AUTOMATE - AN EMPATHIC FIRST-AID COMMUNICATION SYSTEM TO REDUCE THE BYSTANDER EFFECT IN CAR ACCIDENTS

Cansu Demir
cansu.demir@stud.sbg.ac.at
University of Salzburg
Salzburg, Austria

Isabel Melibeu
isabel.melibeu-de-mendonca@stud.sbg.ac.at
University of Salzburg
Salzburg, Austria

Sonja Lang
sonja.lang@stud.sbg.ac.at
University of Salzburg
Salzburg, Austria

Alexander Meschtscherjakov
alexander.meschtscherjakov@plus.ac.at
University of Salzburg
Salzburg, Austria

ABSTRACT

The bystander effect (i.e. theory that individuals are less likely to offer help in presence of others) is a common problem especially, when in cases of car accidents. In this paper, we present a first-aid communication system (AutoMate) that shall increase empathy of nearby drivers and support them in helping a car accident victim. Based on expert interviews, we designed and implemented a prototypical AutoMate system and evaluated it in a user study (N=8) in a car simulator. Results show the potential of such a system towards a more empathic behavior. We discuss challenges and opportunities for the design of in-vehicle information systems addressing bystander effects.

CCS CONCEPTS

• **Computer systems organization** → **Embedded systems**; *Redundancy*; Robotics; • **Networks** → Network reliability.

KEYWORDS

Bystander Effect, Empathy, Interaction Design, First-Aid, Emergency, UCD, Voice Assistance

ACM Reference Format:

Cansu Demir, Isabel Melibeu, Sonja Lang, and Alexander Meschtscherjakov. 2023. AUTOMATE - AN EMPATHIC FIRST-AID COMMUNICATION SYSTEM TO REDUCE THE BYSTANDER EFFECT IN CAR ACCIDENTS. In *Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems (CHI EA '23), April 23–28, 2023, Hamburg, Germany*. ACM, New York, NY, USA, 7 pages. https://doi.org/10.1145/3544549.3585777

1 INTRODUCTION

Empathy means to be able to understand and sympathize with other people's emotions. It happens on cognitive, moral, behavioral and emotional levels [23]. In order to have a more emotional engagement, and thus a deeper empathy, it is necessary to use these four levels together, as only the emotional part of the empathy would not suffice without a cognitive statement, and vice versa [23].

Sometimes human empathy is declining into a more apathetic approach, especially in cases of an emergency. Especially in cases when other people are present, individuals do not offer help, caused by the lack of feeling responsible and emotional attachment toward a victim. Sometimes they feel overwhelmed and afraid that they might do something wrong or worsen possible injuries.

Situations such as bystanders ignoring accidents and subsequently injured victims are becoming way too common, and using mobile apps such as Waze [7] or Google maps, the driver navigates away from an accident to avoid these types of encounters. This leads not only to an apathetic approach of an accident, as victims can be considered as a nuisance rather than someone that needs help, but victims would be completely by themselves in these situations, and that is judgmental for the situation, as every lost minute could be crucial for someone's life.

One possible solution for reducing bystander effects is through the means of an in-vehicle information system that supports the user when helping a car accident victim. We decided to design and implement a voice assistance system that helps drivers in such situations and research this approach in a simulator based user study. The guiding research question was:

RQ: How can extended first-aid knowledge available in a voice assistance system help bystanders empathize with victims of car accidents?

Additionally, we were interested in the following sub questions:

Sub-RQ1: How does sharing information about a nearby accident affect another person's behavior/emotions?

Sub-RQ2: How can the communication system provide knowledge to reduce bystander cognitive dissonance?

The design of AutoMate followed the assumption that proactively asking for a bystander from the perspective of the victim to come and help would create a more effective impact than merely displaying information. AutoMate informs drivers (bystanders) that an accident occurred and how far it was. With our research we provide an approach to how future first-aid communication systems in cars could be designed.

CHI EA '23, April 23–28, 2023, Hamburg, Germany

ACM ISBN 978-1-4503-9422-2/23/04.
https://doi.org/10.1145/3544549.3585777

2 RELATED WORK

We conducted research on the need of bystander action, the causes of the bystander effect and existing help systems for car accidents.

Bystander action usually has an impact on the outcome of an accident, especially with respect to bridging the time between an accident and the arrival of the ambulance. In case of an emergency the appropriate conveying of first-aid steps can be of great significance [21].

First-aid training has an important impact on bystanders' willingness to stop and help [14, 22]. As Hall et al. [13] point out, the motivations for bystanders to not help can be rooted in numerous factors, such as the number of other bystanders at the scene [9, 18, 19], the severity of an accident [10], the demographics and appearance of the victim [10, 17], the relationship to the victim [10, 16], insufficient first-aid knowledge [17], fear of liability [1, 14], or simply the fear of doing something wrong [1, 14, 17, 24]. Also differences between the challenges of face-to-face and non-face-to-face situations have been analyzed [20, 25].

Current solutions mainly focus on facilitating the automatic sending out of emergency calls and the victim's data to the ambulance. One example is the eCall system which is mandatory for all newly registered cars within the European Union since 2018 [6]. In case of an accident (e.g., when the airbag is activated) the eCall system automatically calls the ambulance [3].

Besides that it can also be activated manually through a button [4, 15]. Since eCall can not be deactivated by the driver, there has also been some discussion about privacy and ethics, as users are afraid that their information would be shared not only to ambulances, but with other people, or that their data would be hacked [11].

Apart from eCall, there have been similar approaches from several car companies [8]. Smartphone applications that tackle are for example iOnRoad Augmented Driving or Porsche Car Connect [2]. Systems that go beyond informing the ambulance and instead network with other cars in a certain radius did not seem to be of big interest yet.

3 SYSTEM DESIGN

When it comes to designing such voice-based helping systems, the usage of an emotionally-laden or anxious voice may be counterproductive [5] and interfaces in such a context should avoid high color contrast and flickering animations [5]. Using an appropriate combination of visuals and voice within a car interface has been proven to work well in guiding and reducing stress for witnesses of traffic accidents [5].

Zepf et al. [26] mentioned that an empathic interface on vehicles can prevent emotional distress from drivers and dangers such as car accidents. They claimed that the driver's emotional state can affect their ability to drive, and thus focused on studying what external real life triggers could influence the user's emotion.

Gröber et al. [12] mentioned that, with the automatization of cars, they are becoming more complex and with that, leading to new forms of accidents. They mentioned that having proper communication inside the car could help drivers understand the car's behavior, build trust in the technology and resolve possible problems [12].

Their study showed that a form of communication between car and driver can be helpful to prevent possible accidents, and so, a first-aid communication system would also be beneficial for both bystander and victim.

4 PROTOTYPICAL AUTOMATE SYSTEM DESIGN

4.1 Analysis

To frame the functionality of our system, we conducted one interview with a paramedic from the red cross for expert knowledge and two interviews with possible users that drive regularly. There was no need to limit down the user group, since everyone can potentially be affected by an accident situation.

The user interviews had the main purpose of finding out about people's driving habits and how they usually react in case of an accident, as well as, questions about our concept and their opinions about sharing health information. The expert interview had the purpose of gathering important insights about first-aid. Before developing AutoMate, the first-aid content needed to be suitable for bystanders who do not have detailed expert knowledge. With this insight, we were able to keep a balance between providing necessary first-aid knowledge and not overwhelming the driver.

The paramedic stated five basic first-aid steps, and three steps considered optional. Paramedics do not expect nor encourage in-depth first-aid knowledge from bystanders. Moreover, he noted that people might have reasons to not stop by, especially when the accident is fatal and the bystander has emotional barriers.

Another reason for conducting the expert interview was to find out which types of victim's health data could be helpful for a bystander. He stated that most of the health data we had in mind (allergies, medication, etc.) are not helpful at all for laymen but rather for the ambulance. So, during the interview we came to the conclusion that AutoMate should only portray basic information about the user's wellbeing as well as the fatality of the accident.

4.2 Conceptual Design

We created a concept which fulfills the following functionality: Before starting the car the user logs in with their personal profile on the car interface in the middle console. In the personal profile the user's basic data (first name and age) is stored. Optionally, they can also provide an avatar and additional data such as children being on board.

When an accident occurs in a certain radius, the user receives a notification on the interface of their car. There will be a visual cue as well as a short sound to attract drivers attention without distracting them. In a real setting, the driver would have the possibility to accept or decline to stop by and help. As mentioned above, the decline option is important since there might be serious reasons for not being able to help. To avoid chaos on the accident site, the notification will only be sent to a limited number of bystanders, namely those who are very close to the accident.

After accepting, the system provides information about the accident. The data will not only be visually displayed on the screen but also read out loud by a voice assistant. The information will be told in a first person perspective to create a feeling of an actual person talking to the driver. In the next step the voice assistant asks the user to follow the route to the accident. In the meantime, there

will be a map portrayed on the screen, just like a usual navigation system.

When arriving at the accident location the system will start providing the 5 first-aid steps we determined in the previous subchapter. These steps may vary depending on the type of accident, but in our work we focus on one specific scenario where the following 5 first-aid steps are needed: 1. Park safely. 2. Turn on the warning lights and place the triangle somewhere visible. 3. Take your first-aid kit. 4. Approach the victim from the front and check if they have any injuries. 5. Kneel down next to the victim and calm them down.

On the screen, the steps will be portrayed in short sentences and a pictogram. The user will be able to click through, skip or repeat a step anytime they want. The selected step will be read out loud by the voice assistant.

5 STUDY DESIGN

The study was set-up in a driving simulator environment. The driving scenario was implemented with SCANeR™ software by AVSimulation. The ride starts right before an intersection, which is crossed by some pedestrians. In the route there are a couple of intersections with traffic lights. In general, there is low traffic density in the area.

Driving the predefined route took about five to ten minutes. The scenario of urban traffic was thought as a first experiment as one of the main ideas was to research whether this possible extra interaction would improve the empathy from bystanders (inside a car) and victims.

Inside the scenario, it was possible to conclude that the others cars might not have AutoMate implemented, as in more than one case it showed them driving past the accident and ignoring it. We concluded that not everyone would have this in their cars, and the more people it approaches in order to gather help, the better for the victim's mental and physical being.

At the intersection before the bridge, AutoMate alerts to an accident in the immediate vicinity of the participant. During this process, a voice assistant describes the situation and asks the driver for support and guidance. After the participant perceives the emergency situation and confirms to help, the location of the injured person appears as a map. The participant follows the map and arrives at the accident site after about two minutes of driving. As soon as the driver confirms their arrival at the accident location, the five first-aid steps appear.

At the same time, the voice assistant asks the driver to go through and follow the steps before leaving the car. Since the victim might be in a critical situation, this step takes only about one minute. Once the first-aid steps have been gone through, the driver gets out of the car with the intention of helping the injured person. Since this is in the context of a simulator lab study, the study ends at this point.

The emergency situation including alerting, playing the voice assistant script, and controlling the first-aid steps of the AutoMate interface were manually controlled by a human assistant who observed the interaction. Figure 1 shows an setup overview of the simulator study.

Figure 1: On the left: Driver receives an emergency notification; on the right: Interaction during first-aid steps

6 METHODS AND PROCEDURE

In order to assess the interface, we used a mix of qualitative and quantitative methods. To first generate an estimate of participants' general empathy level, we used the standardized Toronto Empathy Questionnaire (TEQ), which represents empathy as a primarily emotional process. The TEQ consists of 16 questions, each rated on a five point scale from 'never' to 'often'.

Furthermore, we used the User Experience Questionnaire+ (UEQ+) with the subscales attractiveness, efficiency, perspicuity, novelty, trust, usefulness, value, visual aesthetics, intuitive use, trustworthiness, quality of content, clarity and response quality as a quantitative assessment of usability and user experience to assess UX with AutoMate.

Semi-structures post-interviews were utilized to gain qualitative insights on empathy during the emergency situation, appropriateness, awareness, and understanding of the AutoMate interface and interaction. Questions asked included:

- How do you feel about the situation you have just experienced?
- How was it to empathize with the victim, even though she is a stranger?
- How much the information shared about the accident helped your decision?
- How hard was it to understand and interact with the AutoMate?
- What do you feel about the information shared? Would you be comfortable sharing your location with other people?

In addition, demographic data (age, gender) were collected. Open-ended and questions scored on a 7-point Likert scale were defined for general assessment of driving experience, assessment of behavior in an accident (self or bystander), and initial assessment of first-aid skills.

We recorded via an observation protocol the driving behavior of the participants in general, their reaction to the emergency situation and their interaction with the AutoMate System.

The study proceeded in five phases: In phase one, participants were introduced to the study goals and agenda, gave their informed consent, and filled in the pre-questionnaire which includes the experience questions and the TEQ.

In phase two, participants could familiarize themselves with the simulator by driving one or several laps across a different track.

In phase three, participants drove across the track with the emergency situation.

In phase four, participants responded to the interview questions about empathy, the AutoMate interface, interaction with AutoMate and the setup in general.

Finally, in phase five, the participant was asked to fill in the post-questionnaire that consisted of the UEQ+ with the subscales mentioned above.

On average, the studies lasted about 30 to 40 minutes. Based on the rules of the University of Salzburg, no formal ethical approval from an ethics committee was required. We nevertheless followed ethical standards of our institutions including e.g. informed consent and data protection rules.

7 RESULTS

7.1 Sample Description

Overall, eight participants took part in the study. We took a convenience sample recruited via word-of-mouth at University of Salzburg. Most participants were undergraduates. none of them were familiar with the study. Three (37,5 %) considered themselves as female and five (62,5%) as male. The youngest participant was 23 years old, the oldest 29. With a mean and median age of 26 years, the sample was rather young (SD=2,05).

No participant indicated to suffer from a perception disorder or epileptic seizures, which would have been reason for exclusion from the study. All participants had a valid driving license and four (50%) indicated that they are driving weekly, two (25%) monthly and two (25%) less often. Two (25%) respondents said to be inexperienced drivers, another two (25%) indicated that they were experienced, one participant stated to be experienced, whereas three (37.5%) indicated that they were very experienced drivers.

7.2 Questionnaires

37,5% of participants had witnessed a car accident, and were shocked and scared to react. The others never had witnessed, but they believed that they would try and help, but they were honest that in the situation they might be too stressed to react properly without guidance.

One of the more interesting data was that around two thirds (66%) of females don't believe they have the proper knowledge of first-aid, whereas 60% of males do believe they have the proper knowledge. 66% of females and 60% of males would not feel comfortable performing first-aid.

75% of the participants (N=6) scored slightly above average in empathy on the TEQ. The average score was 45 with a standard deviation of 4,62. One participant scored above the average score with 52 points, whereas another participant scored below with 35 points. This shows that in our case the participants have a similar empathy level. However, it should be noted that we only had eight participants in our study. Therefore, it would be interesting to see to what extent this result changes with a broad number of participants.

The UEQ+ resulted in medium to high ratings (all scores in the positive range of the scale) on all scales, with only Novelty, Visual Aesthetics, and Efficiency rated lower overall. Usefulness was rated highest, followed by Clarity, Quality of Content and Response Quality.

7.3 Post Interview

After the study's main part in the car simulator we conducted a 15-minute interview to gather the participants' impressions. The overall feedback was positive. In the following, we summarize the results from the post-interaction interviews clustered by interface, background experiences, empathy, privacy, personal use and possible changes.

7.4 Interface Design

Participants were confused while driving to and arriving at the accident location. Five participants criticized the map, as it was not dynamic and therefore not intuitive to use. Half of participants mentioned a feeling of impatience when listening to the first-aid steps after parking the car. They had a need to directly leave the car and help the victim, but at the same time needed to finish listening to the first-aid steps. We also noted that in most cases participants did not notice that they were able to skip the steps by clicking on the interface. One participant described how he once experienced an accident and forgot all the first-aid steps out of nervousness, so during the simulation he was glad to have all steps directly at hand.

The system's design was overall rated positive. Most participants described it as clear, straightforward and easy to understand.

7.4.1 Background Experiences. In general there seemed to be a discrepancy between the levels of first-aid skills among participants. Most of the participants stated that the first-aid steps provided by AutoMate were easy to follow and did not stress them too much.

One participant seemed to be underwhelmed as the mentioned steps were self-explaining and nothing new. One insight describes the simplicity of the steps as a negative connotation, whereas another insight describes that these steps helped the participant to be more calm.

While the underwhelmed participant had a first-aid class while doing her driver's license, the latter one never had such a class. This shows that different backgrounds and levels of comfort with first-aid is something that needs to be considered by the system in the future. For users with advanced first-aid skills it might be helpful to include the three additional steps we gathered during the expert interview (see chapter AutoMate).

7.4.2 Empathy. One part of our assumption was that addressing the participant directly and through a first person perspective has an impact on the willingness to help. Three participants stated to be surprised when the notification came in and suddenly the emergency sound appeared. After the surprise, all of our participants appreciated the guidance provided by the voice assistant. The voice assistance as an additional layer of information was valued, as it made the participant aware that there is a real person seeking for help. Most participants found it easy to empathize with the victim, even though she was a stranger.

For the victim a persona called Gertrude was created. She was an old lady, and most participants felt responsible to help her, as she was elderly and they believed she would be more likely to have serious injuries even from a mild accident.

Interestingly, two participants stated that it does not make any difference if the victim was a friend or a stranger as they would help anyways, while at the same time two other participants said

they could not empathize much with the victim because they did not see her or were too busy driving. One participant mentioned that empathy might be increased, if the victim had a profile picture that showed her in person.

We can conclude that, by addressing the driver directly from a first person point of view, empathy is increased in a way that drivers have a clear image of the person seeking help. Therefore, they show an increased willingness to help. The information shared about the victim contributes to this as well.

7.4.3 Privacy. At the same time personal data seemed to be a very controversial issue for most of our participants. While most of the participants saw no problem in sharing accident-related data (such as the severity, the location and if the ambulance is on their way) data that relates directly to the victim sparked some discussion. Several participants seemed to be torn. On the one side they admitted that personal data helps in empathizing with the victim.

In our scenario, the participants had a clear image of the victim in their heads due to the victim's age and name shared. As one participant describes it: 'When you know there is an older person maybe you approach them differently'. On the other hand, half of the participants said that they would feel uncomfortable with sharing personal data, even if it increases their chances of receiving help in case of an accident. Revealing the victim's real name seemed to be an issue of discussion as well.

Several participants liked knowing a victim's name and being able to address them directly. It could also be reassuring and calming for the victim if someone talks to them directly. Three participants saw a risk of discrimination when disclosing a victim's real name. Especially the earlier mentioned 'having a clear image of the victim in your head' seemed to be seen as a disadvantage when it comes to bias and discrimination.

Interestingly, one participant also mentioned how he does not '(...) like the idea of designing a technology for racists (...)' which means that the system should not be changed just because of someone's bad stance. It was interesting to see how some participants really seemed to weigh up the arguments for and against sharing data in their head. One participant admitted how they contradicted themselves at several points in the interview. This shows us how challenging and sensitive this topic is.

We concluded that the sharing of personal data is something the user should be able to set individually in the settings of their personal profile.

7.4.4 Possible changes. When asked if they would use AutoMate in their cars a majority confirmed that the system would make them feel more reassured. It adds comfort and safety to already existing systems. Although AutoMate was rated overall positive, there was also some criticism and room for improvement mentioned.

When receiving the accident notification, one participant stated that he missed information about how long the ambulance will take. Moreover, they think it could be helpful if their location was also shared with the victim. Two participants referred to the voice assistant being too slow. Another participant added that the assistant's pronunciation was weird and robot-like. When arriving at the destination three participants said they missed an indicator to confirm that they reached the right location.

As mentioned earlier the timing of the first-aid steps was highly criticized. That is why one participant voiced the idea of having AutoMate connected to their smartphone, so that she could listen to the first steps after leaving the car. Another participant would prefer having all five steps directly on one screen, so he can quickly skim through them.

8 DISCUSSION AND LIMITATIONS

With respect to our overall research question we found that the proposed AutoMate interface with extended first-aid knowledge available in a voice assistance system helps bystanders empathize with victims of car accidents. The AutoMate system serves as the basis of a concept for car manufacturers. It introduces the important functions that a first aid communication system should provide. It is to be built into existing systems as an integrated feature. We found out that bystanders feel more responsible to help by sharing information about a nearby accident, as they are directly approached by the victim (Sub-RQ1). Addressing the bystander directly, as a victim with name and age, and asking for help is enough for them to feel empathy towards the victims.

It is worth mentioning that confirming the help function is not mandatory, and bystanders retain the right to reject help if they think it might cause a negative reaction.

Based on our findings, the cognitive dissonance of bystanders can be reduced by the guidance of the voice assistant and the offering of basic first-aid steps. This gives users the feeling that they are being supported in providing help (Sub-RQ2). As Klieger et al. [14] and Fischer et al. [9] make clear, a recent first-aid training has a massive impact on bystanders' willingness to stop and help. Therefore, we could imagine offering workshops or informative videos at regular intervals in the AutoMate system to keep first-aid knowledge up-to-date. Unlike the functions of the eCall system [6], AutoMate additionally serves as a first-aid communication system that alerts the closest bystander and asks for help, however, similar to the eCall system we found privacy issues [11] in AutoMate. The majority of our participants voiced their concerns over these issues. In order to prevent this, the user themselves should be able to choose which information they want to share. The only necessary information is the location. These findings provide a good basis for future built-in first-aid communication systems.

As Zepf et al. [26] mentioned, an empathic interface on vehicles can prevent emotional distress from drivers and dangers such as car accidents, and as an empathic system, The concept of AutoMate makes drivers feel more calm and at the same time more responsible to help victims. Lastly, Gröber et al [12] , mentioned that a form of communication between car and driver can be helpful to prevent possible accidents. Therefore a communication between those two parties can help prevent worsen conditions from victims as well as building a trust between drivers and cars.

We have to keep in mind that ecological validity of a simulator study is limited. In our simulator setup, the non-panoramic view (frontal projection only) and the lack of integrated vehicle interfaces such as turn signal and clutch resulted in a rather artificial environment. To substantiate our findings, a field test in a real vehicle should be conducted. A higher number of participants might have led to more meaningful results. Future studies in an improved

setup and different scenarios might reveal further possibilities for the development of the concept. In addition, it is beneficial to strive for a between subject design approach to measure the impact of empathy in two versions, namely the differences between the first- and third person perspective and also a human-like or robot voice.

9 CONCLUSION

In this paper, we provide a report on a study in which we investigated an interface to reduce the bystander effect in car accidents. We found that the direct approach or contact of the bystander can lead to positive effects. The map interface, which was used to navigate to the accident scene, was not effective and the interface of the last first-aid steps was not intuitive.

The accident in this scenario was very mild, therefore the first-aid steps provided by AutoMate were kept minimal. As a result, it did not evoke strong emotions such as anxiety and fear in the participants. Nevertheless, the availability of navigation in combination with voice assistance is very helpful. Although, using voice assistance for the first-aid steps in AutoMate had a more superfluous impact, the direct approach of the injured person was perceived very positively.

Despite the fact that the drivers could not see/knew the injured person, they could feel empathy towards the injured person. The participants felt responsible to help the victim.

We therefore conclude that the concept of AutoMate is suitable as a system to reduce the bystander effect in car accidents.

Future work should focus on improving functionality, especially with regard to the user experience of navigation and first-aid steps on the spot. A possible outcome is a collaboration with car manufacturers to integrate AutoMate in existing car interfaces.

10 ACKNOWLEDGMENTS

This work was created within the project HADRIAN, which has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement number 875597. The Innovation and Networks Executive Agency (INEA) is not responsible for any use that may be made of the information this document contains.

REFERENCES

[1] Paul Arbon, Jo Hayes, and Richard Woodman. 2011. First Aid and Harm Minimization for Victims of Road Trauma: A Population Study. *Prehospital and Disaster Medicine* 26, 4 (2011), 276–282. https://doi.org/10.1017/S1049023X11006522

[2] Jon Blancou, Joao Almeida, Bruno Fernandes, Luís Silva, Muhammad Alam, José Fonseca, and Joaquim Ferreira. 2016. eCall++: An enhanced emergency call system for improved road safety. In *2016 IEEE Vehicular Networking Conference (VNC)*. 1–8. https://doi.org/10.1109/VNC.2016.7835964

[3] Abderrahim Chariete, Mohamed Bakhouya, Ahmed Nait-Sidi-Moh, Wafaa Ait-Cheik-Bihi, Jaafar Gaber, Raed Kouta, Maxime Wack, and Pascal Lorenz. 2016. A Study of Users' Acceptance and Satisfaction of Emergency Call Service. *Int. J. Commun. Syst.* 29, 15 (oct 2016), 2279–2291. https://doi.org/10.1002/dac.3161

[4] Ioannis P. Chochliouros, Anastasia S. Spiliopoulou-Chochliourou, and George K. Lalopoulos. 2005. Emergency Call (eCall) Services Based on Approved E-112 Regulations and Infrastructures : A solution to improve security and release of road help.

[5] Henrik Detjen, Stefan Geisler, and Stefan Schneegaß. 2020. "Help, Accident Ahead!" Using Mixed Reality Environments in Automated Vehicles to Support Occupants After Passive Accident Experiences. (09 2020). https://doi.org/10.1145/3409251.3411723

[6] Europe. 2016. *European Commission Delegated Regulation of 12.9.2016.* http://ec.europa.eu/transparency/regdoc/rep/3/2016/EN/C-2016-5709-F1-EN-MAIN-PART-1.PDF

[7] Europe. 2022. *Waze - live app.* https://www.waze.com/de/live-map/

[8] Bruno Fernandes, Muhammad Alam, Vitor Gomes, Joaquim Ferreira, and Arnaldo S. R. Oliveira. 2016. Automatic accident detection with multi-modal alert system implementation for ITS. *Veh. Commun.* 3 (2016), 1–11.

[9] Peter Fischer, Tobias Greitemeyer, Fabian Pollozek, and Dieter Frey. 2006. The Unresponsive Bystander: Are Bystanders More Responsive in Dangerous Emergencies? *European Journal of Social Psychology* 36 (03 2006), 267 – 278. https://doi.org/10.1002/ejsp.297

[10] Peter Fischer, Joachim Krueger, Tobias Greitemeyer, Claudia Vogrincic, Andreas Kastenmüller, Dieter Frey, Moritz Heene, Magdalena Wicher, and Martina Kainbacher. 2011. The Bystander-Effect: A Meta-Analytic Review on Bystander Intervention in Dangerous and Non-Dangerous Emergencies. *Psychological bulletin* 137 (05 2011), 517–37. https://doi.org/10.1037/a0023304

[11] Christophe Geuens and Jos Dumortier. 2010. Mandatory implementation for in-vehicle eCall: Privacy compatible? *Computer Law & Security Review* 26, 4 (2010), 385–390. https://doi.org/10.1016/j.clsr.2010.03.009

[12] Lea Theresa Gröber, Matthias Fassl, Abhilash Gupta, and Katharina Krombholz. 2021. Investigating Car Drivers' Information Demand after Safety and Security Critical Incidents. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) *(CHI '21)*. Association for Computing Machinery, New York, NY, USA, Article 696, 17 pages. https://doi.org/10.1145/3411764.3446862

[13] Anna Hall. 2013. Bystander Experiences at and after a Motor Vehicle Accident: A review of the literature. *Australisian Journal of Paramedicine* 10 (01 2013).

[14] Andreas Kliegel, Wolfdieter Scheinecker, Fritz Sterz, Philip Eisenburger, Michael Holzer, and Anton N. Laggner. 2000. The attitudes of cardiac arrest survivors and their family members towards CPR courses. *Resuscitation* 47, 2 (2000), 147–154. https://doi.org/10.1016/S0300-9572(00)00214-8

[15] David Kubát, Petr Weinlich, and Tereza Semerádová. 2014. Data security concerns of future eCall users. 21–27.

[16] Nobuo Kuramoto, Takeshi Morimoto, Yoshie Kubota, Yuko Maeda, Susumu Seki, Kaori Takada, and Atsushi Hiraide. 2008. Public perception of and willingness to perform bystander CPR in Japan. *Resuscitation* 79 (10 2008), 475–81. https://doi.org/10.1016/j.resuscitation.2008.07.005

[17] Eva Larsson, Niklas Mártensson, and Kristina Alexanderson. 2002. First-aid Training and Bystander Actions at Traffic Crashes — A Population Study. *Prehospital and disaster medicine* 17 (09 2002), 134–41. https://doi.org/10.1017/S1049023X00000352

[18] Bibb Latané and John M. Darley. 1970. The Unresponsive Bystander: Why Doesn't He Help?

[19] Mark Levine and Simon Crowther. 2009. The Responsive Bystander: How Social Group Membership and Group Size Can Encourage as Well as Inhibit Bystander Intervention. *Journal of personality and social psychology* 95 (01 2009), 1429–39. https://doi.org/10.1037/a0012634

[20] P.M Markey. 2000. Bystander intervention in computer-mediated communication. *Computers in Human Behavior* 16, 2 (2000), 183–188. https://doi.org/10.1016/S0747-5632(99)00056-4

[21] Colin O'Keeffe, Jon Nicholl, Janette Turner, and Steve Goodacre. 2011. Role of ambulance response times in the survival of patients with out-of-hospital cardiac arrest. *Emergency Medicine Journal* 28, 8 (2011), 703–706. https://doi.org/10.1136/emj.2009.086363 arXiv:https://emj.bmj.com/content/28/8/703.full.pdf

[22] Timothy Dale Peterson, Soraya Noland, Daniel W Russell, and Norman F. Paradise. 1999. Bystander Trauma Care training in Iowa. *Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors* 3 3 (1999), 225–30.

[23] Kathy Stepien and Amy Baernstein. 2006. Educating for Empathy. A Review. *Journal of general internal medicine* 21 (06 2006), 524–30. https://doi.org/10.1111/j.1525-1497.2006.00443.x

[24] Andreas Thierbach, L Pelinka, Silja Reuter, and Walter Mauritz. 2004. Comparison of bystander trauma care for moderate versus severe injury. *Resuscitation* 60 (04 2004), 271–7. https://doi.org/10.1016/j.resuscitation.2003.11.008

[25] Sven Voelpel, Robert Eckhoff, and Jens Förster. 2008. David against Goliath? Group size and bystander effects in virtual knowledge sharing. *Human Relations - HUM RELAT* 61 (02 2008). https://doi.org/10.1177/0018726707087787

[26] Sebastian Zepf, Monique Dittrich, Javier Hernandez, and Alexander Schmitt. 2019. Towards Empathetic Car Interfaces: Emotional Triggers While Driving. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems* (Glasgow, Scotland Uk) *(CHI EA '19)*. Association for Computing Machinery, New York, NY, USA, 1–6. https://doi.org/10.1145/3290607.3312883

11 APPENDIX

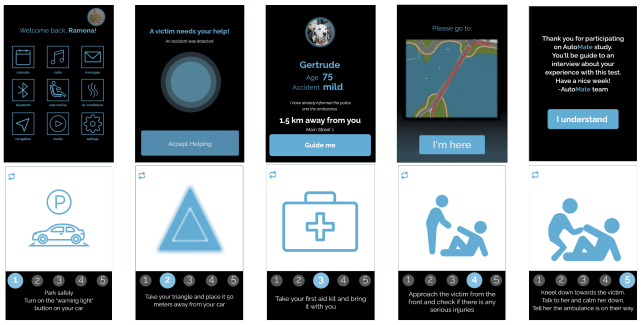

Figure 2: Screen design and five first aid steps