Save the Smombies:
App-Assisted Street Crossing

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Choice of Paper

Basically the name Smombies and the abstract caught our attention to the paper. We choose this one because it seemed nice, the name was intriguing and we were running out of options.

Introduction

- Pedestrians are not protected against collisions with motorized vehicles.
- Using smartphones while walking divides attention and increases, reaction times as well as risky behavior

- In prior investigations, people using smartphones failed to see
  - a unicycling clown
  - someone in need of help
  - money attached to a tree
- Recently, a collision of a motor cyclist and a boy who was focused on the game ended deadly

Smartphone Zombies = Smombies

Introduction

The main focus of the study was to individually, via their smartphone, protect a pedestrian, from the mobile device it self.

- **Therefore**, the **proposed solution** aimed to present a mobile interface traffic guidance in a transparent manner directly on the screen of the device.

Objective & Hypotheses

- Creating a smartphone application which displays important guidance information while pedestrians may use any other application simultaneously. **The Smombie Defender, SmomDe.**

- H1: Using SmomDe increases the success rate in crossing decisions over a baseline without the application
- H2: Using SmomDe results in a lower mental workload than the baseline condition.

Prototype Design
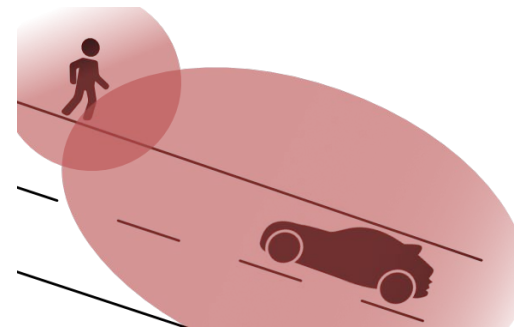
- The initial idea was to transfer explicit vehicle signals and traffic lights to mobile devices
- On screen guidance should be scalable and work in urban traffic scenarios

- Several sketches were created and evaluated in a focus group with four HCI experts (all male, 25 to 32 years old). The main outcome was that the application should feature:
  - Recognizable warnings even if the mobile phone remains in the pocket or the display is turned off
  - Tactile feedback and sound
  - On-screen overlay independent of running applications
  - Colors inspired by traffic lights
- If a **safety area** of a pedestrian and an vehicle **overlap**, the application would trigger a warning

Prototype Design

Figure 1
Sliced screenshots of the Notify concept

- The group study resulted in four visual concepts
  - Bars
  - Traffic Light
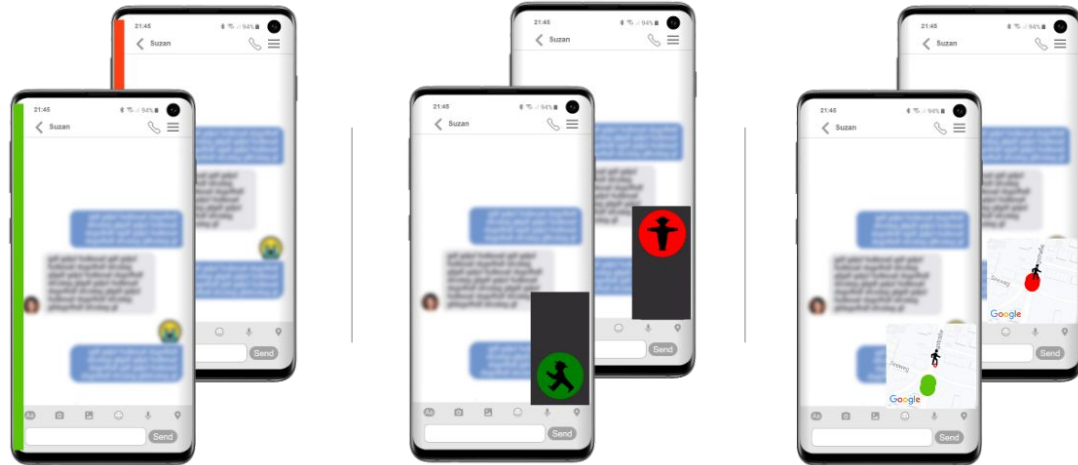 - Map
  - Notify

Figure 2 Evaluated design concepts for smartphone-assisted street crossing. From left to right: Bars, Traffic Light and Map.

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Pilot Study

- 8 Participants: 2 Females, 6 Males, ages between 24 - 42

- Participants used the image application Imgur for several minutes together with the SmomDe prototype while the experimenter changed the status (safe to cross / not safe to cross) five times for each of the guidance concepts.

- Relevant results obtained:
  - Sound is not needed;
  - Vibration pattern considered too aggressive;
  - Bars concept considered unobtrusive and effective;
  - Traffic Light, intuitive and easy to understand;
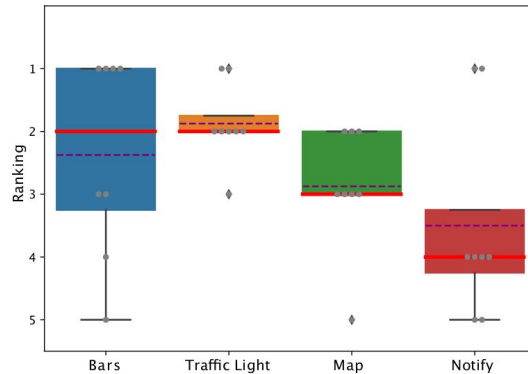 - Notify, annoying and likely to ignore.

Figure 4
Ranking of concepts evaluated in a pilot study

Evaluation & User Study

- 24 participants: 9 Females, 15 Males ages between 19 and 36.
- To ensure the safety of the participants, a crossbox was built and six videos were shooted on a local road.
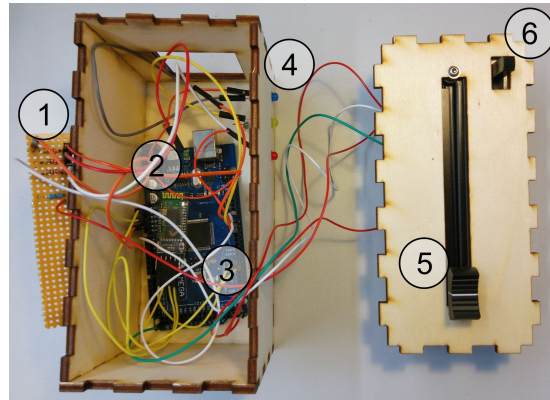

Figure 5: Crossbox based on the Feeling-of-Safety Slider.
(1) circuit board; (2) Bluetooth module; (3) Arduino; (4) LED-status lights; (5) slider and knob; (6) on-off button.

Videos

To **ensure safety of participants**, they could not allow participants to cross a road using a smartphone.

Six videos were recorded of a car driving in the a straight road. The camera was at a **height of 156 cm.** The camera was **positioned to mimicked the field of view of a pedestrian.**

Car **driving at 30 Km/h** half of the times would yield and completely stop 5 meters away from the camera

Figure 7: Screenshots from videos. Left to right: one vehicle approaching, two oncoming vehicles, further pedestrian already waiting while vehicle is approaching.

Study Procedure

- Participants were given the explanation of the crossbox and went to two practice trials to become comfortable with the setting.
- They were oriented towards the canvas showing videos of recorded traffic scenarios and indicated their willingness to cross in real time with the Crossbox while using the Imgur application.

- During the video, the vehicles' intent was shown by the visual guide in the SmomDe.
- Status changes from safe to unsafe were accompanied by a 200ms vibration.
- After each run participants filled out a NASA-TLX questionnaire.

Figure 6:
Participant during user study
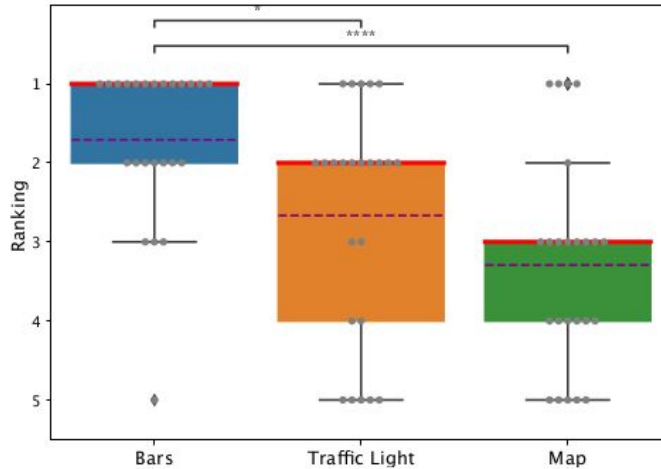
Results

Figure 8: User ratings in grey dots. Mean: dashed purple line;
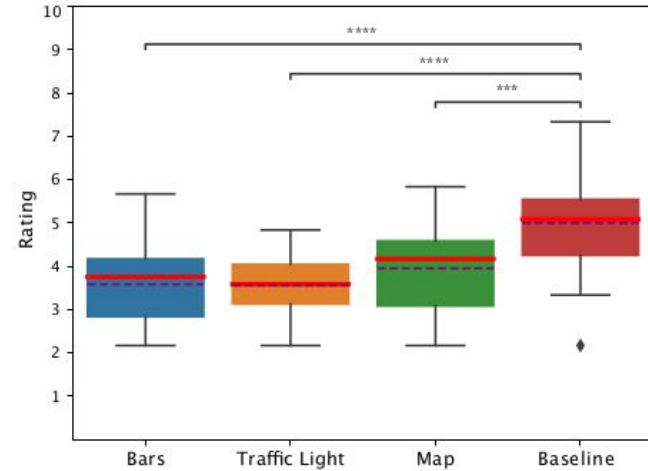median: solid red line, stars indicate significance.

Figure 9: Combined raw NASA-TLX workload means per concept, stars indicate significance of pairwise comparisons.
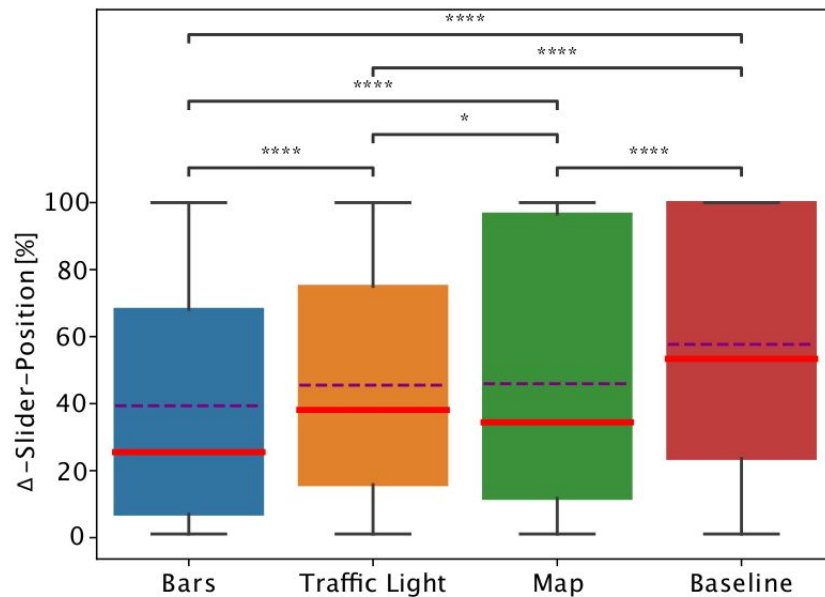
Results

Figure 10: Mean Δ-values of unsuccessful runs per concept.
Stars show significance of two-sided Mann-Whitney-U tests.

Results

- All 24 participants stated that they would accept the general concept of SmomDe.
  - 48.5% stated that they could imagine fully relying on SmomDe
  - 29.2% stated that they would accept the system, but only as additional feedback
  - 25% stated that they would accept if the following conditions were met:
    - A sufficient familiarization phase
    - Approval by traffic safety authorities
    - If there is a lack of eye contact while crossing (e.g. driverless vehicles)

- Participants suggested the app should feature
  - Include app status
  - Map visualization resizable
  - Directional arrows to the traffic lights concept
  - Combining Bars and Traffic Light concept
  - Additional timer which displays a countdown for red signals

Conclusions

- Tactile feedback via vibrations was perceived as a valuable addition to the visual guidance
- Design recommendations:
    - DR1: Show unobtrusive and directed indications of oncoming traffic;
    - DR2: Reduce presented information and include tactile feedback;
    - DR3: Present warnings only;
    - DR4: Do not use notifications for warnings;
    - DR5: Consider the target audience and enable inclusion.

- The goal of the work done was to mitigate the negative effects of mobile device usage on traffic and not to encourage people use their smartphone while walking on the street,

Conclusions - Limitations & Future Work

- It was not investigated the mental effort of the image browsing task on Imgur
- It was not observed any behavior in real-life situations

- Future work should consider how a universally understandable application could be designed, including multiple modalities and directed and tactile feedback

Conclusions - Our Opinion

proposed paper code:

-> **SMOMBIES** <-