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Acceptance of Tactile Belts for Directional Information Representation in Automobiles

Amna Asif
University of Oldenburg
amna.asif@informatik.uni-oldenburg.de

Wilko Heuten
OFFIS Institute of Information Technology
wilko.heuten@offis.de

Susanne Boll
University of Oldenburg
susanne.boll@informatik.uni-oldenburg.de

ABSTRACT

Tactile belts are an alternative display to present directional information in automobiles. We conducted a user evaluation in a controlled environment to investigate the acceptability of tactile belts for that purpose and circumstances. A tactile belt, consisting of six vibrators was used for continuous direction presentation in a driving simulation. The simulation consisted of a video clip showing a recorded drive from the driver's viewpoint. This was synchronized with a tactile track providing tactile presentations of upcoming turns through a tactile belt. Information regarding front direction, right or left turns was presented on participants' waist by activating appropriate vibrator(s). Factors of the Technology Acceptance Model (TAM)[1] have been evaluated with the help of questionnaires afterwards. The results show that tactile belts are acceptable by drivers for directional information.

Categories and Subject Descriptors

D.2.8 [**Human Machine Interaction**]

General Terms

Measurement, Experimentation, and Human Factors

Keywords

Tactile user interfaces, Automobiles, Acceptability

1. MOTIVATION AND HYPOTHESIS

Todays car navigation systems use mainly visual and auditory interfaces to display directional information, e.g. for navigation support. Since the visual and auditory senses are already used for driving or communicating, they cause additional distraction, irritation, and cognitive workload. With respect to the Multiple Resource Theory [2], tactile stimulation as an additional channel could support driving without using the visual or auditory sense. We have evaluated the acceptability of tactile belts as one example of tactile user interfaces, for presenting directions using the TAM. In particular the factors *Perceived Usefulness* (PU) and *Perceived Ease of Use* (PEoU) have been determined.

2. EXPERIMENT

We have used a tactile belt with six vibrators to present front, right and left directions in the driving simulation. The front direction was presented by simultaneous activation of two vibrators situated in the front-left and front-right of the belt. The stimulation on right and left side represent upcoming right and left turns respectively. Front, right and left vibrators continuously display directions until a crossing is reached. Duration of right and left vibration is calculated as: on small routes a vibrator is activated 50 meters in advance and on main routes 200 meters in advance. In the experiment a video of 267 seconds of a pre-recorded route was presented to the participant and synchronized with the tactile stimulation indicating the turns. The route was composed of different turns on smaller streets and main roads of a city. In the end of evaluation participants asked to fill a questionnaire, which is designed according to scale proposed by Davis [1]. Fourteen participants belonging to 18 to 40 years age group have taken part in experiment.

3. RESULTS AND DISCUSSION

According to the calculated mean of responses, all factors of PU and PEoU fall on scale of 'Quite Likely', this shows participants' acceptability to tactile belt for directional information presentation in automobiles. Results show learning, usage, and interaction of tactile belt are more acceptable factors among all. According to oral responses of participants, they prefer to use tactile belt as an integrated feature for directional information over visual and auditory interfaces, but demanded to provide visual map for showing full route. Participants feel irritated with continuous direction information, especially for longer trips. They desired to have vibration of tactile belt as controllable feature because probability of messing vibration information with the vibration of the car. Distinct information need to present with different frequencies patterns.

4. REFERENCES

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