Overview maintenance in man-machine environments : applications in ship navigation
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PART II: THE EXPERIMENTS

The second part of this dissertation discusses the experiments performed to analyse factors that are hypothesised to influence the risk of overview loss (see Chapter 2). Some experiments examined attention narrowing in general man-machine systems, while others focused on loss of overview in the specific setting of a ship's bridge.

The main test paradigm that was used in most experiments of this dissertation, consisted of a primary information source that was always available, and secondary information sources that had the potential to distract the operator's attention from the primary source. In order to measure the range of attention and other behaviour in a simpler way than by means of eye-measurements, the information sources were linked to a particular task. This link between tasks and information sources was also made in order to give the operators a purpose to attend them in time. For this reason, in the next chapters, 'information source' and 'task' are used interchangeably. At least, in an operational environment, an information source has no meaning if the state of a relevant information source is not linked to a particular task.

Information characteristics that provoke intense processing or a high level of engagement, such as complex, difficult, or unfamiliar information, were the first group of factors that were hypothesised to increase the risk of losing overview by attention narrowing. Chapter 3 and 4 describe a number of experiments that were performed in order to find empirical evidence for the hypothesis that engaging information provokes attention narrowing and overview loss. The experiments in chapter 3 use a computerised test to measure attention narrowing. The central paradigm of this test is that participants have to perform a continuous primary task related to one source of information, and also pay attention to a secondary task that is based on another source of information. By manipulating the engaging character of the information on which the secondary task is based, its potential to distract the participant's attention from the primary information source is varied. The experiments in chapter 4 examine the engaging-information hypothesis in the applied setting of a (simulated) ship's bridge. Most of these experiments have a similar task paradigm as the computerised tests in chapter 3, based on a primary information source and distracting secondary information sources.

In the pursuit of ensuring safer man-machine operation, research efforts have been made in the areas of ergonomics, or technical support of operators, or on selection of superior personnel. Inspired by some evidence that individuals differ in their tendency to experience attention narrowing and thus lose overview, the experiments in chapter 5 investigate whether individuals exhibit a consistent tendency to overview loss in different situations and contexts.

A third, more general but situational factor that may affect ability to maintain overview is the transient psychological state of the operator, such as motivation to perform a particular task. Chapter 6 examines one experiment in which motivation is manipulated by means of behavioural and financial incentives. Another transient psychological state that is particularly relevant to a discussion of performance on a ship's bridge is tiredness, which may be caused by factors such as time on task, sleep deprivation or circadian fluctuations. Two further experiments are discussed in chapter 6 in which the development and the hazards of tiredness on the ability to maintain overview are investigated.