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ASAM: an Emotion Sampling Method for the Automotive Industry

Michael Braun
BMW Group
Garching, Germany
michael.braun@ifi.lmu.de

Karina Serres
LMU Munich
Munich, Germany
k.serres@campus.lmu.de

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Abstract
We present a software tool to assess driver emotions during the ride. This tool can be used to repeatedly query the driver's current emotional state, based on a two-dimensional emotion model (arousal/valence). While established questionnaires offer the same functionality, we optimized the application for usage while operating a vehicle, giving special focus on keeping induced driver workload at a minimum.

Author Keywords
Automotive User Interfaces; Affective Computing; Emotion Sampling

CCS Concepts
•Human-centered computing → HCI design and evaluation methods;

Introduction
Automotive user interfaces are steadily becoming more and more user centered. Improvements in sensor technology and machine learning enable computer systems, and with them also cars, to sense their occupants' emotional states. Consecutively, automotive interface designers are starting to incorporate the driver's emotion in their concepts to improve safety and comfort [4]. We contribute to this field of affective computing in the car with a methodology to assess driver emotions through self-reporting.

Circumplex Emotion Model

The fundament of an affective system is its understanding of human emotions. In order to grasp the concept systematically, various emotion models have been published. One of the most versatile models was introduced by Russel in 1977: they describe a circumplex model of emotions on scales of pleasure-displeasure, degree of arousal, and dominance-submissiveness [6]. This model has been used and slightly modified in the years since, resulting in either additional dimensions such as novelty, or restriction to less dimensions for the sake of simplicity (arousal/valence).

Present approaches

Existing questionnaires on user experience, e.g. *meCue* already include general user emotions [5], further approaches reference Russel's circumplex model, notably the *Self-Assessment Mannikin* (SAM). The SAM consists of three scales for valence, arousal, and dominance and according illustrations for easier understanding [2]. As it was introduced in 1980, a need for a more modern design has been rising over the years, which Betella et al. tackled with the *Affective Slider*. They also omitted the scale for dominance, as it has "not shown consistent effects across studies" in recent research [1].

These questionnaires are however designed to be answered after a given task, and would be too demanding to be filled out while driving. This motivated the design of a less demanding method to assess driver emotions while driving.

ASAM: an Automotive Self-Assessment Method

We envisioned a tool to assess driver emotions in the specific use case of in-vehicle user studies. Based on aforementioned existing approaches, we came up with an interface consisting of two sliders for valence, represented by

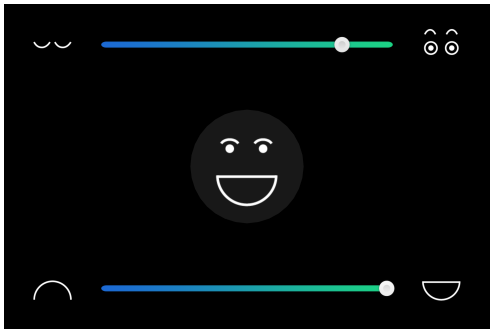

Figure 1: The ASAM main screen contains sliders for arousal (top) and valence (bottom). The values are combined into a centrally displayed emoticon representing the driver's emotion.

a pair of eyes, and arousal, shown with different shapes of mouths. The scales can be adjusted continuously from left (low arousal/valence) to right (high arousal/valence). In the center of the screen an emoticon is assembled of the chosen pair of eyes and mouth. Each dimension has five incremental representations, resulting in a total of 25 possible emotion combinations. The results are saved on a scale from 0 to 100 and can so easily be projected onto Russels's circumplex model. After a threshold of 5 seconds, the system asks the driver to describe their present emotion in one word. The answer is recognized with a speech-to-text system and also saved for later analysis. This way an independent breakdown of the self-assessment without the limitations of specific emotion models can also take place.

Due to the fast and easy way of interacting with this system, we propose this method to be used repeatedly in fixed time intervals during the ride. Hence it can be seen as an affective extension of the experience sampling method [3]. A study to validate the concept is currently in progress.

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