Educating future generations' master mariners: Using visualisation for re-creating, assessing, and learning from prior performance in post-simulation debriefings

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ABSTRACT

This study draws on video recorded data of debriefings in a navigation course to analyse the practical use of visualisation technologies in post-simulation debriefing. The analytical focus is on instructions, i.e. the instructors' use of the playback and interplay with the students. The results show how the playback creates a shared perceptual field to which instructions are directed and navigational problems are elaborated to demonstrate how to coordinate with other ships in confined waters. The meanings of the rules of the sea are hard to teach in abstraction since every decision relies on an infinite number of contingencies that have to be accounted for. The use of visualisations in post-simulation debriefings offers opportunities to portray rules in a context in which their meanings could be tied both to situations as they were actually carried out and to demonstrate more preferable alternatives.

1. INTRODUCTION

A general problem of educating workers in safety-critical domains is to prepare for skilled performance in real work settings. Simulations have been developed to meet these demands in master mariners' educational programs but have also been prominent for decades in healthcare and aviation. An almost universal conclusion in simulation research is that post-simulation debriefing, allowing for feedback and reflection, is a necessary component for participants to learn from their experiences. The rationale is that retrospective analyses of what just happened can form the basis for prospective strategies on how to manage future situations [1]. In order to facilitate feedback and reflection on prior performance, different technologies have been developed to visualise and replay the scenarios during debriefings. In maritime navigation training, visualisations that replay the simulated scenario by taking a birds-eye view of navigation routes is used as means for organising debriefings [2]. Similarly, visualisations are used in aviation training to offer multiple views on the pilots' conduct during debriefings, including video from the cockpit, the pilots' outside view, the instruments involved in steering the plane, and the flight path [3]. In healthcare, in comparison, video recordings of simulated clinical work commonly provide a third-person perspective of what happened [4]. By offering

an outside perspective on the participants' conduct, the use of videos and other visualisations is said to reduce hindsight bias and enable self-reflection [5]. However, studies on the participants' practical use of video in debriefing sessions shows that, while videos of prior performance are central to such reflections, the reflections acquire their work-relevant meaning in and through instructional guidance [2;3;4]. Hence, studies in this tradition emphasise both the role and importance of instructional support and the anchoring role of technologies to visualise and replay the simulation. Moreover, these studies display, in interactional detail, how and why debriefing tools provide the means for re-actualising prior performance, enabling assessments of the participants' conduct, and opening up discussions on what constitutes good work practices [2;3;4].

Given this background, this study investigates a series of simulations in the education of master mariners that teach the rules of the sea in ways that constitutes good seamanship. The analysis was carried out by scrutinising video-data from six post-simulation debriefings in a navigation course for master mariners during their second year [6]. The aim of the study is to present and discuss the practical use of devices for displaying visualisations which is, in this case, a playback of scenarios that reconstruct the events from a birds-eye-view, in order to demonstrate navigational problems and explain how these should be dealt with to be in line with good seamanship.

2. RESEARCH APPROACH, METHOD, AND DATA

This study is part of a tradition that analyses the social and material organisation of learning with technologies [2;3;4;8]. In particular, the analytical focus is put on work-relevant activities and how professional learning is an instructional accomplishment achieved in and through such activities [7]. A number of social and material resources are integrated in such learning processes: a shared perceptual field (for example, a radar display or, as in this case, the playback used in debriefings), the instructor's gestures or inscriptions that highlight relevant aspects of the perceptual field, and instructive talk explaining what there is to be seen [7]. Hence, learning to see and interpret a work-relevant phenomenon, as a professional, is not seen to reside inside the individual brains of students but, rather, by the ways in which instruction is practically accomplished in the technological environment. In this way, the analytical focus is put on how the next generation of professionals are trained through access to one another and the details of the prior activities as played out in the scenario.

In this study, video data from six post-simulation debriefings serves as a basis for conducting a detailed interaction analysis of the instructors' use of visualisation technologies and interplay with the students [6]. The debriefings are part of a larger data corpus, collected in a navigation course for master mariner students during the autumn of 2014. The course took place during the students' second out of four years and consisted of lectures and five simulator-based training sessions. During the scenarios, students trained in teams of two on five different bridges. The focus was on developing students' proficiency in handling instruments on the bridge and applying COLREG in various situations. In the debriefing session under scrutiny in this study, all ten students gathered in a classroom next to the simulator to discuss and reflect upon their recent crossing of the Dover Strait TSS-lane. A crossing of a TSS-lane is a situation where a number of COLREG apply, and, during the debriefing, aspects of keeping a safe

distance to other vessels (Rule 8), the right-hand rule and its exceptions (Rule 9), and showing the intention to cross (Rule 10) are discussed.

3. ANALYSIS AND RESULTS

In the following sections, transcriptions and pictures from the video-recorded data are used in order to show how the playback provides the means for re-creating the students' prior performance (section 3.1). Section 3.2 focuses on how the playback enables assessments of the students' conduct and how alternative actions demonstrate when and how exceptions to the right-hand rule become relevant in the scenario. Finally, in section 3.3. reasonings on what constitutes good work practices, to generalise the lessons learned from this specific situation, are explored.

3.1. RE-CREATING PRIOR PERFORMANCE

In this episode, a playback of the scenario is projected on a whiteboard in the debriefing room. In the following transcription, the instructor's narrative is directed towards the playback and highlighted through his drawings with a black marker on the whiteboard (Figure 1).
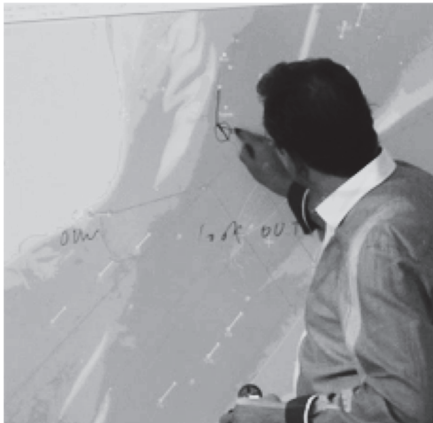

Figure 1 "we aim like that"

Instructor: *it's when <u>these</u> gone down… done the turn… ehhh… then it's <u>this one</u> then…*
one needs to turn to exactly this course as in that line… because then this vessel might have turned in like this… this vessel is on its way down… or you could say that we aim <u>like that.</u>

The indexical utterances (the underlined words in the transcription of the instructor's talk, i.e. "these", "this", and "that") are paired with his drawings on the whiteboard (Figure 1). The drawings, in turn, highlight the students' prior actions in a way that creates a concrete and stable ground for the narrative of how the situation unfolded during the scenario [7].
In sum, in this brief instance of instructional talk, it is seen how the playback of the prior scenario is at the core of re-creating its temporal and spatial nature [2;3;4]. Moreover, the drawings, together with the playback, offer a shared perceptual field on which the instructor's narratives are grounded [2;3;4].

4.2. PROVIDING THE MEANS FOR ASSESSMENT

Assessment of a situation requires knowing what actually happened [4]. The continuing talk from the debriefing episode builds on the re-creating of actions taken in the scenario described in 3.1 and starts with a question from the instructor to the students.

Figure 2" if this one so to say are on the way down" Figure 3 "doing the turn in one move"

Instructor: *n' what intention does one show then… if <u>this one so to say are on the way down</u> here?*

Student: *well then it's a matter of turning in very good time… so we don't turn starboard n' they turn portside*

The question is paired with a new drawing, marking "this one" and the way down with a new line on the playback (Figure 2). The question from the instructor about what intention the students are showing in this particular situation is not answered by the student in a straightforward way. Rather than stating what intentions they show, the student talks about timing the turn. The other vessel's ability to see their intentions in good time is important so as to avoid collision. Next, the instructor provides an evaluation of the student's answer.

Instructor: *Yes, but then when we come <u>like this</u>… n' then one does that turn in one move… n' aim behind directly*

Student: *yeees*

The instructor's formulation, "yes, but…" is showing that the instructor treats the student's answer as only partially right. Instead, he moves on by providing the students with an alternative, better solution to the situation, i.e. to make the turn in one turn to portside and go behind the other vessel. The verbal explanation is paired with yet another drawing on the playback, beginning to show what that turn would look like (Figure 3). The student responds to this suggestion with a positive utterance, i.e. "yeees", agreeing on the solution as an appropriate alternative. The instructor then follows up on this by providing an account of why making a portside turn is a preferable alternative, that is, why this situation is an exception of Rule 9, i.e. the right-hand rule.

Figure 4" then you show the intention…".   Figure 5 "I can just go on"

Instructor: <u>*then you show the intention to cross… it can't be that one is going in to join*</u>*… that's confused… one doesn't think like that initially anyways… ehhh… then this vessel can go on… they don't feel like… yeah I don't need to give way for that one…* <u>*I can just go on*</u>*… n' so one can go in and cross later… follow up n' then the vessels that's behind can turn where there are more space and then also more time*

In this part of the transcription, it is seen how the instructor's rationale of his suggested solution is paired with his drawing of the hypothetical crossing on the playback (Figure 4). What is interesting here is also the following reasoning on how other crews might think about the crossing, i.e. "they don't feel like… yeah, I don't need to give way for that one… I can just go on". In this way, the instructor is concretely demonstrating how taking the perspective of other professionals' can be done in a specific situation [7]. Moreover, the statement "I can just go on" is paired with the instructor's drawing on the playback, showing what this would mean in the continuation of the hypothetical scenario (Figure 5).

3.3. GENERALIZING THE LESSONS TO BE LEARNED

The preceding sections showed how the instructional use of visualisation technologies enables the re-creation of prior scenarios and allows for the assessment of the students' actions, as well as the reasoning of alternative solutions. In this section, the instructor's concluding remarks on the situation is presented.

Instructor: *that is… one does a portside turn that doesn't cause a close quarter situation then huh… that someone else need to solve in a hurry like that… so you are allowed to turn portside… but it is with restraint so to say… one should be clear about the consequence so to say.*

While the instructor's previous account of why the specific situation is relevant for an exception to the right-hand rule, the instructor's talk in this transcription is oriented towards more general advice and what to think about in such situations. That is, to turn portside to avoid close quarter situations and avoid putting others in a position where they need to take evasive action, and to do this in an informed manner. Hence, the concluding remark does the work of generalising the lessons from this specific situation by reasoning what the rules mean in practice and what constitutes good seamanship [8].

4. CONCLUSION

In line with research from aviation and healthcare, the results highlight the central role of technologies for visualising prior events and the importance of an instructor to guide the students towards learning objectives during debriefing [3;4]. The results have implications for maritime training, displaying a number of instructional methods for bridging the gap between the application of navigation rules in line with good seamanship and the students' specific actions during the recently performed scenario. A range of different instructional resources were combined in this process: the playback of the scenario, drawings with a black marker to highlight relevant aspects of the scenario, and the students' responses. This, in turn, formed the basis for demonstrating alternative solutions by contrasting what was done and what should be done and by comparing the performed courses of action versus hypothetical ones. In addition, the birds-eye view of the scenario enabled by the playback offered possibilities for seeing others' perspectives on the situation, i.e. of how one's owns actions could be perceived by other navigational teams [2;7;8]. In doing this, navigational problems were elaborated to demonstrate how to coordinate with other ships in confined waters. In this way, the application of the rules of the sea were addressed in terms of practical and timely actions in relation to the ever-changing and contingent character of navigation practice.

In summary, the meanings of the rules of the sea are hard to teach in abstraction since every decision relies on an infinite number of contingencies that have to be accounted for. The use of visualisations in post-simulation debriefing offers opportunities to portray rules in context so their meanings could be tied both to real-world situations and to demonstrate more preferable alternatives.

ACKNOWLEDGEMENTS

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