research of Almén (2002) reports that the own name as an auditory alert or the combination of it with a tactile alert were statistically not more successful in improving the driving performance than a tactile alert or no alert at all. Similarly, Tobias et al. (2013) describe only marginal advantages of the own name as an alert compared to a tone cue.

In terms of subjective experience in our study, participants were positive about the use of their own name. Indeed, the majority thought to have performed better when hearing the own name. The own name also gave the impression to help in gaining a stronger situational awareness as well as a stronger urge to action. In addition, the analysis of subjective experience revealed three further benefits: (1), participants liked the alert with the own name more, (2), they were open for hearing their name in their own car, and (3), they perceived the own name as rather helpful and not annoying in an alert. Participants` open-minded attitude towards an alert with the own name is in line with findings of Tobias et al. (2013) which point out that 77% of their participants would be interested in having an alert with the own name.

Our results can be compared to findings of Wong et. al. (2019). We used the mostly identical wording of their assertive voice condition for all our voice commands. Assessing the metric of assertiveness in the voice rating questionnaire, we obtained relatively high subjective ratings for it. This suggests that the mostly identical wording, their study and ours used is indeed assertive. Moreover, it suggests that our female artificial voice, is equally capable in conveying assertiveness compared to the male actor´s voice in Wong et. al. (2019). Since our rating of assertiveness in the own name condition is significantly higher than the ratings of the other name condition, there is reason to believe that the own name further reinforces assertiveness in commands.

Participants in the study of Wong et. al. (2019) generally reacted faster to the commands, than participants in our study. Indeed, Wong´s slowest observed mean reaction time is 0.961 s in the more immersive, non-assertive condition, which is even faster than our lowest mean reaction time of 1.25 s in the own name condition. Further research is needed to identify the nature of these differences, as both used the same set-up with identical videos and command text. One potential cause of the difference is that while the alerted incidents in the experiment of Wong et. al. (2019) happened quite immediately after the onset of the alert, our signal word in the commands was always emanated five seconds prior to the incident. This means that our commands were displayed earlier in general and participants might have noticed that there was enough time to react and consequently took their time to execute the driving action calmly. Moreover, our study also used a different mobile game ("Bubble shooter") as a non-driving task and did not control how immersive it was. Perhaps the game we used was particularly more immersive than the immersive game of Wong et. al. (2019) and therefore negatively impacted reaction time.

7.2 Implications for practise

Our findings, support the idea that using a driver´s own name can be useful as a trigger for attention in advanced warning systems (Leonard & Wogalter, 1999). In fact, our results suggest that the own name in an alert is highly beneficial for various reasons but most importantly for a quicker transition of control from a non-driving to the driving task. Since non-driving tasks increasingly gain importance in automated vehicles (Hancock, 2018) the use of the driver´s own name within an alert should be highly considered among developers. Our results of high acceptance and openness towards alerts that contain the own name further affirm such implementation.

That said, there was also a small set of participants (namely: 7) that were less unworried about alerts with the own name. In the open feedback of these participants, we could not find out why these participants were concerned. This needs to be investigated further in future studies. How to assure privacy and security is an ongoing debate in the design and research of highly automated vehicles (Kun, Boll, & Schmidt, 2016). These discussions are about much more than one's own name, as they concern the car-to-car connectivity in automated driving, where activities can theoretically be shared, merged, and used again by the collector. The question is to what extent the data must be managed by the driver and what role can be given to automotive user interfaces (Kun et al., 2016). An additional challenge is that future interfaces might also include personal data such as data from a bank account or health data (Smith, 2017). Consequently, including the own name within an alert is only one of many privacy and data security issues that automated driving brings along and that still requires research and solutions.

Irrespective of the unclarified matters regarding privacy and data security, personalization and customization in vehicles have already arrived in theory and practise.

Currently, personalization of advanced driver assistant systems (ADAS) principally involves the technical implementation of a personalized functionality such as lane changing or the autonomous driving style (Hasenjaeger & Wersing, 2017). In general, there are prototypes of personalized ADAS that are not yet accessible to drivers (Hasenjaeger & Wersing, 2017). Adding the driver´s own name to an alert should be integrated in the progress of such prototypes.

Contrarily to personalization where the system gathers data from the user, customization gives the user the freedom to select and choose characteristics of the product (Caber, Langdon, & Clarkson, 2018). Both personalization and customization are a general big trend in many areas (e.g. smartphones, furnishings etc.) as they satisfy people`s desire for tailor-made products (e.g. Arora, Dreze, Ghose, & et. al., 2008; Moniri, Feld, & Müller, 2012; Riemer & Totz, 2003).

Registering the own name can possibly happen through customization, which is already an important feature of more recent commercially available systems. Generally, in many modern cars, drivers are authorized to select suspension control settings by choosing for example between efficiency, comfort, auto, individual and dynamic mode (Audi-technology, 2020) or normal and sport mode (Porsche, 2020). Moreover, adjustments such as the steering wheel and seat position are memorized by the car and allied with the car keys. Normally, in current high-end systems up to three driver settings can be saved on one key and the settings are readapted after someone else has driven the car (Caber et al., 2018). Together with these driver settings, the audio file of the driver`s own name might be saved on the key as well.

Another place where the audio file of the own name might be stored is on an app or platform. For example, Porsche offers its customers a Smartphone App called "Porsche Connect" providing personal services and settings ranging from navigation to services concerning in-vehicle functions (e.g. lock/unlock the vehicle, monitor oil level) as well as services specifically for users (e.g. connecting Amazon music account) (Porsche, 2020b). Other brands provide similar digital services, for example, "myAudi" (Audi, 2020) and "Mercedes Me" (Mercedes-Benz, 2020). When drivers register for these services, the system could ask for their own name and subsequently store it for the use of in-car alerts. This might avoid that personal settings are limited to one car as it is the case with the storage on the key. However, it would still be dependent on the car brand.

The smartphone is a place where the own name might already be stored and used (e.g. within the AppleID). Systems such as Carplay developed by Apple (Apple, 2020a) or AndroidAuto by Google (Android, 2020b) connect several functions of the smartphone with the in-vehicle display. Therefore, they might be suitable to provide the driver´s own name for the warning system of the car. In general, these systems work mainly hands-free and enable the use of the smartphone while driving. For example, CarPlay can rely on Apple Maps and retrieve addresses from contacts or emails to navigate to a desired destination. Siri voice control can be activated during the drive to read and reply to messages and display audio messages through the car´s speakers.

Moreover, other Apps of the phone can be displayed on the interface of the car. These systems are supported by several models from every major automobile manufacturer (Android, 2020a; Apple, 2020b) hence there is no dependence on the car or car brand.

A car- and brand-independent system is advantageous since there is an increasing trend to share and rent cars. This leads to situations where the driver approaches a car that is not owned. Therefore, Caber et al. (2018) propose a car-independent basic concept of an intelligent driver profiling system. According to the authors (2018), the system transmits the profile information between cars and aims to adjust the user´s preferences, abilities, and limitations to be seamlessly customized and personalized at the moment the driver approaches the car. This also includes health data, age and physical condition. If this concept is further developed, the audio file with the driver`s own name could be included to the profile and hence situations like our baseline condition (i.e. hearing a random name) could be entirely avoided.

A further insight from your study regards the technical implementation of the audio file with the own name in any of these systems. Indeed, participants emphasized the importance that the own name is spelled and pronounced correctly. Therefore, developers should make sure that settings allow for an acoustic try out of the audio file as well as the possibility of changing the voice (e.g. providing a selection of voices from different language origins that are all similar levelled and pitched).

7.3 Limitations and future work

Our study was conducted in a driving simulator that allowed us to thoroughly study human behaviour in a safe environment for participants. Similar to Wong et. al. (2019), we displayed driving videos where no feedback was given to participants´ actions on the gamepad. For instance, if participants acted on the brake pedal, the video would not stop as a consequence of the action. Hence, participants might have questioned the meaningfulness of their driving activity since they noticed that they were not in control of the vehicle anyway. In addition, the driving in the videos was on the left-hand side, which contrasts with the right-hand side driving direction that our participants (located in the Netherlands) are used to.

To control the number of alerts in conditions and trials, an equal number of alerted scenarios was given in each trial. Consequently, there were occasionally other scenarios which were not alerted with a voice command (1 – 4 times not alerted scenarios per video). Therefore, participants might have questioned this inconsistency and why an alert was given in one scenario but not in another.

All these circumstances might have had an impact on participants´ reaction times as well as how they dispensed their focus on the driving and non-driving task. Also, participants´ risk perception might have been reduced due to this and because generally, risk is not real in a driving simulator.

We only studied one order of warning sentences, meaning that the alert always started with the own name followed by, first, a scenario description and ultimately an executive command containing the signal word. This implied that by the time of the signal word (towards the end of the alert), the onset of the alert with the own name has been heard around one to two seconds before. Hence, there was a considerable time interval between the own name as an attractor of attention and the signal word that described and called upon the action.

Therefore, we do not know to what extent this time interval between the own name and the signal word impacted reaction time and how much results would have differed if we also tested the own name in closer time proximity to the signal word. Future research should investigate different orders within alerts and perhaps examine the effectiveness of alerts where the own name is emanated between the road description and the execution or even at the end of the alert.

The alerts used in this study only warned before low-level hazards and not before emergencies on the road. From our results, we cannot tell how the own name within an alert would improve driver attention and performance in a severe emergency. However, our positive results are promising to be beneficial even in high-level hazards. Future, research should investigate the effectiveness of the own name in speech alerts warning before other, more critical scenarios. Maybe a study of alerts that warn of low- and high-level hazards can be combined with different combinations of utterances in the alerts. Indeed, one idea, (which was also mentioned by one participant in the remarks of the final questionnaire), might be to combine alerts containing scenario descriptions for low-level hazards with shorter alerts containing the own name for emergency situations. Even though annoyance of the own name within alerts was assessed as low in our study, this idea would avoid drivers to get annoyed and used to hearing their own name as soon as their driving is requested.

We only used one voice, retrieved from a text-to-speech programme, to broadcast the names and commands. Interestingly, ratings of the voice were generally higher in the own name condition, even though the voice was always the same. It seems like the own name “upgrades” the experienced quality of the voice, regardless of its actual quality. Future research might test if this observation can be replicated with different voices.

While we were able to compare voice ratings of both name conditions, we were unable to compare parameters such as pitch, level, speech rate or semantics. It might be, that those voice ratings such as friendliness, trustworthiness and urgency would have been improved with different voice parameters or another wording. For instance, the addition of a name in our study wasn´t able to improve low ratings of anthropomorphism of Wong et. al. (2019). However, our low ratings of anthropomorphism might be due to the use of “Samantha” and not necessarily have to do with the addition of names. Since we only used this one computerized voice, we are unable to reveal the reasons.

The same limitation applies to the use of a female voice in our study, which is in line with literature suggestions that a female voice is believed to be more effective in conveying urgency (e.g. Baldwin, 2011; Edworthy et al., 2003; Hellier et al., 2002; Machado et al., 2012). However, we are unable to say if ratings of urgency would have differed with a male voice and if the speaker`s gender had an impact on the ratings of the own name. This should also be taken into consideration for future investigations.

8. Conclusion

This study explored peoples´ reactions and attitudes to voice alerts with the own name while engaging in a non-driving task in a simulated driving set-up. Results successfully show that the own name serves as an effective stimulus to obtain the focus of attention even in the context of automated driving and while engaged in a non-driving task. The findings that people react quicker and appreciate alerts with their own name provide a useful and elegant insight for developers to influence peoples´ attention on the road.

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Appendix A

Voice Rating Questionnaire adapted from Large & Burnett (2013)

Q1: Do you think that this voice was …?

	1 (Not at all)	**2**	**3**	**4**	**5 (Completely)**
Clear	○	○	○	○	○
Distracting from the game	○	○	○	○	○
Trustworthy	○	○	○	○	○
Assertive	○	○	○	○	○
Friendly	○	○	○	○	○
Annoying	○	○	○	○	○
Entertaining	○	○	○	○	○
Urgent	○	○	○	○	○

Q2: Did this voice make it feel like there is somebody with you?

1 (Not at all)	**2**	**3**	**4**	**5 (Completely)**
○	○	○	○	○

Q3: How likely would you be to use this as your everyday car assistant voice?

1 (Not at all)	**2**	**3**	**4**	**5 (Completely)**
○	○	○	○	○

Q4: How likely would you be to use this on a one-off occasion such as a day-out?

1 (Not at all)	**2**	**3**	**4**	**5 (Completely)**
○	○	○	○	○

Q5: What is your overall rating of this voice?

1 (Not at all)	**2**	**3**	**4**	**5 (Completely)**
○	○	○	○	○

Please add any comment about the voice below if you like to:

Appendix B

Final Questionnaire

Q1: Do you have a driving licence for a car?

Yes	○
No	○

Q2: For how long do you have the driving licence?

1 year or less	○
1 – 2 years	○
2 – 3 years	○
3 – 4 years	○
4 – 5 years	○
More than 5 years	○

Q3: On average how frequently do you drive a car or other motorised vehicles?

daily	○
weekly	○
monthly	○
less than once in a month	○
never	○

Q3.1: (if selected daily) On average how many times a day do you drive?

once	○
2 – 4 times	○
5 – 7 times	○
8 – 10 times	○
more than 10 times	○

Q3.2: (if selected weekly) On average how many times a week do you drive?

once	○
2 – 4 times	○
5 – 7 times	○
8 – 10 times	○
more than 10 times	○

Q3.3: (if selected monthly) On average how many times a month do you drive?

once	○
2 – 4 times	○
5 – 7 times	○
8 – 10 times	○
more than 10 times	○

Q4: Have you ever driven a car or other motorised vehicles on the left-hand side (e.g. as in the UK)?

Yes	○
No	○

Q4.1: (if selected yes) On average how many times did you drive on the left-hand side?

once	○
2 – 4 times	○
5 – 7 times	○
8 – 10 times	○
more than 10 times	○

Q5: In which country do you drive most?

Q6: How old are you?

Q7: Is English your mother tongue?

Yes	○
No	○

Q7: Do you study at the moment?

Yes	○
No	○

Q9: What is your last diploma?

Secondary Education Diploma	○
High School Diploma	○
Bachelor`s Degree	○
Master`s Degree	○
PhD	○
Other	○

Q10: Please indicate to what extent you agree or disagree with the following statement:

"I don`t like systems using my own name in a warning"

completely disagree	disagree	neither disagree nor agree	agree	completely agree
○	○	○	○	○

Q11: Please indicate to what extent you agree or disagree with the following statement:

"I like it when my car uses my own name within a warning"

completely disagree	disagree	neither disagree nor agree	agree	completely agree
○	○	○	○	○

Q12.1: Please indicate to what extent you agree or disagree with the following statement:

"Hearing my own name in a car warning is helpful"

completely disagree	disagree	neither disagree nor agree	agree	completely agree
○	○	○	○	○

Q12.2: Please indicate to what extent you agree or disagree with the following statement:

"Hearing my own name in a car warning is annoying"

completely disagree	disagree	neither disagree nor agree	agree	completely agree
○	○	○	○	○

Q13: To be able to warn you with your own name, systems have to ask and record your name.
How concerned are you about systems recording such personal information about you?

very concerned	concerned	neutral	not concerned	not concerned at all
○	○	○	○	○

Q14: Do you have any remarks about warnings in cars using your own name?

Q15: Have you ever played the mobile game "Bubble Shooter Ball Bust" (or a very similar mobile game)?

Yes	○
No	○

Q15.1: (if selected yes) How many times did you play "Bubble Shooter" or similar?
1 time = opening the app, playing n-sessions, closing the app

once	○
2 – 6 times	○
7 – 11 times	○
12 – 16 times	○
more than 16 times	○

Q16: What is your gender?

Female	○
Male	○
Other	○
No answer	○

Q17: Is your vision normal or corrected

normal	○
Corrected (glasses or prescription lenses)	○

Q18: Do you suffer from hearing problems?

Yes	○
No	○

Q18.1: (if selected yes) What kind of hearing problems do you have?

Q19:

How well do you think you generally performed in the driving task?

How well do you think you performed in the driving task after hearing a warning that starts with your own name?

How well do you think you performed in the driving task after hearing a warning that starts with a random name?

Q20: Do you have any further remarks about the experiment?