

Chapter 8

Social Cars: Sensing, Gathering, Sharing, and Conveying Social Cues to Road Users

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ABSTRACT

Intelligent Transport Systems (ITS) encompass sensing technologies, wireless communication, and intelligent algorithms, and resemble the infrastructure for ubiquitous computing in the car. This chapter borrows from social media, locative media, mobile technologies, and urban informatics research to explore three classes of ITS applications in which human behavior plays a more pivotal role. Applications for enhancing self-awareness could positively influence driver behavior, both in real-time and over time. Additionally, tools capable of supporting our social awareness while driving could change our attitude towards others and make it easier and safer to share the road. Lastly, a better urban awareness in and outside the car improves our understanding of the road infrastructure as a whole. As a case study, the authors discuss emotion recognition (emotions such as aggressiveness and anger are a major contributing factor to car crashes) and a suitable basis and first step towards further exploring the three levels of awareness, self-, social-, and urban-awareness, in the context of driving on roads.

INTRODUCTION

Intelligent Transport Systems (ITS) resembles the infrastructure for ubiquitous computing in the car. It encompasses a) all kinds of sensing technologies within vehicles as well as road infrastructure, b)

wireless communication protocols for the sensed information to be exchanged between vehicles (V2V) and between vehicles and infrastructure (V2I), and c) appropriate intelligent algorithms and computational technologies that process these real-time streams of information. As such, ITS

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can be considered a game changer. It provides the fundamental basis of new, innovative concepts and applications, similar to the Internet itself.

The information sensed or gathered within or around the vehicle has led to a variety of context-aware in-vehicular technologies within the car. A simple example is the Anti-lock Breaking System (ABS), which releases the breaks when sensors detect that the wheels are locked. We refer to this type of context awareness as *vehicle/technology awareness*. V2V and V2I communication, often summarized as V2X, enables the exchange and sharing of sensed information amongst cars. As a result, the vehicle/technology awareness horizon of each individual car is expanded beyond its observable surrounding, paving the way to technologically enhance such already advanced systems.

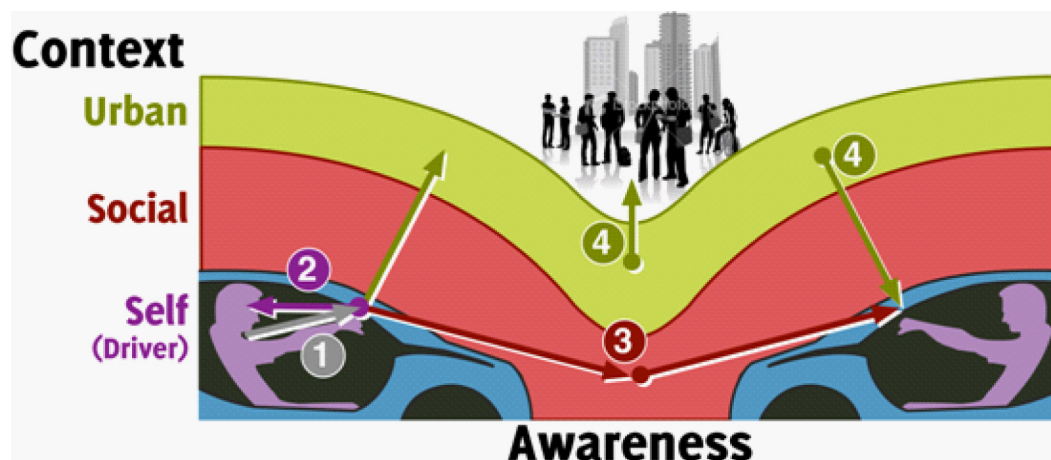
In this chapter, we draw attention to those application areas of sensing and V2X technologies, where the human (driver), the human's behavior and hence the psychological perspective plays a more pivotal role. The focal points of our project are illustrated in Figure 1: In all areas, the vehicle first (1) gathers or senses information about the driver. Rather than to limit the use of such information towards vehicle/technology awareness, we see great potential for applications in which

this sensed information is then (2) fed back to the driver for an increased *self-awareness*. In addition, by using V2V technologies, it can also be (3) passed to surrounding drivers for an increased *social awareness*, or (4), pushed even further, into the cloud, where it is collected and visualized for an increased, collective *urban awareness* within the urban community at large, which includes all city dwellers.

In our view, these areas have been only little explored to date, although they bear great potentials. Technologies focusing on enhancing *self-awareness*, e.g., could positively influence driver behavior, not only in real-time, but also over time. Those technologies focusing on increasing our *social awareness* while driving could positively change our behavior towards others and make negotiating road use easier, friendlier and safer. Lastly, a better *urban awareness* in the context of the car enriches our understanding of the road infrastructure as a whole. We will demonstrate each of these potentials in more detail in the literature review of this chapter

Following the literature review, we discuss our initial case study experiment, which focuses on sensing driver emotion through facial expressions (cf., the first step (1) in Figure 1). Emotions such as aggressiveness and anger are regarded as

Figure 1. Focal points of our research



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