

Emotional Transitions in Driving

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Abstract : emotions resulting from driving situations can have an impact on security both for drivers and passengers of the car. In this experiment we have built a virtual driving environment able to detect and assess emotions felt by a driver. We use for that EEG systems with a driver immersed into virtual emotional driving situations. We observe how emotions evolve from situation to another. According to the situation and the driver's profile, different advices are given by an agent to calm the corresponding emotions.

Keywords : Emotions, Simulation, EEG, Driving, Emotional Transitions

1 Introduction

In driving situations emotions can arise and have an impact on driver's reactions [1]. It seems that road rage concerns more than 16 million drivers in the United States [2]. Generally, emotions that increase the reaction time in driving situations are the most dangerous. Cai et al. [3] found that anger and excitement, in a scenario involving several drivers, caused an increase in heart rate, breathing and skin conductivity. More specifically, drivers who are not in the neutral state infringe more often. Works undertaken by a team at the Institute Human-Machine Communication in Munchen confirm the influence of the affective state on driver performances. Jones and Jonsson [4] have presented a method to identify five emotional states of the driver during simulations. They used neural networks as classifiers, but they have not studied the impact of ambient noise. In this paper we address the following questions: How do we measure or estimate the emotion of the driver in certain situations? How can we reduce these emotions? The use of Electroencephalograms (EEG) sensors is precise and the most up to date technology [5]. In fact, EEG signals are able to detect emotions and cerebral states which can highlight what happens in the brain.

2 The Emotional Car simulator

To generate and assess emotions in a driving situation we have built a Virtual Environment able to simulate specific driving situations including sources of emotions. The virtual environment takes the form of a game in which the player is a driver who

is presented with a variety of realistic situations (nine scenarios likely to provoke emotions) that everybody could experience every day in the traffic. The emotion corrector, represented by *virtual emotional agent*, is intended to reduce the emotions of the driver by giving advices. To collect the data we used the EPOC headset built by Emotiv. EPOC is a high resolution, multi-channel, wireless neuroheadset which uses a set of 14 sensors plus 2 references to tune into electric signals produced by the brain to detect the user's thoughts, feelings and expressions in real time. From the Emotiv EPOC we detect four primary emotions: boredom, excitement, frustration and meditation. For example the followings scenarios show 1) a participant who has to find a place in a public parking. There is only one place left and before the participant can reach it, another car takes it. The participant has to look around to find another place (Figure 1), and 2) a fire truck comes from behind and starts its siren. The participant has to move his car to the right and stay immobilised until the fire truck is gone (Figure 2).



Figure 5. The parking slot (Scenario #1)

Figure 2. The Fire Truck (Scenario #2)

In scenario 1, when the driver is looking around to find a place to park, we observe the following transitions of emotions. 85% participants who were excited remained excited. Participants who were excited transitioned to frustration with a significant 68%. 73% participants that were in the engagement state remained engaged, and 78% transitioned to a state of excitement. 89% participants who were engaged became frustrated and 89% of participants that were frustrated became bored.

References

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