Adjunct Proceedings of the Second International Conference on Automotive User Interfaces and Interactive Vehicular Applications
(AutomotiveUI 2010), November 11-12, 2010, Pittsburgh, Pennsylvania, USA

Does My Driving Scare You?

Jennifer Healey
Intel Labs
2200 Mission College Blvd
Santa Clara, CA 95054
+1 408-653-8904
jennifer.healey@intel.com

Georgios Theocharous
Intel Labs
2200 Mission College Blvd
Santa Clara, CA 95054
+1 408-765-0780
georgios.theocharous@intel.com

Branislav Kveton
Intel Labs
2200 Mission College Blvd
Santa Clara, CA 95054
+1 408-653-8607
branislav.kveton@intel.com

ABSTRACT
In the future of automotive experience, we imagine a car that is sensitive to the emotions of its passengers. In particular, we envision a system that could alert an aggressive driver about how their driving affected their passengers. We present the results of a pilot study showing features of galvanic skin response that significantly correlate with passenger fear ($p<0.001$, $p<0.005$).

Categories and Subject Descriptors
H.5.2 [**Information Interfaces and Presentation**]: User Interfaces – *evaluation/methodology*

General Terms
Algorithms, Measurement, Experimentation, Human Factors

Keywords
Emotion, driving, scare, fear, galvanic, GSR, signal, physiology

1. INTRODUCTION
This paper presents the results of a pilot experiment to determine if galvanic skin response (GSR) could be used as a metric to determine if a passenger was scared of a driver's erratic or aggressive driving. Such a metric might be an unspoken channel for communicating to an aggressive or distracted driver that their driving is disturbing their passengers.

2. EXPERIMENT
Passengers were told that they would be involved in an experiment designed to measure driver distraction and were asked to wear a GSR sensor. During the experiment, the driver engaged in distracted behavior such as: seemingly unintentional lane deviations, accelerating at inappropriate times and not watching the road. On first drive, the driver immediately began distracted driving. On the second drive, the driver was attentive for the first half of the drive then began distracted behavior. In a post-hoc session, passengers were given a video recording of the drive and were asked to rate the level that the driving scared them (1=not at all to 7=extremely scared). Only 1, 3, 5, and 7 were selected as scores although this was not specified. The passengers chose the moments where they felt that their fear level changed. Figure 1 shows the continuous GSR signal with the passenger ratings. Each rating change defined a new segment of the drive.

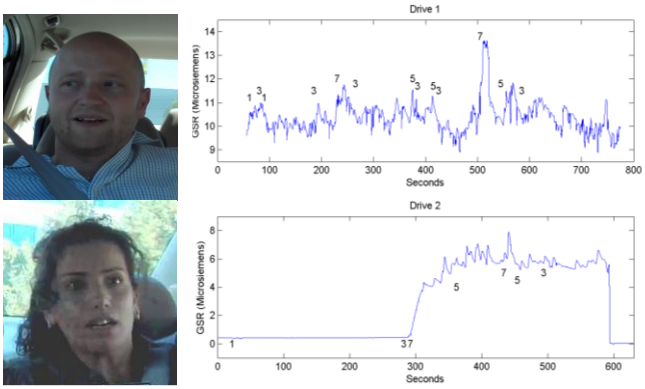

Figure 1. Stills from the video and the GSR signal during drives with ratings marking the beginning of each segment.

Table 1. The average of the peak GSR increase vs. Rating

Rating	1	3	5	7
Max Increase (μS)	0.36	0.60	1.1	3.2

Table 2. The average difference between means for successive segments vs. the difference between scores (e.g. a 3 rating followed by a 7 rating would be a "4" difference in ratings)

Difference in Ratings	-4	-2	2	4
Difference in Means (μS)	-0.58	-0.24	0.26	2.0

3. RESULTS
Since the recovery period of GSR can often exceed 15 minutes, the best features for short term events are often relative. We calculated two features of the GSR signal for each segment: the maximum GSR increase and the mean. We correlated the maximum increase feature with the passenger rating and found the results were significant with $p<0.001$. We also correlated the differences in successive means (e.g. μ_segment5 – μ_segment 4) with the difference their ratings (e.g. 7-3= difference "4") and found that the results were significant with $p<0.005$. Table 1 shows the mean value of the maximum increase feature for each rating and Table 2 shows the mean value of the difference in successive means for each level of ratings differences. We believe that these results indicate that features of the passenger's GSR could be used as an indicator for communicating how scared they are of the way that the driver is driving or behaving.