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Perceived Safety Of Passengers On Coastal And Ocean Going Vessels: Construction Of Global Assessment Questionnaire

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In this study, a global questionnaire was developed for the first time to measure perceived safety and the factors influencing it among passengers on ocean-going and coastal vessels. The research approach places the human-centered construct of perceived safety at its core.

Transportation safety research, especially in the maritime domain, has focused primarily on improving safety performance in terms of reducing accident and near-accident rates (Papanikolaou, 2009; Vassalos, 2006). However, this approach neglects the central aspect that laypersons, i.e. passengers, directly interact with and are also affected by the socio-technical system, e.g. the ship. Perceived safety can be one way in which the passenger is affected by the system. The main difference from actual safety performance is that passengers are not domain experts and therefore cannot always correctly assess whether a certain situation on board the ship, plane, etc. is safe or unsafe (Ahola, 2017). Therefore, they have to assess their own safety based on their perception of the circumstances of the situation (Van Rijswijk et al., 2016). However, their perceptions depend on previous experiences, heuristics, or only basic knowledge about the functioning of the transport vehicle (Ahola, 2017; Rundmo et al., 2011). Here, false beliefs or evaluations of the circumstances can lead to a misperception of the actual safety of the situation (Campbell et al., 1976), i.e. a feeling of unsafety on board, although the circumstances are uncritical. If this perception can be increased, especially in objectively safe but subjectively unsafe situations, it can lead to a greater sense of well-being for passengers on board (Ahola, 2017). To date, research in the maritime domain has primarily focused on finding correlations between certain singular aspects of safety and their influence on perceived safety, such as the effects of an in-vivo safety demonstration, the perceived competence of the crew, or the comparison of different ship types (see e.g. Baker, 2013; Hystad et al., 2016; Lu and Tseng, 2012; Serap et al., 2017). Although these findings are valuable in themselves and provide a first insight into perceived safety, they lack comparability and integration of the results into an overall picture. The aim of this study was therefore to provide a comprehensive description of the construct of perceived safety on coastal and ocean-going passenger ships and to enable it to be measured using a global, human-centered questionnaire.

Based on previous literature from maritime human factors research and related fields such as aviation, as well as our own analysis of 4760 cruise ship passenger reviews gathered from the online review platform "Trustpilot", a global questionnaire on perceived safety was constructed with 26 items in three different categories: ship-related, crew-related, and environment-related aspects. The items were formulated as bipolar rating-scale items with five categories: The passenger could use two values to state that this aspect (e.g. ship size or crew competence, etc.) contributed to more uncertainty for them, two values to state that this item contributed to more safety, and the middle value to describe that this aspect had no effect at all on the passenger's perceived safety. The criterion "perceived safety in a certain situation on board", against which the item scores were to be compared, was assessed with a continuous unipolar rating-scale item. In addition, the characteristics of a past situation on a ship had to be described, as well as information about the type of ship (e.g., cruise ship, coastal ferry, etc.), the position of the passenger during the situation (on deck, under deck, both), and the actual weather

and environmental conditions. This information was used to categorize the situations into different types and compare them to the passengers' perceptions of safety.

In an empirical study, this questionnaire was then tested for the first time with passengers on coastal, island and ocean-going vessels, both in terms of its functionality and its content correlations. Due to the novelty of the instrument, the statistical analysis in both studies was entirely descriptive, with no a priori hypotheses formulated. A total of 27 passengers filled in the full questionnaire. Based on their descriptions, four different categories of unsafe situations could be identified: capsizing/going overboard, injury on board, grounding, and collision situations. Additionally, the situations were categorized according to whether they happened at the harbor or at sea (without land sight). Linear regression models with *perceived safety in the situation* as the criterion and item score sums or single item scores as predictors (all variables z-standardized) were used to analyze the data.

The results showed that for an average item sum score, passengers in capsize/going overboard or injury-on-board situations perceived their situation as 0.54 or 0.53 standard deviations (SD) less safe compared to collision or stranding situations. Additionally, for an average item sum score the participants in situations at sea evaluated their situation as 0.56 SD less safe compared to those with situations at the harbor. If the participant was just on deck during the whole situation, they also perceived their situation as 0.20 or 0.25 SD less safe compared to participants who were partially or completely under deck during the situation. If not all ship-, crew-, and environment-related aspects are considered, but only the environment-related aspects, this effect becomes even more apparent. Here, for an average environment-related item sum score, participants who were under deck during the entire situation perceived their situation as 0.53 or 0.55 SD safer than the passengers who were partially on deck or on deck for the entire time. Additionally, the ship's size and shape which were aspects that contributed to the perceived safety of the passengers on deck or partially on deck, lost their contribution if the passengers spent the entire time of the situation under deck. In general, a linear correlation of 0.37 between the vessel's actual size and the passengers' perceived safety during the situation could be observed. Passengers on larger ships tended to "feel" safer during an unsafe situation. Regarding the "safety demonstration" and "emergency sound signal on board", both aspects only contributed to more perceived safety for those passengers who actually received an in-vivo safety demonstration or were aware of the emergency sound signal and not for the passengers who only received a remote safety demonstration or did not know the emergency sound signal on their ship.

Overall, this study has shown that the perceived safety of passengers on ocean-going and coastal vessels – especially in unsafe situations – can be limited, although these situations do not necessarily have to be "objectively" unsafe. It can be positively or negatively influenced by aspects related to the ship, the crew, and the environment, so that the negative effects of other aspects can be offset, for example, by an in-vivo safety demonstration or by the competent behavior of the crew. This possibility may also apply to other modes of transport, such as aircraft or trains. Future studies should therefore focus on improving and adapting the questionnaire to these other modes of transport, in order to determine which aspects can increase passengers' perceived safety in which situations.

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