Posters 2017

PDF of posters presented in Rome

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News

New Bad designs

Executive committee 2018 – 2020

Annual Meeting Keynote Speaker

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Pedestrians' Hazard Prediction (HP) Cyclists' Hazard Prediction Vehicle Drivers' Hazard Prediction

CHANGE OF PERSPECTIVE APPROACH TO HAZARD PREDICTION ASSESSMENT AND TRAINING

Research Aims

This first study aims to ascertain whether Perception of Traffic Hazards improves with holistic training in the global understanding of traffic situations: training in hazard perception from the perspectives of various different road users.

HAZARD PREDICTION (HP)

For a holistic understanding of the traffic situation, it is important that both the driver and other road users comprehend how all other road users will act. We therefore believe that training that manages to put the driver in the shoes of other users (as actor-observer) will enrich their awareness of hazardous situations that could arise, thus avoiding modal biases that might contribute to accidents.

A new traffic perception test with sub-modules of clips recorded from the perspectives of driver, pedestrian and cyclist was developed.

- Different Hazard Prediction perspectives were analysed: Walking, Cycling, Driving
- Different groups of traffic users carried out the test:
  Pedestrians, Cyclists, Vehicle Drivers.

Time (Clips: Max. 46 sec)

BLANK SCREEN

Hazardous situation Development / CLIP Occlusion

ASSESSMENT HP

Did you see the hazard? NO/YES

What might happen next?
Multiple Choice (3 alternatives)
(SITUATION AWARENESS MEASURE)

Clips Hazardousness Ratings
From 1 to 6.

METHOD

Videos: Clips between 6 and 46 seconds long
Stopped immediately prior to the hazardous situation.
Recorded from 3 different perspectives:
Pedestrian's HP, Cyclist's HP, Vehicle Driver's HP

Procedure

Instructions

Block 1: ASSESSMENT HP

- 10 PEDESTRIAN'S HP CLIPS
- 10 CYCLIST'S HP CLIPS
- 10 VEHICLE DRIVER'S HP CLIPS

10-MINUTE BREAK

Block 2: ASSESSMENT HP
Practice + Feedback & Training
(Complete clip)

- 10 PEDESTRIAN'S HP CLIPS
  Practice + Feedback + Complete Clip
- 10 CYCLIST' S HP CLIPS
  Practice + Feedback + Complete Clip
- 10 VEHICLE DRIVER'S HP CLIPS
  Practice + Feedback + Complete Clip

30' aprox.

Participants

	Gender		Age	
	Male (N)	Female (N)	Mean	SD
Pedestrians	13	11	23	8
Novice Drivers	11	11	23	8
Experienced Drivers	15	13	36	16
Cyclists	11	4	30	10
Total	50	39	28	13
	89			

89 drivers (39 female & 50 male) recruited in Granada (SPAIN).

Results

Test Type Hazard Prediction (HP)

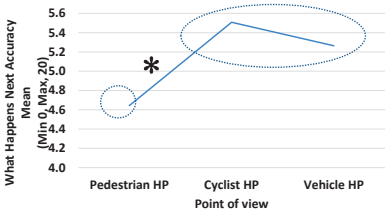

Figure 1. The main effect of the HP Test Type was significant [$F(2,170)=16.354$, $p<0.001$].

Traffic User Hazard Prediction (HP)

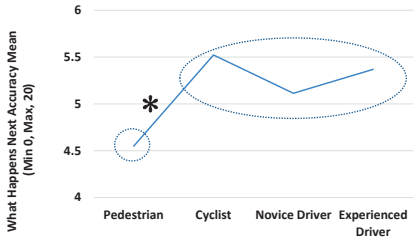

Figure 2. The main effect of the Traffic User's HP was significant t[$F(3,85)=3.655$, $p=0.016$]

PRACTICE + TRAINING & Feedback

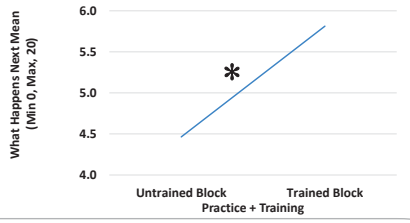

Figure 3. The main effect of the training/practice was significant [$F(1,85)=56,303$, $p<0.001$].

HAZARDOUSNESS RATINGS (Risk Estimations)

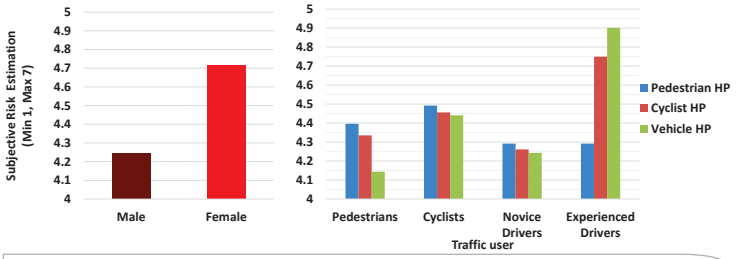

Figure 4 & 5. When analysing the Risk Estimation, the main effect of gender was significant [$F(1.81)=4.807$, $p=0.031$] (left) **& the interaction between the type of HP clip and the traffic user was** significant [$F(6,162)=2.245$, $p=0.042$] (right).

Conclusions

- Holistic training in hazard perception from the perspectives of different road users improves HP Performance.
- Vehicle drivers and cyclists show a higher HP performance.
- The Modal bias is only found in the risk estimations of Experienced drivers' Hazardousness Ratings. They believe that the hazards recorded from the pedestrian's perspective are the least hazardous.
- In addition, Experienced drivers' ratings of the hazards recorded from the cyclist's and the vehicle driver's perspective are the highest.
- In addition, male estimations show the lowest hazardousness ratings.

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- DOI:10.1016/j.aap.2016.02.013 ISSN:0001-4575 Q1
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hfes europe chapter HFES

Improving Safety by Designing Background Characteristics of Medication Labels

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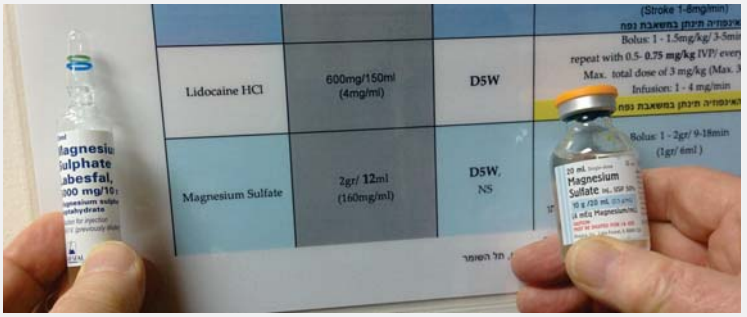
[2] University of Toronto

Yuval Bitan[1,2], Abed El Hamid[1], Greg Fukakusa[2], Paul Milgram[2]

The Need

- Medication administration is an important part of clinical treatment
- In most healthcare organizations the task of selecting and verifying the medication is a manual interaction, prone to errors
- There are no standards to guide medication manufacturers to produce uniformly designed medication labels
- Currently, clinicians identify medications only by their name



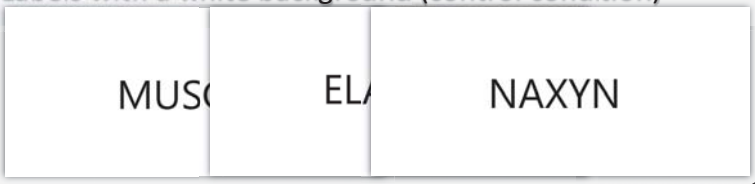
The Goal

To develop a set of visual features that can be added to the background of medication labels, to assist clinicians in identifying specific medications

The Study

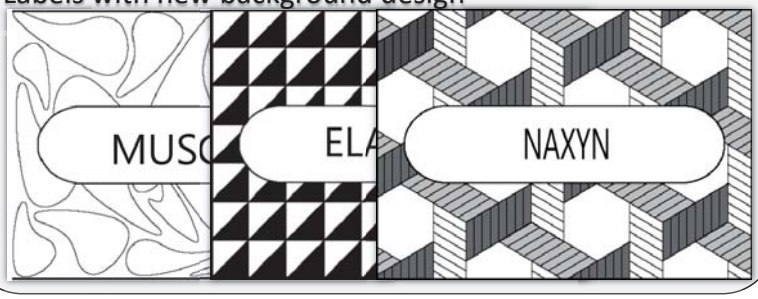
- 21 students from the Ben-Gurion School of Pharmacy
- PC based experiment, using OpenSesame ™
- Compared three types of labels:
  - Labels with a white background (control condition);
  - Existing labels from one of the manufacturers;
  - Labels with new background design

Labels with a white background (control condition)



Existing labels from one of the manufacturers

Labels with new background design



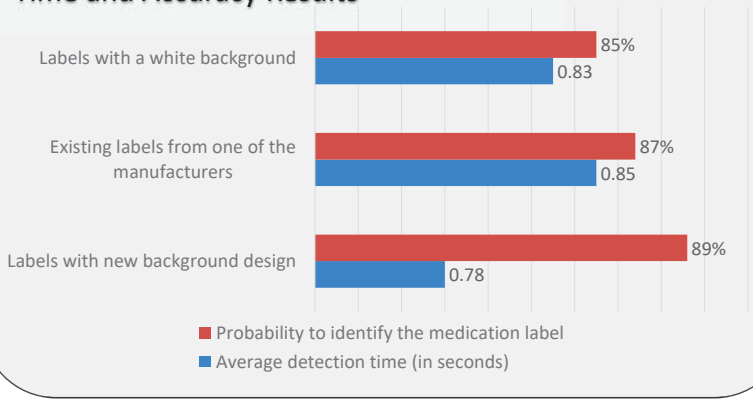
The Procedure

- Each trial consisted of one target label, followed by 6 comparison labels. For each trial, participants' task was to respond Yes or No as to whether each comparison label was identical to target label
- Measured the accuracy and time required to identify each medication label

The Results

- Labels with new background design had shortest detection times ($p<0.001$)
- Labels with new background design had highest frequency of correct detect ($p<0.001$)

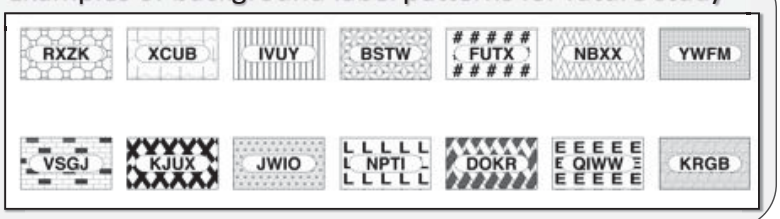
Time and Accuracy Results



The Future

To extend the present work by developing and testing a set of guidelines for designing background patterns that are likely to facilitate rapid and accurate identification of medications

Examples of background label patterns for future study



More Information

http://www.hsi-h.com/safety--resilience.html

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STOP READING, START LOOKING

A PICTORIAL WORKLOAD SCALE FOR THE EVALUATION OF INTERACTIVE PRODUCTS

Baumgartner J., Sonderegger A., Sauer J.

1 BACKGROUND

- Long verbal questionnaires bore people, decrease motivation/answer quality (Galesic & Bosnjak, 2009) and are often difficult for special user groups, e.g. non-native/dyslexic/disabled users; Sonderegger et al., 2016).
- We propose a nonverbal approach for the evaluation of interactive systems, suggesting the ***F-Trinity*** of pictorial questionnaires: ***fun, fast and fascinating***

- Based on verbal scales, we developed pictorial scales for constructs related to user experience, e.g. workload. Comprehension tests showed ambiguous results. Therefore, a keyword approach was applied and tested in a validation study.

2 RESEARCH QUESTION & HYPOTHESES

1. Do pictorial scales correlate higher with verbal scales when using a keyword ?

2. Do pictographic scales are more fun to fill in than verbal scales?

3. Does it require less effort to fill in pictographic scales than verbal scales?

3 METHOD & MATERIAL

SAMPLE/DESIGN

N=60, students *75% female*

18-54 yrs M=24.77, SD=8.18

Usability test, smartphone prototype
2x2 between subjects design

IV1 keyword (yes vs. no)
IV2 system usability (low vs. high)
DV: NASA-TLX, single items for fun with filling in questionnaires

PROCEDURE

1. Interaction with prototype

Low usability vs. High usability

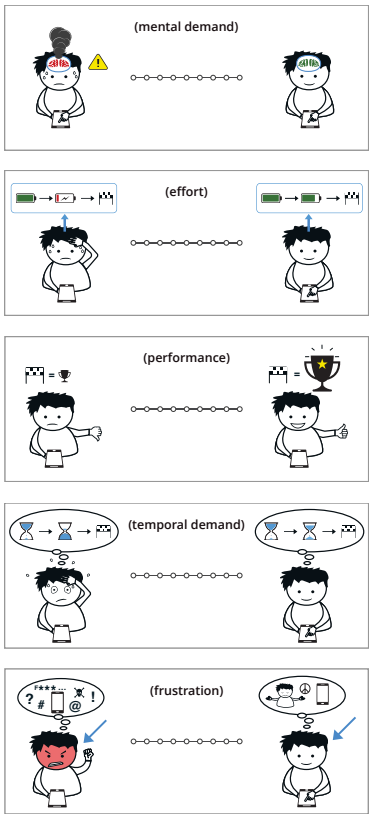
2. Pictorial questionnaire

Keyword vs. No keyword

3. Verbal questionnaire

NASA-TLX (Hart & Staveland, 1988)

PICTORIAL SCALE



VERBAL SCALE (NASA-TLX)

MENTAL DEMAND

How much mental and perceptual activity was required? Was the task easy or demanding, simple or complex?

EFFORT

How hard did you have to work (mentally and physically) to accomplish your level of performance?

PERFORMANCE

How successful were you in performing the task? How satisfied were you with your performance?

TEMPORAL DEMAND

How much time pressure did you feel due to the pace at which the tasks or task elements occurred? Was the pace slow or rapid?

FRUSTRATION

How irritated, stressed, and annoyed versus content, relaxed, and complacent did you feel during the task

4 RESULTS

CONV. VALIDITY

	verbal: Mental demand	Effort	Performance	Temporal demand	Frustration
pictorial: keyword	.509**	.538**	.611*	.375*	.917***
pictorial	.448*	.211	.503**	.516**	.805**

FUN

Higher rating for the pictorial representation *M=3.62, SD=1.15*
than for the verbal one
M=3.00, SD=1.02
t (59) = 3.595, p = .001, r = 0.42

EFFORT

Similar rating between pictorial *M=2.67, SD=1.28*
and verbal representation
M=2.70, SD=1.13
t (59) = 0.141, p = .888, r = 0.02

5 DISCUSSION

1. **Adding a keyword to a pictorial item results in higher correlations with the verbal item for most of the cases, thus leading to less ambiguity.**
2. **Filling in pictorial questionnaires is perceived more fun than filling verbal ones.**
3. **There is no difference for effort between pictorial and verbal questionnaires.**

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FIAT CHRYSLER AUTOMOBILES

Acceptability beyond usability: a manufacturing case study

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ABSTRACT

This study is part of an innovation project carried on ErgoLab, the ergonomic laboratory of FCA in Turin, to evaluate the use of a passive exoskeleton for upper limbs in automotive manufacturing tasks. The introduction of new technologies into a production environment is not always effective, because operators do often not use them. For this reason it is important that future users accept the innovation.

With the aim to evaluate Usability and Acceptance, the testing protocol included different data gathering techniques: observation during simulated working tasks, interviews, TAM2 questionnaire to analyse acceptance, and finally a focus group.

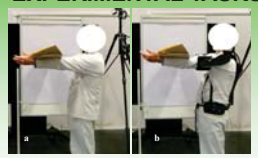
Levitate technology: (a) structure of the exoskeleton, (b) workspace of the exoskeleton. (Images available at: http://www.levitatetech.com; accessed 02/03/2017).

Overall results showed that operators judge positively the exoskeleton because of evidence in carrying on activities with less physical effort. The device is perceived useful especially in tasks where precision is required. The evaluation showed a good interaction human-device, but the operators involved in the tests consider the work-device interaction a critical point. More in deep, workers refer perceived ease of use, voluntariness and results demonstrability but low intention to use and perceived usefulness.

LABORATORY TASKS

Goals: evaluate efficiency end effectiveness (task duration, quality, force applied)
Technique: Borg scale, time count, observation, interviews

EXPERIMENTAL TASKS



Static posture task:
(a) without exoskeleton
(b) with exoskeleton

Repeated manual material handling task:
(a) without exoskeleton
(b) with exoskeleton

Precision task:
(a) without exoskeleton
(b) with exoskeleton

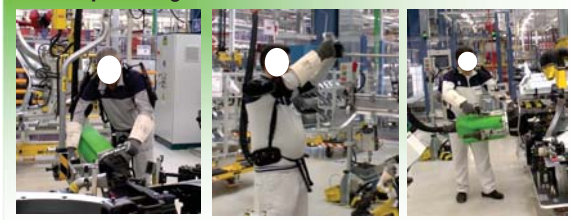
SIMILARLY TRUE TASKS

sealing under scooter task:
(a) without exoskeleton
(b) with exoskeleton

mounting gasket task:
(a) without exoskeleton
(b) with exoskeleton

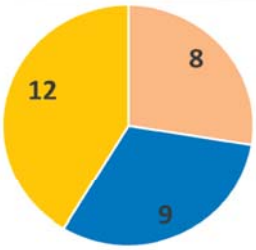
ASSEMBLY LINE TASKS

Goals: evaluate efficiency end effectiveness in real context
Technique: Borg scale, time count, observation, interviews



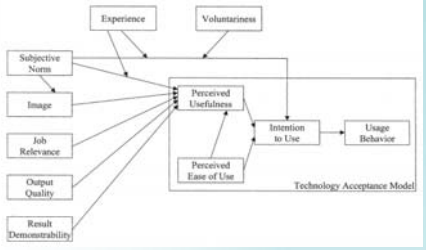
fastening with clamps

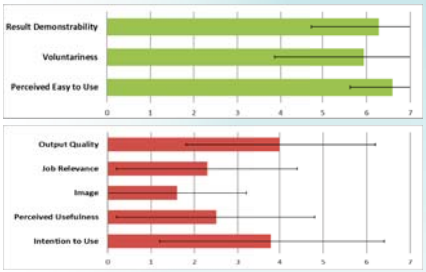
SAMPLE



- Presses preparation operators
- Mold repairer, fitter and maintainer
- Plant, process and tools conductors

TAM
TECHNOLOGY ACCEPTANCE MODEL





A seven-point Likert scale questionnaire
Average and Standard Deviation

TAM2 (Venkatesh&Davis,2 000) is an extended version of TAM, used to analyze the technology acceptance considering perceived ease of use and perceive usefulness. Furthermore, as mentioned by authors, it's important to take into account that others aspects can influence device acceptance like: subjective characteristics, voluntariness, experience and social norms.

TAM2 results showed that workers assigned high values (> 4) in items that referred to perceived ease of use, voluntariness and result demonstrability and low values (< 4) in items connected with intention to use, perceived usefulness, imagine, job relevance and output quality.

USABILITY QUESTIONNAIRE

The usability assessment was based on workers agreement with sentences, choosing a value on Likert scale from 1 (*I completely not agree*) to 7 (*I completely agree*).

In usability metrics questionnaire the positive characteristics had high score (> 4) that mean a good interaction human-device, but, in the other hands, they considered critics the work-device interaction.

FOCUS GROUP

A focus group was created to obtain qualitative data. The moderator conducted the session and involved the workers to discuss on the use of exoskeleton, focusing on positive and negative aspects, relating to their work context and trying to define the optimal wished characteristics of the device. Results showed that workers judge positively the exoskeleton because it was evident the helps them to carry on activities with less physical and mental effort. The device was, in particular, perceived as useful in precision tasks.

Finally: operators affirm that exoskeleton is useful to carry on some specific activities, but the use has to be voluntary.

COLD LEGS DO NOT MATTER

INVESTIGATING THE EFFECT OF LEG COOLING TO OVERCOME PASSIVE FATIGUE

E. Schmidt[1,2], A. Dettmann[2], R. Decke[1], A. C. Bullinger[2]

Motivation

Simulator studies investigating facial cooling (Schmidt et al., 2017) and hand cooling (van Veen, 2016) showed that those treatments invoked physiological arousal, which indicates sympathetic activation. This in turn reduced perceived fatigue and improved driving performance on simulated monotonous highways. Although, facial and hand cooling showed awakening effects, it had a negative impact on driver's comfort ratings. According to a laboratory study on leg cooling in a cold water bath by Janský et al. (2003), the treatment yielded an activation of the sympathetic nervous system. Inspired by water treading and its reported physiological effects, an investigation of leg cooling as a countermeasure against driver fatigue is worthwhile.

Research questions

- Which effect does 4-minute leg cooling have on subjective fatigue?
- Which reaction does leg cooling cause in skin conductance?
- Which reaction does leg cooling cause in pupil diameter?

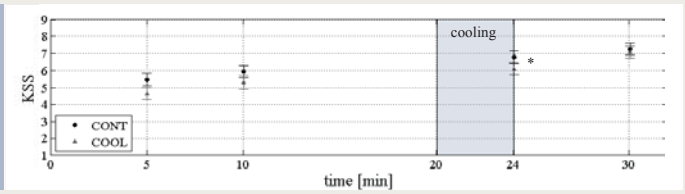
Method

- Simulator study with a between-subject design with 2 groups (21 participants each).
- Control group (CONT): 24°C for the entire drive.
- Cooling group (COOL): climate change from 24°C to 15°C between minute 20 and 24.
- Participants wore pants and T-Shirts and avoided caffeinated beverages before the study.
- Recordings of eye tracking, skin conductance, ECG and driving data.
- Questionnaires on subjective fatigue (KSS, Karolinska sleepiness scale) and thermal comfort (Bedford scale).

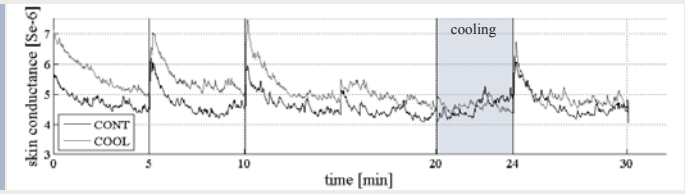
Results

- No significant differences between groups in terms of sleep duration in the night before the study and in initial KSS ratings.
- Increasing heart rate variability, eye closures and KSS ratings as well as decreasing skin conductance and pupil diameter indicate that participants developed fatigue over the course of the monotonous drive.
- Minute wise comparisons between the conditions were performed on continuously recorded data.
- In none of the 4 cooling minutes, the physiological measures of the COOL group are different to the measures of the CONT group.
- Driving performance was not affected by the treatment.
- Verbal assessment of fatigue after 5, 10 and 24 minutes of driving significantly increased pupil diameter and skin conductance.

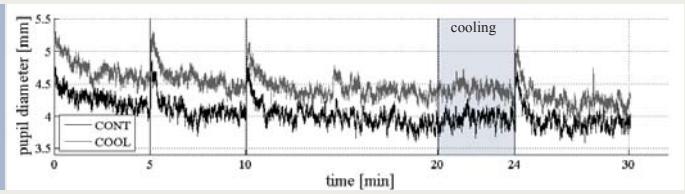
Subjective fatigue is **significantly reduced** directly after the stimulus.



Skin conductance level is **not affected** by the thermal stimulus.



Pupil diameters were **not affected** by the thermal stimulus.



Conclusion

Even though the participants perceived reduced fatigue, the physiological indicators do not align with this perception. Since skin conductance and pupil diameter were not affected by the stimulus, a sympathetic nervous system activation is ruled out. The lower KSS ratings by the participants may be due to a Placebo effect. Therefore, leg cooling at 15°C for a period of 4 minutes is not suited as a countermeasure against passive fatigue. It is also interesting to see that the verbal assessment of fatigue caused more sympathetic activation than the cooling. Future research should address colder temperatures, because those may yield a fatigue mitigating effect, as the laboratory study of Janský et al. (2003) has shown.

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Rolls-Royce Motor Cars Limited

Augmented indication of lane change intention - Creating an assistive HMI using design thinking

Adrian Haar[a,b,*], Frederik Schewe[a], Andro Kleen[a], Martin Schmettow[b], Willem Verwey[b]

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INTRODUCTION

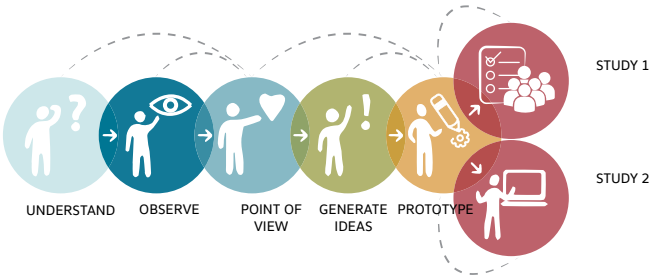
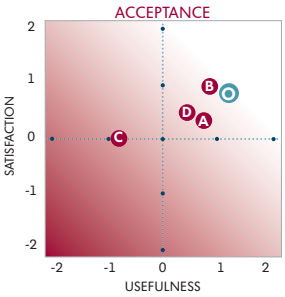


Figure 1 - The design thinking process used in our study inspired by Calrk & Smith (2008)

- Traffic becomes denser, space is limited and drivers interact more frequently. This raises the need for cooperation to ensure smooth traffic flow. The application of modern head-up displays (HUD) offers an ideal possibility to support cooperative interactions.
- Nowadays, information transmitted between drivers is often limited by the binary nature (on or off) of turn indicators.
- Therefore, the opportunity to provide additional information about upcoming lane change maneuvers of other cars in the drivers HUD was evaluated.
- The design process of this novel HMI was inspired by the well-known design thinking process illustrated in Figure 1.

METHOD

- Following the design thinking process, at first, four different design variations were developed by understanding, observing, defining and brainstorming.
- Using a low fidelity simulation, these designs were then prototyped and evaluated with naive participants (n=8).
- A combination of thinking aloud, interview, user sketches and questionnaires was used.
- Figure 2 summarizes the ratings of the participants on the van der Laan-scale (Van Der Laan, Heino, & De Waard, 1997). The O in Figure 2 illustrates the rating of a fictive own concept that the participants were asked to sketch.



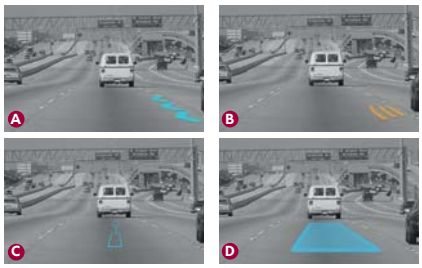


Figure 2 - Results and designs used in first iteration.

RESULTS

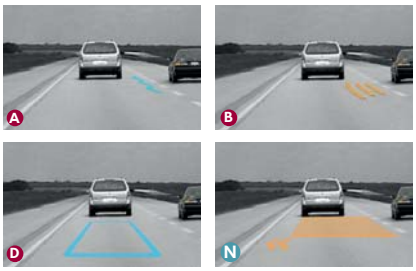
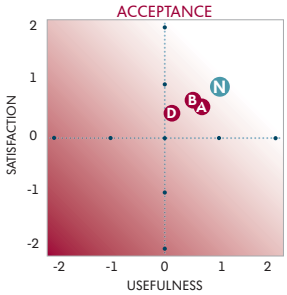


Figure 3 - Results and designs used in second iteration.



- Using the results of the first iteration distinct design features of an HMI supporting the perception of others intention were developed. Based on that knowledge an optimized design was created.
- In a validation study with additional naive participants (n=8), this optimized design was than tested and compared to the previous design alternatives.
- The ratings regarding usefulness and satisfaction showed substantial improvements achieved by the optimized design (Figure 3).
- The optimized design was also described as more elaborate and convenient.

DISCUSSION

- The results of both study iterations, show a high overlap regarding the design alternatives which indicates that a high validity could be reached.
- The qualitative nature and the low sample size of this approach do not allow for further generalization.
- However the goal of this approach was to develop a design that is easily understandable and is based on the actual user needs and not merely on the intuition of the designer.
- Achieving these results within a short period of time (two weeks in total) proved the value of design thinking and rapid prototyping during the HMI development process.

Design thinking and rapid prototyping proved to be valuable in the HMI design process and can be utilized to generate user centered insights at an early stage.

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DRIVER BEHAVIOUR AT SLEEPY STATE – CAR FOLLOWING TASK

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ČESKÉ VYSOKÉ UČENÍ TECHNICKÉ V PRAZE

INTRODUCTION AND BASIC IDEAS

Decrease of vigilance due to drowsiness affects driver behavior and results in:

- Delay in response/reaction
- Problems with vehicle control (lateral and longitudinal)
- Traffic accidents

Vulnerable driver population:

- young, novice drivers,
- senior drivers,
- shift workers, overtime workers.

MEASUREMENT METHOD

Testing cohort

- 12 subjects, all male
- two age groups

(***young/novice*** drivers – n=8, s=3.6, s^2=12.98, sd= 3.37, sd^2=11.36, mean = 23.87;

elder/experienced – n=4, s=13.96, s^2=194.6, sd=12.09, sd^2=146.19, mean=49.75)

Experiment setting

Testbed: light half-cockpit steady based simulator – personal car Skoda Octavia II

Figure 1: Simulator Skoda Octavia – inside view

Scenario:

- highway with minimum road curvature and with light/no traffic
- sleep-provoking, tedious landscape
- leading vehicle with speed-change cycles

Figure 2: Screenshot from driving scenario

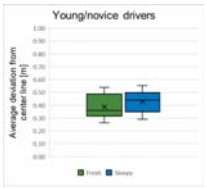
Measurement conditions:

Each subject is measured in two states – **rested** (normal night sleep) and after **limitation of sleep** in last 24 hours.

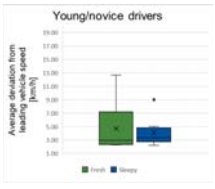
MEASUREMENT RESULTS

Vehicle control

Lane position

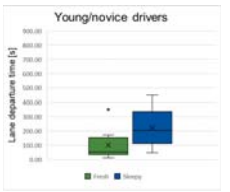


Deviation of speed

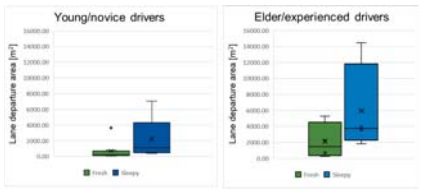


Lateral position

Lane departure time

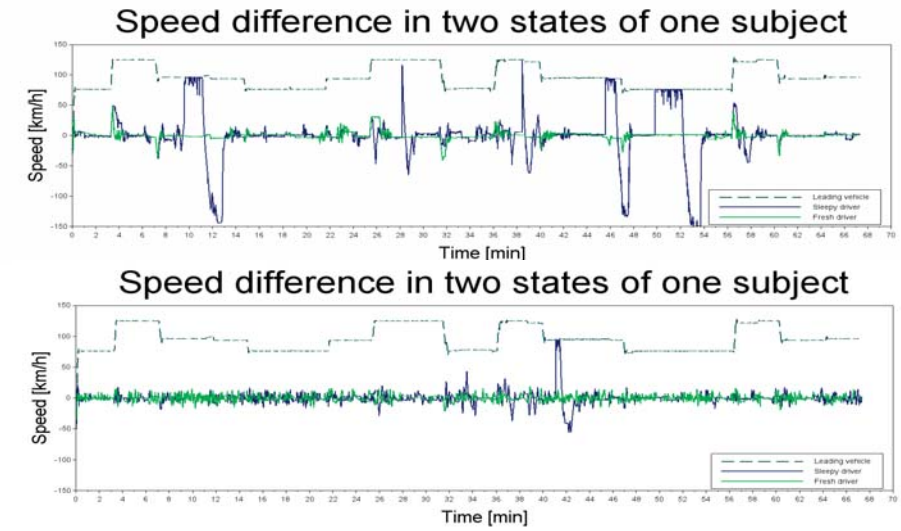


Lane departure area



EXAMPLES

upper – experienced driver, bottom – novice



EVALUATION METHOD

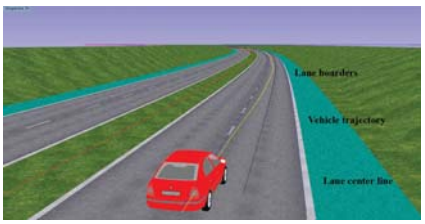


Figure 3: Basic curves from scenario used for analyses

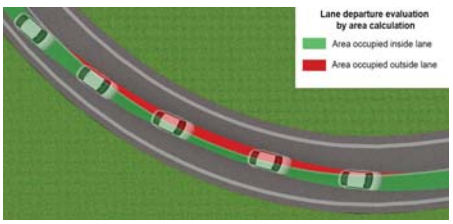


Figure 3: Calculation of area per vehiicle position

CONCLUSIONS AND SOME OTHER FINDINGS

Increase in lane departure time and area is a characteristic measure for all categories of subjects.

Change in speed variation differs between groups:

- Increase in speed variation in experienced subgroup is explained by higher headway gaps
- Decrease of speed variation in novice subgroup was caused by keeping dangerous (short) headways.

Each age group included: 1 shift worker, 1 long-distance driver

and a driver with experience of accident due their falling asleep at wheel.

50% of all subjects admitted they are not sleeping enough,

17 subjects were invited for experiment, 5 couldn't participate in measurement because of simulator sickness

Using Paper, E-ink device or Desktop-PC for office work and subjective strain - a comparative study

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Background

- A new generation of large mobile devices enable digital uses similar to paper. Unlike studies concerning the use of tablet-pcs, so far, it is unclear to what extent e-ink devices are more like paper or computers in respect of resulting strain.
- It was reported that people use paper, as it is easier to navigate through multiple pages [1]. Handwritten commentaries are usually inserted easier and faster than their digital counterparts [2]. So people often get frustrated and distracted when using digital formats for these tasks [1].
- Reading from computer monitors was found [3] to be significantly slower compared to paper. Other performance parameters like reading comprehension, or textual productivity differed between studies.
- On the other hand, people often prefer digital over analogue documentation [1]. And reducing information loss due to media breaks is an appreciated goal in most workplaces.
- The aim of this study was a comparison between an e-ink device, a conventional desktop-pc and common paper for a reading and a correction task.

Method

Tasks
- "proofreading" 40 lines of pseudo words
- reading double-sided texts with multiple choice questions

Material
- large-size e-ink device (DPTS1 Sony, US-letter format)
- Desktop-PC (22"-LCD-Monitor)
- paper hardcopy

Data
- subjective strain (NASA-TLX [5], scale 1= low, 21= high)
- Performance parameters (lines edited, errors, reading time)
- Media preference: for 5 different tasks

Participants
- 36 Participants (15 man, 21 women), within- design
- Age: Ø 37 years (min: 20, max: 62 years)
- Technical affinity Ø 3.5 (SD= 0,59) (TA-EG [4], scale 1= low to 5= high)

Literature

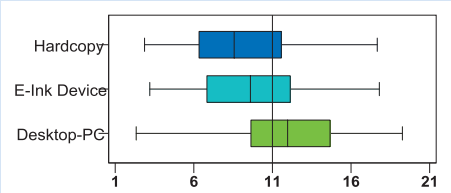
[1] Sellen AJ, Harper RHR (2002). The myth of the paperless office. MIT press.
[2] Schneider SC (2014). Paperless Grading of Handwritten Homework: Electronic Process and Assessment. Proceedings of the ASEE North Midwest Section Conference, October 16-17, 2014, Iowa City, IA, 3B2.
[3] Noyes JM, Garland KJ (2008). Computer- vs. paper-based tasks: Are they equivalent? Ergonomics 51.9, 1352-1375.
[4] Karrer K, Glaser C, Clemens C, Bruder C (2009). Technikaffinität erfassen – der Fragebogen TA-EG.
[5] Hart SG, Staveland LE (1988). Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research. In: PA Hancock & N Meshkati (Eds.), Human mental workload. Amsterdam: North-Holland, 139–183.

Results and Discussion

Subjective strain:

- Overall the strain for the tasks were of medium intensity with a significant difference between conditions ($F(2, 70) = 14.92$, $p < .001$, $\eta 2 = .30$). Compared to the desktop condition (Ø: 11.43 SD: 4.14) subjective strain for paper handling (Ø: 8.74 SD: 3.60) and the e-ink device (Ø: 9.55 SD: 3.67) was significantly lower.

➢ *So a digital paper variant may help to optimize strain for similar tasks especially if executed over a longer period of time.*



Overall subjective strain ratings (NASA-TLX) for both tasks combined

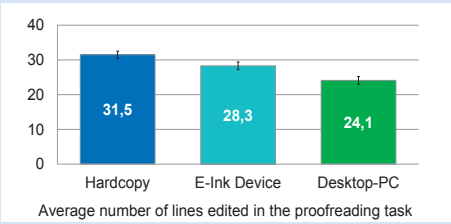
Performance parameters:

- Divergent from data reported in [3] no difference for reading velocity was found between the media ($F(2, 70) = 1.68$, $p = .194$, $\eta^2 = .05$).

➢ *Reasons may be a greater display size and quality compared to [3] or a higher familiarity for reading from a computer display, probably both.*

- Proofreading showed an effect of media used for lines edited ($F(2, 70) = 42.73$ $p < .001$, $\eta^2 = .55$). Lines progressed from desktop-pc (Ø: 24.11 SD: 6.62) via e-ink device (Ø: 28.31 SD: 6.76) to hardcopy (Ø: 31.50 SD: 6.09). No differences for errors were found ($F(2, 70) = 0.15$, $p = .859$, $\eta^2 < .01$).

➢ *Tagging the pseudo words on the desktop-pc using a mouse caused a divide between hand and text. For both paper variants participants were able view text and hand/pen together, which could have caused the higher speed.*



Average number of lines edited in the proofreading task

- The participants had indicated a high preference for paper prior to the experiment, especially for reading (first choice paper 90%) and correcting (71%). After using all three media 17% of the participants would have swapped the paper for the e-ink device for the reading task, and 14% for correcting.

➢ *Even though this was not a high change in paper preference, it seems a noticeable amount for the short device use time.*

Conclusion

- Paper like digital devices combine the memory capacity and potential for organizing material with the paper like handling and subjective strain.
- User acceptance for the tested e-ink device was good and independent of age, gender or technical affinity.
- The results indicate that paper like digital devices like an e-ink device can be an alternative or a useful addition to using paper in the (mobile) workplace.

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UR:BAN

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Ingenieur- und Verkehrspsychologie

Practice makes perfect

Driving experience with a multi stage warning system

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Motivation

- Driver assistance can increase traffic safety
- As safety-critical situations can be diverse, integrated adaptive warnings (like a **multi stage collision warning**) need to be developed and examined in a variety of situations over time

Research questions

1) How much can drivers benefit from such a system over time (**learning**)?
2) Can drivers **transfer** learned knowledge to new situations?
3) How is the warning system **accepted** by drivers before and after experiencing it?

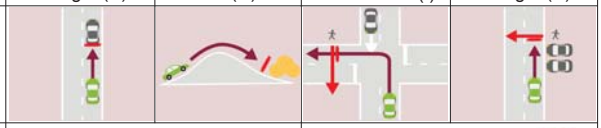
Method

Multi stage collision warning in head-up display (HUD)

- Adaptive to situation criticality & driver reaction

Warning stage	Aim	Timing	Visual	Acoustic
W1) Warning	Moderate decelerating	2 s ≤ x < 8 s	⚠	-
W2) Urgent warning	Emergency braking	x < 2 s	STOP	1 kHz "Beep"

4 urban scenarios of varying criticality

Hazard	Lead vehicle (L)	Obstacle (O)	Pedestrian (P)	
Location	Straight (S)	Hill (H)	Intersection (I)	Straight (S)
Picture				
Warning stage	W1) Warning ⚠		W2) Urgent warning STOP	

4 trials (T) each of one less & one rather critical scenario

- Repetition: T1 without, T2+T3 with assistance (learning)
- New scenarios: T4 with assistance (transfer)

Driving simulator experiment (fixed-base)

- Brake reaction time, subjective ratings measured
- *N* = 24 drivers (*M* = 27 years, *SD* = 8 years)

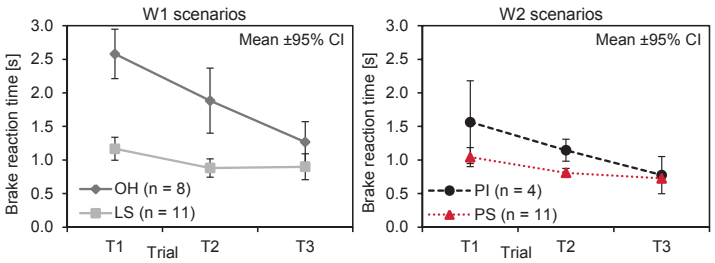
Results

Manipulation check (15-point rating scale; Heller, 1982)

- Scenarios differ significantly in situation criticality:
  → W1 scenarios: M_{all} = 7 (*"moderate"*), 95% CI (6.1, 7.9)
  → W2 scenarios: M_{all} = 14 (*"very high"*), 95% CI (13.5, 14.5)

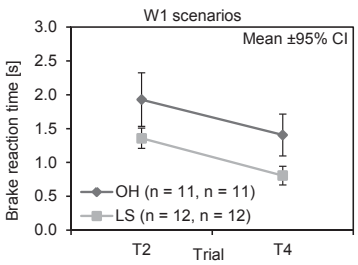
Learning effect (T1-T3)

- Significant interaction & main effects of within-subjects factor *trial* & between-subjects factor *scenario* for W1 & W2 scenarios (significant post-hoc tests in all trial comparisons)



Transfer effect (T2 & T4)

- Significant main effects of between-subjects factors *trial* & *scenario* for W1 scenarios
- Initial brake reaction time in T2 in W2 scenarios already low



System acceptance (Van der Laan, Heino, & De Waard, 1997)

- Positive system acceptance rating on a scale from -2 to +2:
  → *Usefulness*: M_{all} = 1.1, 95% CI (0.9, 1.3)
  → *Satisfaction*: M_{all} = 0.7 , 95% CI (0.5, 0.9)
- No significant differences before & after system experience

Conclusion

- Multi stage collision warning system is
  → Beneficial in various critical situations
  → Well accepted
- Drivers learn to brake faster over repeated trials
  → Reduced accident severity
- Positive transfer of assistance experience to new situations is possible
- Practice with assistance is recommended to maximize its benefits

Heller, O. (1982). Theorie und Praxis des Verfahrens der Kategorienunterteilung (KU). In O. Heller (Ed.), *Forschungsbericht 1981* (pp. 1-15). Würzburg, Germany: Psychologisches Institut der Universität Würzburg.
Van der Laan, J. D., Heino, A., & De Waard, D. (1997). A simple procedure for the assessment of acceptance of advanced transport telematics. *Transportation Research Part C: Emerging Technologies, 5,* 1-10.

MOTION SICKNESS IN CARS: INFLUENCING HUMAN FACTORS AS AN OUTLOOK TOWARDS HIGHLY AUTOMATED DRIVING

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Presented at HFES Europe Chapter 2017 Rome, September 28-30

Motivation

The individual susceptibility for motion sickness in cars varies broadly. Human factors which influence motion sickness have to be understood to improve comfort for highly automated driving scenarios.
The Motion Sickness Susceptibility Questionnaire Short-form (MSSQ-Short) has shown to present a good self-evaluation. Additionally age, gender and personality traits have been discussed and their connection to motion sickness is still a research topic.
To analyse those items and answer the question on how individuals experience motion sickness by discrete symptoms an online survey was applied.
It was the goal to achieve items of pre-categorisation and common coping strategies for further testing and development of countermeasures.

Method

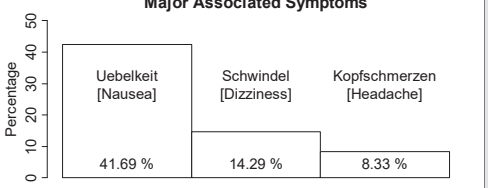
The online survey had the following content: experience with motion sickness in cars and in general (MSSQ-Short by Golding, 2006), associated situations (free text), activities in cars (free text), coping strategies (free text), personality traits (BFI-10 by Rammstedt & John, 2007), demographic facts.

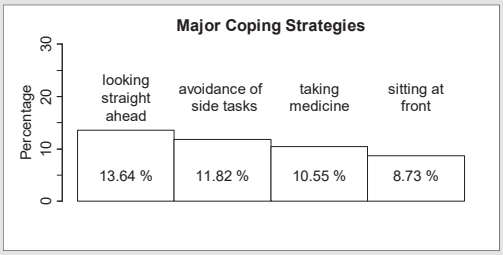
408 Participants completed the survey (M_{age} = 35.24; SD = 12.67).

The respondents had a strong bias towards female gender (n_{male} = 121 (29.66%); n_{female} = 287(70.34%)).

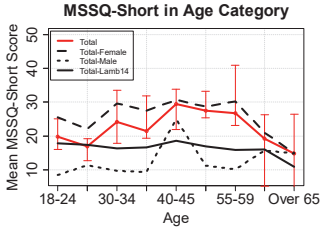
Results

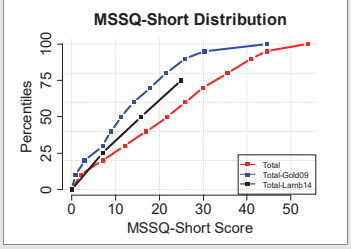
SYMPTOMS + COPING STRATEGIES

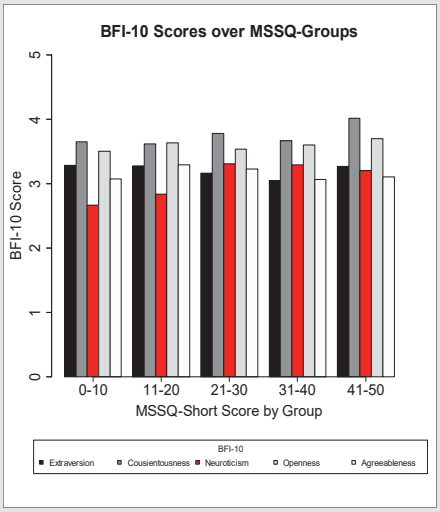




MOTION SICKNESS SUSCEPTIBILITY + PERSONALITY







Conclusion

- **Three terms confirmed known symptoms** and their order of importance
- The occurring symptoms for cars were identical to other motion environments (e.g. ships, simulators) (Neukum et al., 2006)
- Possible use cases during highly automated driving were in contradiction to coping strategies
- The solution of **taking medicine is highly critical** for scenarios when a person's role changes between passenger and driver

- **It is confirmed that women report higher MSSQ-short score than men ($p < .001$)**
- The large difference in the sample between genders in the response to the survey indicates this influence
- **A positive coefficient between Age and MSSQ-short score ($p=.033$) was found**
- Compared to the susceptibility in general public with low self selection effects stated by Lamb et al. (2014) a **large increase of MSSQ-short score is found** in ages between 35 and 59
- A comparison to Golding (2006) and Lamb et al. (2014) showed that a higher group of susceptibility dominates this data

- **Neuroticism correlated positive to MSSQ-short score ($p < .01$)**
- This supports the findings by Wilding et al. (1972), where as Nieto et al. (2006) did not find an effect with a more general public like group (lower Mean MSSQ-short score)
- **Neuroticism again correlated to MSSQ-short score for an over average susceptibility group**

Outlook

- **For testing with German speaking subjects symptom rating can be done with "Uebelkeit, Schwindel, Kopfschmerzen"**

- **Coping strategies seem to contradict the advantage of highly automated cars which increases the importance of countermeasure research**

- **MSSQ-short score, age and gender will be used for the selection of more critical subjects for validation of symptom occurrence in real car driving tests**

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