

Workshop “Subliminal Perception in Cars”

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ABSTRACT

Following laws and provisions passed on the national and international level, the most relevant goal of future vehicular interfaces is to increase road safety. To alleviate the cognitive load associated with the interaction with the variety of emerging information and assistance systems in the car (and to increase driving performance as well), subliminal persuasion is assumed to be a promising technique to reduce the amount of information the driver must store and recall. Subliminal cues could be provided across appropriate sensory modalities, according to the specific nature of the current task, and corresponding to drivers' cognitive abilities.

The central objective of this workshop is to provoke a lively debate on the adequacy of information provided below active awareness and to discuss how to resolve potential problems in this highly risky research field. This approach exhibits exciting challenges, which can – once fully understood – impact on society at large, making significant contributions toward a more natural, convenient, and even relaxing future style of driving. Therefore, and to further strengthen significance of results, the workshop is directed at researchers from a range of disciplines, such as engineering, neuroscience, computer science, and psychophysiology.

1. COGNITIVE LOAD AND DRIVING

The application of subliminal techniques to improve driver-vehicle interaction is a timely, relevant topic to be discussed, underpinned by the facts that cognitive abilities of the driver as well as its attention are limited resources [4], and even more as vehicle operation requires an ever increasing level of attention. Reasons include (i) the emergence of new driver information and assistance systems, (ii) more and more cars on the road, (iii) rising number of traffic signs, and (iv) penetration of car-to-car communication. This divergence demands for new ways and means of communication to prevent information overload and a stipulated, overburdened cognitive channel in future. This request is even more tightening as novel, recently emerged interfaces employing multimodality or using implicit interaction also hit their limits. This is supported by studies having verified that vehicle accidents today are more than 90% caused by driver error [5]. The accidents reported does not only have its origin in driving errors such as tailgating, suddenly changing lanes,

or overestimating driving skills [6, p. 59f.], but also have its seeds in cognitive overload, e.g., when task difficulty exceeded resources available by the driver or from reduced situation awareness in times driving at high workload levels. For cognitive overload it has been proven that the driving performance declines, finally resulting in higher safety risks [4]. Unfortunately, major difficulties in its detection (and avoidance) are the facts that (i) the capacity available by a driver is not constant while driving [2] and (ii) that it is almost impossible to determine the exact point where cognitive overload starts to occur. Reasons for the latter issue are that the driver tends to alter his/her task management, e.g., by decreasing the speed when engaged in side activities [10, p. 338], or by excluding or omitting certain elements.

This short review makes it clear that approaches involving drivers' cognitive resources are needed to ensure safe vehicle operation in future. In case of supported functionality, subliminal persuasion carries great potential to reduce cognitive load, stress or incorrect decisions. This assumption is based on the result of cognitive and social psychologists, who have learnt that stimuli presented subliminally can have a considerable influence over a variety of cognitive processes, possibly even behavior. The main idea is to “inject” information into a driver's mind below active awareness, thus transferring supplementary information in a subliminal style without adding load on the cognitive channel. The main benefit of this approach would be the reception of additional, essential information even in the case where almost no capacity is left for information transmission in a traditional way. It is anticipated that, for example events of sudden danger, could be avoided using this technique.

Potential of Subliminal Perception

The notion that stimuli presented below conscious awareness could influence cognition is not new – Peirce and Jastrow [7] were the first reported in 1884 that people could perceive small differences in pressure to the skin without conscious awareness of different sensations. Moreover, it is well known that certain subliminal cues can facilitate certain behaviors. For example, store chains sprays fragrances with a subtle influence outside their stores to attract customers, background music in shopping malls is said to increase sales by subliminally stimulating shoppers, and millions of people buy subliminal audiotapes to help them lose weight or increase their assertiveness.

Quite recently, there have been some attempts made to extend current user interfaces by means of subliminal com-

munication, with examples being adaptive user interfaces, subliminal teaching techniques, or neurofeedback systems to enhance well-being. Subliminal techniques have also been used in driver state analysis systems or in road layout optimization based on driver behavior [9]. We propose to employ subliminal techniques as an encouraging approach to provide the driver with (noncritical) driving related information without dissipating available attention resources.

2. OBJECTIVES OF THE WORKSHOP

In this workshop, we will pick up on all the previously discussed ideas and put them into an automotive context. The central objective of this workshop is to **provoke a lively debate on the adequacy of information provided below active awareness and to discuss how to resolve potential problems** in this highly risky research field.

This discussion is long overdue, confirmed e.g. by [8, p. 339] who noted that “*researchers have failed to produce reliable subliminal effects for at least three reasons*”: (i) inconsistent use of the term “subliminal”, (ii) lack of adequately precise, standardized methods, and (iii) lack of an adequate conception of subliminal processes. And in addition “[...] *as a consequence of these problems, it has not yet been possible to describe, with confidence, conditions under which subliminal effects are likely to occur*”.

Subliminal information processing raises elementary questions including

- “How good is the mind at extracting meaning from stimuli of which one is not consciously aware?” [3],
- “How to measure the positive effect of subliminal information cues?”, or
- “How something presented subliminally would persuade a driver if he/she did not consciously attend to it?” (as it is generally accepted that such stimuli are weak and often presented at very low intensity [1]).

To answer these questions we would like to invite researchers to take part in an in-depth, interdisciplinary discussion of this timely, relevant, and important field of investigation.

We assume that a broader knowledge of subliminal perception and persuasion would have much potential in improving driver-vehicle interaction. It has to be pointed out once more that this is high risk research and it cannot be taken for granted at all that answers can be found to the stated research questions. The fact that subliminal information poses high danger for driver, passengers, and other road participants (if used in real traffic and for driving related information) has to be emphasized when defining/conducting experiments in the wild. But on the other side, as nonhazardous information does not require active attention of the driver and hopefully does not compromise safety risk, this kind of information could be transmitted subliminally.

Topics of Interest

The workshop will address the following issues:

- Taxonomy of the terms: implicit, subliminal, supraliminal, priming, conscious, preconscious.
- Philosophy or rationale for the use of subliminal interfaces.
- How to reduce “risk” in subliminal interfaces?

- Socio technical issues, e.g., social acceptance and/or aversion/repulsion about this type of technology?
- Is the perceived information difficult to interpret?
- Is there an influence on individual differences such as age, gender, intelligence, characteristics, abilities and disabilities, cognitive style, cultural differences, etc.?
- Evaluation techniques for the perception of subliminal information
- Is an impact of subliminally delivered information discoverable on the cognitive load or perceived workload (e.g., using NASA TLX)?
- What are appropriate subliminal techniques for workload reduction while driving?
- Subliminal interfaces for the automotive domain (head-up displays, vibro-tactile transducers, olfactory stimulation, brain-computer interfaces (BCI))
- What are characteristics of subliminally delivered information (e.g., reachable bandwidth, natural bounds, complexity of information, speed of perception, appropriate modalities, strength/duration/frequency)?
- Potential of subliminal cues to guide a driver to the right course of action or to a specific emotional state?

3. REFERENCES

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