

**Summary:**

# **Developing a model of driver behaviour**

## **Introductory working papers**

### **SIP Driver Behaviour Models: Report 1**

SIP is an abbreviation for "Strategic Institute Program" which is an activity initiated and partly financed by the Norwegian Research Council (NFR). In 1998, a SIP on *Driver behaviour models* was started. It is financed by the NFR and the Norwegian Public Roads Administration (Vegdirektoratet).

One important background for starting a SIP on this topic was the recognition of the fact that one lacks satisfactory driver behaviour models in the field of traffic safety. Topics like speed choice, risk compensation, information processing and decision making, are central fields that need to be fully understood and integrated in a well developed model of driver behaviour. One important hypothesis has been that it is feasible to develop more effective road safety measures by developing a more comprehensive and sound driver behaviour model than the ones that are prevailing today in this field.

The present report comprises introductory working papers concerning "state-of-the-art" of central topics needed for an elaboration of a model. Such topics are: Information processing, motives, emotions, factors affecting speed choice, driver experience, risk perception and human error, among others. The present report covers the initial phase of the SIP activity, i.e. from the autumn of 1998 till June 2000.

It was early recognized that a development of one model comprising the behaviour of drivers in a general sense, would be a breakneck activity. The topic had to be narrowed and in the first assembly of the reference group it was agreed that the development of a driver behaviour model should be limited to developing a model of driver speed choice.

The first assembly of the reference group became very important and directional in more than one way as several statements here had significant influence on the activities to come. When the first version of a draft model was presented and discussed on the assembly mentioned, the SIP-group was confronted with the question: "*Why do you choose to focus so much on motives? Why not chose intentions and emotions instead?*". This seemingly simple question gave rise to several new questions that became key issues of the development:

- What are the fundamental questions concerning understanding and explaining behaviour?

- Which concepts are the most suitable for understanding and explanation?
- How to integrate recent results from the “cognitive revolution”?
- How to distinguish between “*the emotional*” and “*the cognitive*” and how to integrate such problem statements in a model?
- How to deal with the limitations of the language regarding how people think and experience, the relation between conscious and subconscious experience, things that are “only felt” and not easily accessible by words?

Three other concepts also became path-breaking: “*Scenarios*”, “*emotion accounts*”, “*the best feeling*”. Some explanatory statements are needed: In conscious choice situations it is believed that people, “see” the alternatives as images or “scenarios”, weighing positive and negative alternatives against each other, and choose that specific alternative that gives “the best feeling”. What we do when we weigh our alternatives in order to reach the one that gives the best feeling, is to perform some kind of “emotional accounting”. And the point is: Such emotional accounting cannot be performed unless the alternatives, the scenarios, have a definite emotional dimension attached to it. This was indeed new and significant knowledge. And it is on this background one should read and regard the working papers of the present report.

Chapter 1 in this first report from SIP *Driver behaviour models* discusses the need for a model on driver behaviour. Existing models are considered as deficient and the benefits of organising the large amount of knowledge results from empirical studies are pinpointed. The chapter describes the purpose of the SIP activity and set focus on central areas considered to be of importance to study in order to increase the knowledge and the competence concerning driver behaviour models. The SIP activity is regarded as a necessary premise for giving satisfactory answers to the problem statements that commissioners expect traffic safety research to solve.

Chapter 2 uses the evolution and man’s basic need for identifying risks as a starting point. The evolutionary selection of man’s properties regarding risk monitoring in a motorised transport system, must, by necessity, be incomplete. On this background focus is set on issues of information processing in car following situations, i.e. how monotonous driving in a queue is experienced, peculiar phenomena as “highway hypnosis” and “learning traps” is discussed, as well as problematic aspects of “the best feeling”: For some drivers the monotony of driving in a queue of cars could be relaxing while others would experience the monotony as so boring that they will try to escape from it, by means of overtaking as the most predominant solution.

Chapter 3 discusses motives and emotions in the light of recent neurobiological research. The discussion is by and large built on Antonio R. Damasio book “*Descartes Error: Emotions, Reason and the Human Brain*”. Damasio describes the neuro-anatomic base of human thinking, including the role of the emotions and feelings. Conscious, rational thinking have traditionally been located to the neocortex, but neocortex is built on the top of, and from, evolutionary older parts of the brain, i.e. structures that is steering man’s emotional activity, which means that attempts to separate rational thinking from emotions and feelings must be

regarded as dead-ends as these are phenomena, activities and anatomic structures that are tightly knitted to each other.

Chapter 4 discusses factors affecting driving speed and gives an update of the knowledge needs in this field. Factors and knowledge needs are grouped and attributed to the sectors of road, road environment, vehicle, and driver characteristics.

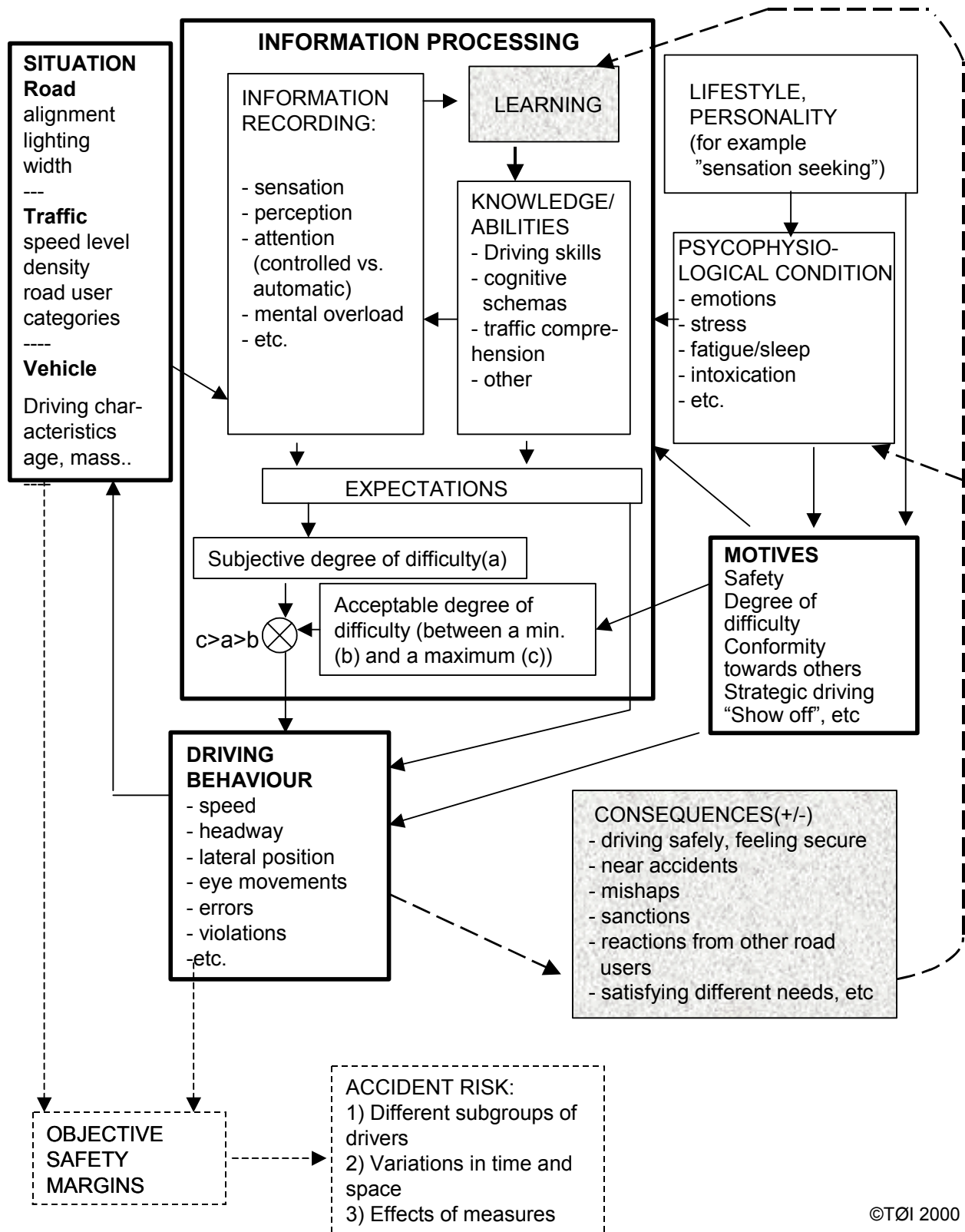
Chapter 5 discusses driving experience, risk perception, drivers' expert "knowledge" and asks rhetorically: "*Is the elevated risk of inexperienced drivers caused by their late discovery of hazards*"? The starting point of the discussion is two explanatory models regarding accidents among young drivers: One model explaining accidents by social, emotional and motivational factors, while the other model is attributing accident causes to the abilities of the drivers, i.e. to their (in)ability to read the traffic and their (in)ability to foresee hazardous situations. The latter model connects accidents with cognitive skills of the drivers and to their (in)experience. Chapter 5 presents studies that deal with inexperienced vs. experienced drivers with special focus on how risk is perceived and expert knowledge develops. A first version of a draft model is presented in the chapter.

Chapter 6 presents a field which is highly needed for integration in a complete and comprehensive driver behaviour model – i.e. information processing and decision-making as this is a topic that by no means is satisfactorily dealt with in prevailing models. Information processing and erroneous acts are discussed and a separate model for information processing is presented. Processes and functions from perception to decision-making is described, as well as how errors can come into being in this dynamic circuit of perception, information processing and decision-making. Chapter 6 gives a concentrated, condensed and "simple" presentation of a topic that indeed is difficult to unravel and describe in a way that is understandable to the reader. The introduction and use of the principles of "frequency-gambling" and "similarity-matching" seem fruitful and facilitate the understanding of information processing and decision-making, including also why human errors may result from inadequate processing of information.

In chapter 7 a revised draft model is presented and the chapter focuses on problem statements in relation to the draft model (enclosed here as figure S1). Chapter 7 can be regarded as "state-of-the-art" as it was per June 2000 concerning the elaboration of a driver behaviour model. Finally, also problem statements regarding more qualitative issues as, among others, identity and emotional experiences associated with driving and choices of driving speeds, is discussed. Chapter 7 is then describing the first base of empirical investigations to come.

Chapter 8 is an epilogue that discusses the status of the draft model and the potential for further elaborations. Finally, an overview of expected headlines in the next report from SIP *Driver behaviour models* is presented.

SIP Driver behaviour models:  
 "DRAFT MODEL"  
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Figure S1 Draft Model – version per 07.02.00