Exploring User Expectations for Context and Road Video Sharing While Calling and Driving

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ABSTRACT
Calling while driving a car has become very common since the rise of mobile phones. Drivers use their phone despite the fact that calling in the car is potentially distracting and dangerous. Prohibiting communication while driving is not a good idea as there are also positive effects of calling (e.g., ability to notify about a delay, staying awake, preventing fatigue, guidance at foreign places).

In contrast to passengers in the car, remote phone callers do not know any context details about the driver besides transmitted background noise. Using driving-related context information and live images allows to create situation awareness for the caller outside of the car and share a passenger-like view of car, road, and traffic conditions. In this paper, we explore drivers’ and callers’ expectations and reservations towards context and video sharing before and during phone calls. First, we explored which data can be shared between callers and drivers. Based on a web survey conducted with 123 participants, we evaluate the callers’ and drivers’ attitudes towards sharing of such information. We then conducted separate interviews with various drivers to get deeper insights about their attitudes towards sharing context information while driving and their expectations towards systems that provide such features. We found that automatic context and video sharing is less preferred than situation-based sharing. If drivers like the idea of video sharing, they also assume that it would have a positive influence on driving.

Categories and Subject Descriptors
H.5.2 [Information Interfaces and Presentation (e.g., HCI)]: User Interfaces; H.4.3 [Information Systems Applications]: Communications Applications

Keywords
Automotive user interfaces, calling while driving, context sharing, driving safety, phone call, video call.

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Figure 1: Concept of sharing the driving situation with a remote caller in real-time.

1. INTRODUCTION
Today, it is very common for owners of cell phones to be available at any time. The worldwide number of cell phone subscriptions has increased from about 738 million user in 2000 to almost 6 billion users in 2011. Besides many benefits of always being reachable, people experience situations where the use of a cell phone might be inconvenient (e.g., at a movie theater) or even dangerous such as in the car. Hands-free kits integrated into the entertainment system of modern cars often provide connectivity to the driver (e.g., phone calls, SMS, e-mail) among a variety of other tertiary tasks while driving. One reason for this development is the driver’s desire to also be connected and available in the car as well.

Due to the distracting factor of calling, the risk of collisions is higher while calling and driving. We can observe an increasing number of accidents where the phone had been used just before the accident. Therefore, handheld calling

has been prohibited in a variety of countries\(^2\). In contrast, hands-free calling is oftentimes allowed, although studies revealed that the distraction is similarly high [1, 2, 18]. One benefit of hands-free calling is that at least both hands can reside on the steering wheel and thus offer the chance of faster and better lateral control. One might also imagine situations where calling on the phone assists the driver such as navigating in unknown areas, or preventing fatigue. As described by the Yerkes-Dodson Law [23], the relationship between arousal level and human performance can be described by an inverted U-shaped curve. As a consequence low arousal (fatigue) and high arousal (stress) both impact human performance and the goal is to keep a medium level of arousal to achieve good performance. Especially with the increasing number of advanced driving assistance systems, we can imagine that fatigue situations might appear in the car. In such a situation, an additional source of arousal (such as calling on the phone) might lead to an improved human performance.

Looking at the behavior of drivers today, our opinion is that calling while driving cannot completely be banned. Nevertheless, we see the need for improving driving safety with regard to communication while on the go. Therefore, our idea is to support the caller (outside of the car) in understanding the current driving situation of the person driving the car. This might help the caller to identify dangerous situations and act accordingly (e.g., defer an intended call, terminate an ongoing call, or wait until the end of a challenging situation). We imagine two ways to create an awareness of a driver’s current situation: (1) By offering abstract descriptions of the current driving situation (e.g., “is driving”, location, speed, road type, weather, traffic) the caller outside of the car can get an impression of the situation even before establishing a phone call. (2) A real-time video stream of the road and/or the driver can convey the feeling of a “virtual passenger” to the caller outside of the car.

As a first step towards context-aware communication in the car, we investigated the users’ expectations and reservations towards this kind of enhanced communication. We set up a web survey to get a first impression of how people would like the idea. In-depth interviews were then conducted to gain further insights. In the remainder of this paper, we will first present related work. Next, we explain our concept of sharing context and video streams to callers outside of the car. The web survey and the interviews will be discussed in detail before we draw conclusions on how to continue the initial idea. For the remainder of this paper, without loss of generality we assume that the person outside of the car initiates a phone call (referred to as “(remote) caller”) to a driver of a car (referred to as “callee” or “driver”).

2. RELATED WORK

Already more than a decade ago, first concepts of communicating context over (mobile) phones in general have been developed [12, 19]. The idea is to borrow from communication in a social setting where “situation matters” [19] and where both communication partners take context and situation (e.g., importance of communicating now, relation, type & length of communication) into account before starting a conversation. Looking at ordinary remote communication, such information is often not available and people instead ask suitable questions at the beginning of a call to be informed about the current context and the appropriateness of the call. To overcome this knowledge gap for mobile communication, Context-Call [19] offers a WAP-based solution that allows the caller to read callee-provided context information. Thus, the caller can decide whether to place a call, to leave a voice message, or to hang up. Other concepts propose solutions to negotiate a good time to call in the (near) future [22] or let the callee respond to incoming calls either with pre-recorded messages [14] or allow to first listen to an incoming call and then playback pre-recorded messages when talking is not an option [13]. Similarly, the DeDe system [7] allows the sender of a text message to choose the situation when the message should be delivered.

In a 10-day contextual inquiry with 20 participants, Khalil and Connolly investigated users’ privacy preferences and sharing patterns of context-aware phone calls [9]. They provide a broad overview of related work with regard to context-aware telephony and privacy. From their point of view, context-aware systems can be divided into two groups: (1) those that empower the “phone owner” (i.e., the callee) by sensing and adapting to the current context in order to better handle incoming calls, and (2) those that empower the caller by offering means to reason about the appropriateness of making a certain call. One main finding of their study is that context-aware calling is feasible and desirable as the participants were only available 53% of the time. They also found that even privacy-informed users share information in return for useful services and they offer some application design guidelines. To understand what types of context information should be conveyed to a caller’s awareness display”, DeGuzman et al. [3] conducted a four week diary study to find out which information callers considered and which information callees expected their callers to consider when initiating a call. They compiled a set of lessons to support the design of awareness displays.

For automotive environments, several projects investigated the challenge of reducing distraction for remote communication. An early investigation of intervening phone calls in certain situations has been conducted by Manalavan et al. [11]. Using various auditive signals, they provided context information to the remote caller and found that this could induce the caller to speak less. In a second experiment, they found out that the driving error rate which was increased during conversation could be reduced once the caller ceases talking in critical situations. As a follow-up experiment, Schneider et al. [20] evaluated the effect of a shared traffic display in form of a mirrored low- or high-fidelity driving simulation on driving performance. The idea was to create context awareness for the remote caller. Their study suggest that drivers’ behavior changes if a caller has access to remote context information. This could be caused by a different amount and timing of speech. As mentioned in their paper, very high fidelity driving situations would be required to investigate these effects further. Also, they did not evaluate the user acceptance with regard to the proposed technology.

Many calls initiated by callers outside of the car end once the caller notices that the callee is driving. Thus, Kern et al. invented a prototype that communicated an abstracted calling recommendation (“calling is ok”, “calling might be inopportune”, “only call if absolutely necessary”) to the caller.

before setting up the call [8]. The current status can either be set manually by the driver (“only call if absolutely necessary”) or derived from certain driving parameters. An initial study showed that drivers felt more comfortable when calls were postponed to more suitable situations and that callers took the calling recommendation into account: unnecessary calls were often postponed or replaced by a text message; often the recommendation was ignored in urgent cases.

With regard to technology, platforms already allow accessing car-related information (e.g., [16]). Applications like Foursquare\(^3\), Google Latitude\(^4\) or Glympse\(^5\) offer the chance to share the driver’s location but need to be enabled manually while or before driving and do not necessarily intervene call initiation.

A body of research exists that investigates the effect of calling on driving distraction (e.g., [6]). To undistract the driver on the road, Lindqvist & Hong developed a context-aware Android app that offers the concepts of burden-shifting (to the caller), time-shifting (delivery time for messages), and activity-based sharing to reduce driver distraction [10]. Their idea is to provide context information to the caller without needing to answer the phone, and to allow communication in appropriate situations. Additionally, their system offers automatic responses, defers message delivery until receiving is appropriate, and allows to send pre-planned messages to people outside of the car. So far, the system has not been evaluated with regard to driving performance and user acceptance. The effectiveness of proactive alerting and communication mediation while driving has been investigated in a study where auditory messages were used to indicate critical road sections and where calls were placed on hold [5]. The study revealed that interventions positively affected driving with less driving errors. While drivers supported such interventions, callers were neutral.

Summing up previous work, we see that the issue of calling and texting while driving is of high interest among researchers and actual drivers. While a lot of research has been done looking at different ways to reduce and investigate distraction, the idea of streaming real-time video to the caller has not been investigated deeply, especially when it comes to evaluating the callers’ and drivers’ expectations and position about such technology. Also, the callers’ and drivers’ opinion towards context sharing has not been investigated thoroughly so far. With our study, we contribute an empirical basis for investigating this technology option further.

3. CONCEPT

In order to offer the remote caller more details about the current driving situation and thus reduce the knowledge gap compared to a real passenger, our idea is to provide certain context information while establishing and maintaining a phone call.

Similar to previous work about context-aware calling, our goal is to share context information even before setting up a call. Our special interest is on high-fidelity driving-related context information. As a major advance, we would also integrate real-time video streams from the callee’s car to the remote caller. When driver and caller are actually talking on the phone, our idea is to also share a real-time video stream of the road (c.f. Figure 1) or the driver. By showing a live video various context information such as current speed, traffic, or weather can implicitly be shared without having to notify the caller through symbols, text, or auditory notifications. In a way, this would turn the role of the caller into a virtual passenger. Such a solution can empower the caller to realize the driver’s current situation and act accordingly. For instance, in dangerous or challenging situations, the caller could either decide to reduce the call time, hang up, or remain silent until the end of the current road segment. Similarly, the caller could even warn the driver if necessary or engage the driver in fatigue situations such as when all driving assistance systems are switched on while driving along an empty and straight highway.

Altogether, we imagine that the proposed system is realized as an app on the driver’s phone or is installed as a kind of extended hands-free speakerphone in the car. To provide context information to the caller we identified the following details to potentially be shared with a caller:

**Video** In order to implicitly transmit context information and let the caller feel like a “virtual passenger”, the car could transmit real-time images to the caller. Different transmission types are possible with regard to image representation (high-resolution color image, low-resolution color image, black-and-white image, edge image, e.g., to deal with privacy preferences), frequency (video, still image every 5 seconds, single image on call initiation), and viewing position (front view onto the road, side view, panoramic top view, view to the driver).

**Location** Before initiating a call, certain location information could be transmitted to the driver such as fine (GPS position) or coarse (suburb) location of the car, and the current road type.

**Sensor data** Also, data collected by the sensors of the car (e.g., current speed, wiper activity, lights on/off, fog lights, temperature, distance to other cars) could be processed and shared with the caller to create an impression of the current driving situation, e.g., with regard to weather, traffic, or time of day.

**Trip information** Details about the current trip (destination, time to travel, time traveled, number of passengers) could also help the caller to identify the current driving situation or find a suitable time when actually calling the driver.

**General driving information** If the driver refrains from revealing private data as mentioned before, one of the simplest messages to the caller would be if a person is driving or not—without having to reveal additional data.

In order to respect a driver’s privacy, various concepts could meet the drivers desire, such as those discussed in previous projects. A simple solution could be to offer the driver enabling and disabling context sharing completely. One idea is that the driver can define a set of caller groups and set up different sharing preferences for each of these groups. A potential distinction could be done using the following grouping: (1) close family, (2) family, (3) close friends, (4) friends, (5) colleagues, and (6) other callers.

\(^3\)http://www.foursquare.com, last access: 2013-06-10
\(^4\)http://www.google.com/latitude, last access: 2013-06-10
\(^5\)http://www.glympse.com, last access: 2013-06-10
4. WEB SURVEY

Solutions that support the driver and reduce driving distraction while calling are only helpful when they are used by most of the drivers and callers. Therefore, as a first contribution of this paper, we aim at investigating the users’ expectations and reservations towards systems that share context information of the driver with potential callers.

4.1 Method

4.1.1 Design

In order to get a broad overview of the users’ (drivers and callers) expectations of context and road video sharing while driving, we set up a web-based survey. The survey was publicly available and invitations to participate were distributed via e-mail, Facebook, faculty mailing lists, and learning platforms. Our goal was to gain knowledge about current driving and communication patterns and to investigate the drivers’ and callers’ opinion on sharing context or video while driving. We also asked concrete questions about the way of sharing information and the users’ expectations about the impact of sharing context information.

4.1.2 Participants

In total, 123 participants completed the survey throughout a period of two weeks. They were 19 to 58 years old ($M = 27.21, SD = 8.18$). 34 participants were female (27.6%) 83 male (67.5%), while 6 participants did not tell (4.9%). With regard to their level of education, 43.9% of the participants had a school-leaving certificate, 10 participants finished a professional training (8.1%), 56 contestants held a university degree (45.5%), and three participants did not tell (2.4%). About 69.9% of all participants stated that they are currently enrolled as university student. All participants but one owned a driver license that allows them to drive a car (99.2%).

4.1.3 Apparatus and Procedure

The survey was hosted on a publicly available web server of our institute using LimeSurvey$^6$ to present questions and record the contestants’ responses. The whole system was set up in German and thus focusing on German-speaking participants. At the beginning, an introductory page was shown to inform about the goal of this questionnaire (investigation of future & safe communication while driving). Additionally, the participants were informed that their participation is voluntary and that they can interrupt and resume the questionnaire whenever they like. They were able to fill out the survey without revealing their identity. The participants did not receive any financial compensation. On average, the survey was completed in 15:47 min.

Employing the survey, we wanted to investigate both current and future communication behavior of drivers and remote callers. Therefore, we first presented a set of questions about the participants’ current driving, calling, and texting behavior. Next, we (textually) presented the idea of sharing context information as a driver and asked about the participants’ willingness to share such information. We also presented the idea of sharing live images (videos) with a remote caller and asked about how and when to share live views from the car. As a next step, we asked corresponding questions with regard to context and video sharing from the perspective of a remote caller. Finally, we asked a set of basic, optional questions about the participant such as age, gender, and education.

4.2 Results

In the following sections we will first describe the results of our survey with regard to (a) drivers’ and callers’ current driving and communication behavior. Next, we will describe the (b) drivers’ opinions about sharing context information with a remote caller and (c) their opinion about sharing live images (videos) with a remote caller. Looking at the remote callers’ perspective, we will provide details about (d) their opinion on context sharing by drivers and (e) their opinion about drivers sharing live (videos) from their car.

4.2.1 Current Driving, Calling & Texting Behavior

Among all participating drivers (i.e., 122 participants), 41% used a car almost daily, 2–3 times per week (14.8%), about once a week (19.7%), less than once per week (21.3%), or never (3.3%).

Most drivers had permanent (51.6%) or shared access to a car (32.8%) leaving a 15.6% of drivers without regular access to a car. If people had at least shared access to a car, we also asked whether their car had some hands-free calling capabilities. In 28.2% of the cases the participant’s car was equipped with a fixed or portable hands-free kit. Speaker phones (17.5%), headsets (6.8%), or other devices (1.9%) were also used to allow hands-free calling while 45.6% of the cars were not equipped with any hands-free speaking technology.

When it comes to mobile phone use all participants but one owned either a smart phone (77.2%) or a traditional phone (22.0%). Similarly, 76.2% of all participants used mobile broadband services on their phone. Most of the phone owners used their phones for calling, SMS, browsing the web, e-mail, or other message services; Skype and Voice-over-IP were used less frequently (Figure 2). Among all drivers, a third (36.3%) of the participants never called while driving and another third (32.8%) did so less than once a week. The rest of the participants used calling while driving either almost daily (9.0%), 2–3 times a week (8.2%), or about once a week (13.9%).

4.2.2 Context Sharing from a Driver’s Perspective

To evaluate the drivers’ impression about sharing context information, we asked them to imagine that their car is able to

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$^6$https://www.limesurvey.org/
share certain types of context information with remote callers such as location, traffic, video or still images, and speed (details see Figure 3). As visualized in Figure 3 we proposed six different groups of remote callers: close family (partner, children parents), family, good friends, friends, colleagues, and other callers. We asked the participants about their willingness to share the different information with each of these groups if this information is shared automatically for each call. We further wanted to know how their willingness to share such information on a situation-dependent (call-by-call) basis is, in this case without distinguishing different caller groups. For each of the groups as well as for the situation-dependent case, multiple information types could be selected.

As shown in Figure 3, the most frequently information shared automatically would be the current traffic situation (close family 50 %, family 41.8 %, good friends 43.4 %, friends 27.0 %, colleagues 25.4 %) as well as the current weather conditions (close family 42.6 %, family 34.4 %, good friends 37.7 %, friends 23.8 %, colleagues 22.1 %) and the current road type. With regard to the exact location, 37.7 % of the drivers would automatically share their fine location with their close family, it would only be shared by less than 17.2 % of the drivers to callers of the other groups. The coarse location (e.g., the current suburb) would be shared more frequently among family and good friends: close family 38.5 %, family 30.3 %, good friends 36.1 %. Also, some of the drivers would share their current speed (close family 28.7 %, good friends 23.8 %) or workload (close family 26.2 %) with certain caller groups. The remaining context information types would be shared by less than 20 % of the drivers. Looking at the sharing preferences across all context information types, we observed the highest sharing frequency for the caller group close family, followed by good friends, family, friends, colleagues, and other callers (lowest).

Comparing the preferences of automatic sharing with those of the situation-dependent case (unfilled bars in Figure 3), we see a higher tendency to share information based on the current situation across all mentioned context information types. In this case, between half and two thirds of the drivers would eventually share their fine location (62.3 %), traffic situation (50.8 %), coarse location (48.4 %), or weather (47.5 %) information. Also, current speed (39.3 %), road type (36.9 %), workload (29.5 %), live road video (28.7 %), live video of the driver (23 %), or still images of the road (21.3 %) might be shared from time to time.

As we assumed that there might be differences with regard to the driver’s willingness to share information based on their driving behavior, we also compared how sharing frequencies differ between drivers that drive almost daily and those that drive less frequently. We found that the willingness to share fine or coarse location, traffic situation, and road type is slightly higher among those drivers that drive less frequently. In contrast, the willingness to share videos or images, weather, and workload is slightly higher among frequent drivers.

Similarly, we compared the groups of drivers that frequently call while driving (at least weekly) and those who call less frequently. The results are similar to the comparison before, but showing slightly larger differences for fine location and workload.

4.2.3 Video Sharing from a Driver’s Perspective

In order to not bias the participants with regard to their preferences of sharing a video while driving, we did not tell them about the potential benefits of our intended concept of sharing context information and videos with remote callers. As depicted in Figure 3 the drivers’ willingness to automatically share a real-time video of the road or of the driver is rather low. Only for close family members, some drivers would share a video of themselves (13.1 %), a video of the road (12.3 %), or a still image of the road (10.7 %). If the drivers can decide to share a video on a call-by-call basis instead, we observed a higher acceptance rate: 28.7 % of them might share a video of the road or a video of themselves (23.0 %) or a still image of the road (21.3 %).

In addition to the general video sharing preferences, we asked the drivers about how they would like to share live images with their callers. With regard to the frequency of images sent, the drivers would prefer to send a live video stream (17.2 %) over sending a still image every 10 s (4.1 %), a still image on call establishing (16.4 %). The rest would not send images at all (62.3 %). Most of the drivers (95.6 %) had
the feeling that sending video images affects their privacy. Two thirds of the drivers would like to choose the camera perspective for each individual call. For the general preference of a camera perspective, 59% of all drivers would prefer to send videos from a front perspective (through the front screen) to their callers (Figure 4).

4.2.4 Context Sharing from a Callers’ Perspective

When calling somebody’s cell phone, 74.8% of the participants would like to know if the callee is currently driving a car. In contrast to the low drivers’ willingness to automatically share information while driving, we see a higher interest in knowing certain context information when calling somebody who is currently driving (Figure 5). Similarly to the question about sharing from a driver’s perspective, the participants were able to select which context information they would like to know. The information of highest interest is the current traffic situation (49.9% of all participants) followed by exact location, time to destination, and workload (31.7% each).

With regard to the way the information is presented (multiple responses were possible), the callers preferred icon+text (43.9%) over icon (26.6%), text or image+text (25.2%), image (24.4%), video or video+text (17.9%), and spoken information (14.6%).

5. IN-DEPTH INTERVIEWS

In order to also get subjective feedback about sharing and video streaming, we conducted in-depth interviews to investigate details about callers’ and drivers’ sharing preferences and how they would like to use such a system.

5.1 Method and Participants

We collected details about drivers’ sharing preferences by conducting semi-structured interviews of about 30 minutes each. The participants received 5 EUR as financial compensation. In total, 9 participants aged between 25 and 57 years ($M = 36.2, SD = 11.6$) took part in the interviews. All of them owned a driving license and drove at least multiple times a month up to 20,000 km per year. With regard to calling or texting while driving, three of them reported that they regularly phone while driving and another two participants stated that they only talk on the phone while driving if they receive a call.

4.2.5 Video Sharing from a Callers’ Perspective

To investigate video sharing from a remote caller’s perspective, we asked several questions about how a video should be presented to the caller. With regard to the frequency of images sent, the callers would prefer to see a live video stream 29.3% over receiving a still image on call establishing (10.6%), or seeing a still image every 10 s (10.6%). The rest would not like to receive images at all (39%). As a camera perspective, the front view was preferred most (46.3%), followed by panoramic view (26.8%), a view of the driver (24.4%), and a view through the side window (2.4%).
5.1.1 Procedure

During the interview, we first introduced our proposed idea of video and context sharing while calling and driving. Therefore, we showed the participants sample videos (see Figures 1 and 6) of road situations as they could be seen by a remote caller when calling a driver and using the proposed technology. These videos were pre-recorded using a GoPro Hero 3 Black camera that was mounted to the front screen of a car to record driving situations from a front passenger view. In total, four different situations and videos (duration between 28 and 71 seconds) were shown to the participants: (1) Leaving a freeway resting area, (2) single-lane tunnel entrance on a highway, (3) almost empty, straight highway, and (4) narrow and winding alpine road.

Afterwards, we asked various questions about the participants’ opinion to such context sharing system from both caller’s and driver’s perspective. We further wanted to know how they would assume that such systems have an influence on driving and the driver’s privacy and if they would be willing to use such a system.

5.2 Results

Looking at why one would share context information or even video data or not, we found various positive and negative responses. By sharing context information (before calling) “the caller could decide whether to call or not based on the current driving situation”: “I would probably only call if I have to tell or discuss something very important if the other person is driving.” (Participant 3) Also, another participant noted that sharing a video could help “to assist the driver, e.g., by helping to navigate at unfamiliar places, or by warning the driver if necessary”. Taking the current situation into account, the caller could also “adapt the call length to the current driving situation”. Another participant stated that video sharing increases the mutual context knowledge as “the caller doesn’t need to ask for the current situation any more”.

When asked about the advantages of context and video sharing while driving, a lot of participants imagined that such a technology can improve driving safety:

“I can delay a phone call until the driver is in a less challenging situation. I can also remain silenced during a dangerous situation. This way, a part of the responsibility can be shifted from the driver to the caller. (...) Information of special interest would be a hint about when calling would be more suitable or I could even receive an automated callback.” (Participant 1)

If context information is presented even before a call is initiated, the remote caller could take this into account: “If I know the driving situation before placing a call, I can decide to defer the call if the current driving situation requires to do so.” (Participant 3) Also, one participant noted that such a technology could “cause other people to only call a driver if really necessary”. If a video of the road is shared, this could help the driver to concentrate on driving:

“Video sharing makes the caller feel like a passenger: The caller can see the current situation and gets a clue why the driver might not respond from time to time”. (Participant 6)

“It is cool that the caller can see where I currently am. But the caller also needs to respect if I do not share the current view. The advantage is that I as a driver can show that calling right now is not suitable. This is much nicer than rejecting a call.” (Participant 2)

As a potential drawback, one participant noted that “the driver could get annoyed if the caller wants to influence the driving behavior”. Similarly, the video streaming could “make the driver feel like having a real passenger but also feel more stressed”. Another participant wondered “whether providing context information to the caller indeed can help to estimate the current driver workload”. Also, several participants highlighted that the driver’s privacy needs to be taken into account as they might not like to be observed by their callers.

“I would like the system to distinguish between family and other participants: My family and especially my child should be able to call at any time. Maybe different rules apply throughout the day while working and if I am on a private trip.” (Participant 1)

Therefore many participants proposed that the system should offer ways to disable/enable context sharing - either on a call-by-call basis, as a “main switch”, or based on user-defined categories (e.g., taken from the driver’s phone book).

As mentioned by a participant, the “benefit of video sharing could [also] get lost if the caller just ignores the video”.

6. DISCUSSION AND CONCLUSION

Summarizing the web survey and the interviews, we see a diverse image of sharing context information and video streaming while driving. From a driver’s perspective, the motivation to automatically share information is lower than expected. The less familiar a caller is to the driver, the less context information would be shared. The drivers would mainly share context information with closely related people (family, friends). Even in this case, only less than half of the participants would like to share context information as a driver.

If we look at the willingness to share when the decision is made just before a call (situation-based), we see in contrast a higher acceptance across all context categories. Altogether, this shows that the participants are rather privacy aware and that the acceptance of such context sharing systems depends on the situation and the user. It seems to be challenging to create acceptable default settings. In combination with the findings from our interviews, this leads to the conclusion that for future context-sharing systems it is very important to offer suitable privacy control and customization means to the driver. If such decisions need to be made while driving, multimodal approaches could be used that for instance combine speech and gestures (e.g., [15, 17]). Some of the highest acceptance rates were found for sharing the traffic situation. Compared to other information types as video stream or exact location, the traffic situation abstracts much from the actual driving situation and therefore potentially ensures a certain level of privacy to the driver. Thus, one recommendation for future systems is to offer context sharing on various levels of detail, starting for instance with a very general context information to the caller such as ‘currently driving’. This could help to suit different needs with regard to privacy. Additionally, special privacy concerns of the drivers such as preventing the remote caller to store live video streams should be tackled accordingly.

Looking at the caller’s perspective, three quarters of the participants would like to receive some kind of context information as a caller. In combination with findings of the interviews, we see both a high interest of the caller as well as various benefits for the driving situation as the caller gets
more insights of the current situation. This is especially interesting for sharing video streams or still images to the remote caller. In order to not bias the participants of the survey, we prevented explaining potential benefits of our concept. In contrast, when talking more detailed about potential context sharing systems as we did in our interviews, the participants recognized the potential value of such systems for driver and caller. Therefore, one of the main challenges will be to communicate the values (for both sides) to the users.

While we explored the drivers’ and callers’ context and video sharing preferences in detail some aspects remain to be explored. On the one hand, the survey has only been published in German, restricting the audience to German participants. It will be interesting to investigate if sharing preferences and the willingness to share differ between countries.

As situation-based sharing was preferred over automatic sharing, the next step is to investigate different sharing concepts that support the drivers’ desire of situation-based sharing. Based on these results, a prototypical implementation can help to evaluate the concept further. Also, this can help to investigate the real behavior of drivers and callers while communicating and potentially sharing context information to the remote caller.

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8. REFERENCES


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