

Dynamic Anticipation of Driving Scenarios

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Anticipation in dynamic traffic situation is the supposition to ensure safe driving and prevention of conflicts and accidents. Predicting future events increases the time and space for adequate action which has a positive impact on driving performance (e.g. Fitch, Blanco, Morgan, & Wharton, 2010; Jackson, Chapman, & Crundall, 2009). Anticipation in driving is a competence that is based on high level cognitive processes and includes the perception of characteristic cues and the identification of stereotypical traffic situations (Stahl, Donmez, & Jamieson, 2014). However, this process can be impaired by a variety of influencing factors like visual or cognitive distraction (e.g. Baumann, Petzoldt, Groenewoud, Hogema, & Krems, 2008). In order to develop driver assistance systems that support anticipation and help to avoid the deteriorating effect of distraction on anticipation of driving events knowledge about the underlying cognitive processes is required. A cognitive model of anticipation is presented that is based on situation comprehension (e.g. Baumann & Krems, 2009; Durso, Rawson, & Giroto, 2007). Based on Endsley's (1995) theory of situation awareness that proposes that situation awareness consists of the perception of situational elements, their understanding and the projection of the future development of the situation, Baumann & Krems (2009) and Durso et al. (2007) added to this theory by proposing that situation awareness is constructed and maintained by comprehension processes analogue to text comprehension. One major process involved is the activation of knowledge stored in long-term memory triggered by the perception of situational elements. These activation processes result in a situation model that represents the driver's current understanding of the situation but also includes relevant well-learned expectations about the future development of the situation. But in addition to this expectation-based anticipation of events there is also evidence of more sensory-based processes that support the short-term prediction of events. The phenomenon of representational momentum (Freyd & Finke, 1984) represents a promising paradigm to investigate the effects of combined sensory-based (bottom-up) and experience- and expectation-based information (top-down) in updating of the representation of the situation. Representational momentum describes the systematic error to overestimate position changes along a trajectory of an occluded object in direction of movement that is influenced by previous knowledge (Reed & Vinson, 1996). This effect seems relevant in driving for instance while focussing the road in front of the own car and observing successively rear traffic in order to anticipate future states of traffic participants behind the own car.

A series of experiments is conducted using the paradigm of representational momentum in dynamic traffic situations showing that drivers tend to overestimate position changes along the driven road in direction of movement. The increase of velocity and landmarks each led to stronger forward displacements. Additionally the effect of cognitive distraction on the size of this displacement effect is investigated in various situations. This shift in representation of one's own position in direction of movement might be a relevant aspect of human anticipation in dynamic situations and important in terms of the interpretation of effects of cognitive distraction on driving performance.

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I would like to give a non-paper presentation.