

Supporting the Perception of Spatially Distributed Information on Ship Bridges



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Abstract

Until today, the majority of maritime accidents occur due to human error. A lack of sufficient situation awareness is one of the most frequent reasons for human error. However, using an attention guiding system can support nautical officers to master the information flood and to avoid accidents. For this to work effectively, it has to be evaluated which information has a high demand for attention and therefore should be highlighted. Therefore, we adapted an existing monitoring assistant system to cope with information displays of varying information complexity and used it to rate the situational perception of a nautical officer on the basis of eye tracking data. In this work, we present our adaptation of the monitoring assistant system, parameters to use it in the maritime scenario "takeover with traffic encounter" and the results of a preliminary user study in a ship bridge simulator.



Illustration of Ship Bridge

Transfer of Monitoring Assistant System (MAS)

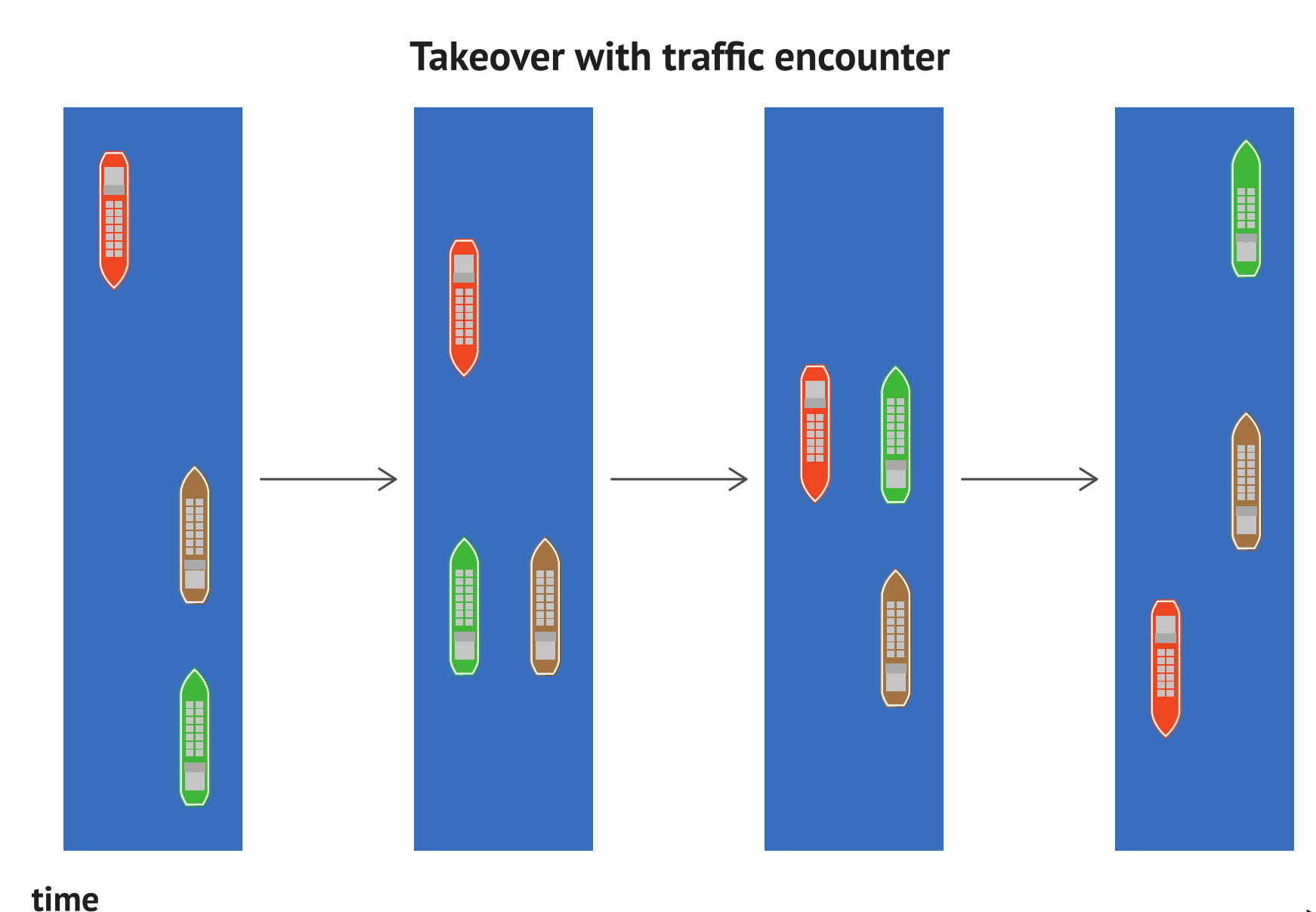
- Fortmann et al. defined the *Demand for Attention* (DfA) based on Wickens SEEV-Model
- transfer of the original MAS from a 2D to a 3D domain
- complexity of information varies drastically between displays
- introduce two new parameters based on fixation count and dwell time, instead of single fixation

$$\text{Demand for Attention} = \text{Relevance} \cdot \left(1 - \min \left(1, \frac{\text{Actual Neglect Time}}{\text{Maximum Neglect Time}} \right) \right) \quad (1)$$

$$\text{Fixation Quotient} = \min \left(1, \frac{\text{Number of Fixations}}{\text{Number of AOIs}} \right) \quad (2)$$

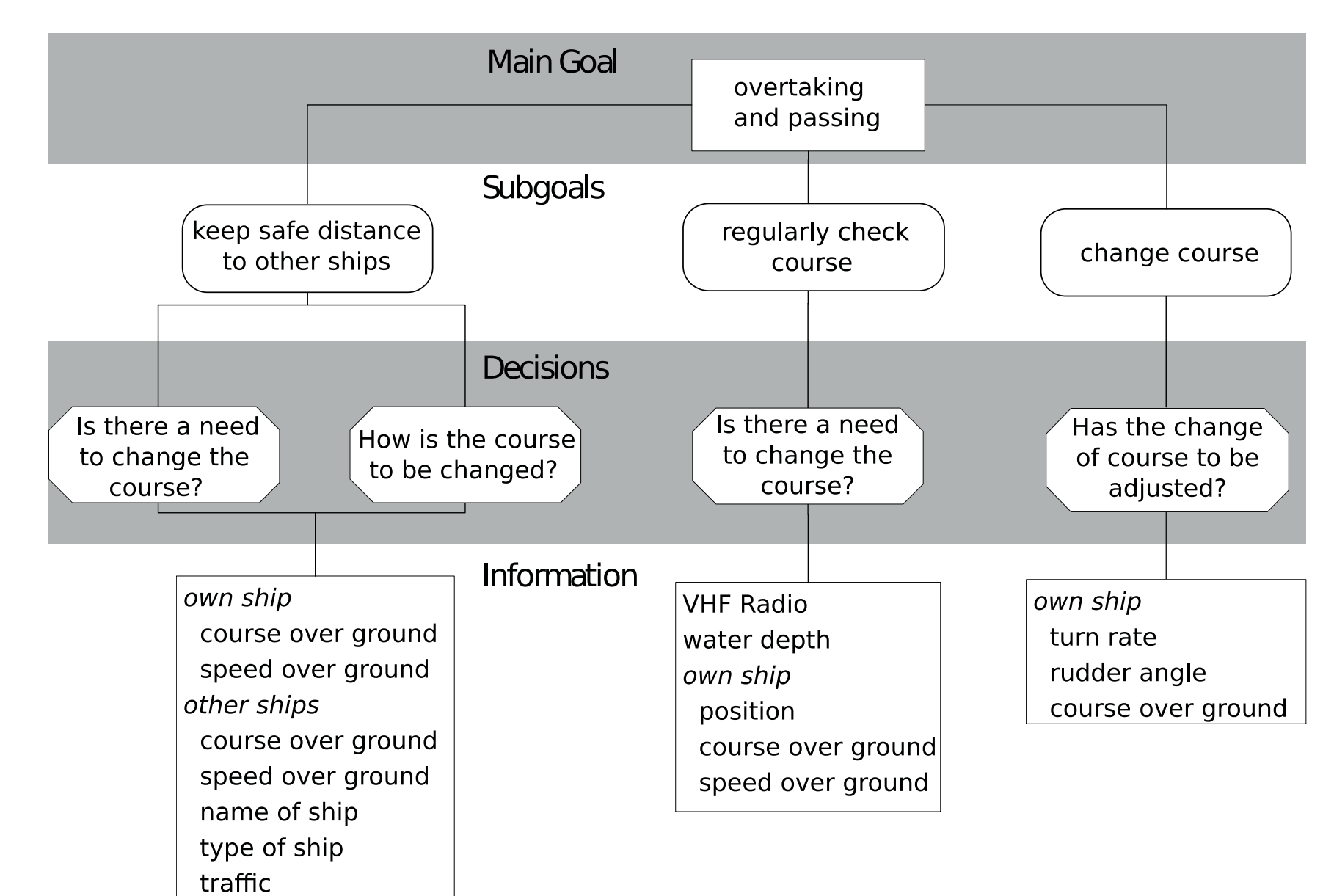
$$\text{Fixation Duration Quotien} = \min \left(1, \frac{\text{Current Fixation Duration}}{\text{Minimum Fixation Duration}} \right) \quad (3)$$

Scenario, Goal-directed Task Analysis & Model Parameters



Test Scenario: Takeover with Encounter

- conducted interviews with two experts (experienced mariners)
- choose scenario based on expert input
- goal-directed task analysis (GDTA) to identify sub-goals, decisions and necessary information
- assessed parameters of model with experts



Goaltree: Scenario - Takeover with Encounter

Preliminary Evaluation in Ship Bridge Simulator

- three trained mariners and six mariners in training (9 total)
- Monitoring Assistants System is transferable to the maritime domain
- copied with information objects of varying information complexity
- perceived less annoying than a fixed interval reminder
- rated as being more usable and having a lower workload



Study Apparatus

MENSCH UND COMPUTER 2019

QR Code