

Collaborative Computing
Connection between affirmative communication
and artefacts in Maersk Training control room
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Abstract

The aim of this paper is to find out what is the connection between affirmative communication and artefacts in Maersk Training control room. In particular, we will analyse the way of working in the simulator environment at Maersk Training based on a literature review and ethnography analysis through a virtual tour, documents, and videos. In the first section, we introduce the research question, explaining the problem and how we started to investigate it; secondly, a theoretical approach is developed in order to have knowledge about the domain of our research; the third section is devoted to the method that we used for investigating, like ethnography, video analysis and literature review; in the fourth section we sum up the results that we gained, and finally, in the fifth section we discuss these results based on the current literature.

1 Introduction

What is the connection between affirmative communication and artefacts in Maersk Training control room?

Maersk Training provides training to maritime and offshore energy production. To train the participants beforehand on the simulators is really important to ensure the safety of the different stakeholders involved and safety of the cargo, for example. As discussed by Ziarati et al. [1], 80% of the sea accidents happen due to human error, and these errors can be reduced if the participants are trained in an environment which is really close to reality. Although

the Maersk Training simulators are 97% close to reality according to one of the trainers of Maersk training, we want to analyse if the same level of accuracy can be achieved in Virtual Reality. The aim is to analyse the Maersk training control room and see if there is any relation between the affirmative communication and the artefacts used in the control rooms how these different artefacts enable awareness across different rooms in the Maersk training. This paper will help the developers of Maersk training in Virtual reality to better understand the relation between the communication and the artefacts and thus allowing them to develop a Virtual Reality control room setting where participants from different geographical locations can train with better use of artefacts for their communication. Furthermore, it helped us to get hands-on experience on CSCW theory by actually analysing the collaborative system of Maersk Training and based on our analysis design guidelines for better communication and the use of artefacts. For this purpose in the next sections, we discuss the results that we have had: we obtained them by focusing on ethnography, video analysis and literature review.

2 Theoretical approach

We are considering what B. Rego et al. explained in their paper [2]: "Mixed-Reality technologies have the potential to improve remote collaboration between distributed team-members", thus considering a bad situation (or anything else that requires more coordinated collaboration in order to keep the safety firstly onboard), the effort of articulation work can

be increased by the fact that a "pre-training" in virtual reality and a collaboration in mixed reality have lots of benefits as discussed by S. Lukosch et al. [3]. VR for solving collaborative tasks "can improve performance time and mental effort in collaborative design tasks" and "can facilitate communication and discussion of engineering processes", all of this must be integrated with a spatial model of group interaction in virtual environments, as is threatened by S. Benford et al. [4], thus providing mechanisms for managing conversations between people, as well as interactions with other kinds of objects, in spatial settings. Usually, there is a lot of gap between the experience of virtual environments and physical reality, but M. Fraser et al. [5], and then P. Gurevich et al. [6] explained which are the limitations of the virtual world, thus how it is possible to limit the gap, in other words, how it is possible that "all the participant's experience increases the effort of articulation work", thus which are the connections between affirmative communication and artefacts in the simulator environment.

The use of technology onboard is not only a way to see some raw processed data, but it is a method for improving the conversation, action and for mediating cooperation. This data needs to be updated at an appropriate frequency, since not refreshing it frequently enough means that the cooperation and the decisions are based on out of date information, on the contrary, updating it too frequently means that it is counter-productive for the decisions mental effort. As mentioned above, the role of that technology (screens, monitors, etc.) is to teach to the sailors, in a way that with the learned skills is possible to achieve excellence (or, at least improve the effort) on chosen actions, as R. Beale claims [7]. In fact, research has demonstrated that the knowledge can improve the sailing, from the point of view of the decision fatigue (as demonstrated by R. McNamara et al. [8] and J. R. J. Hockey et al. [9]), thus improving effectiveness on sailing choices for avoiding obstacles (or trying to deal with them).

3 Method

Due to COVID-19, it was not possible for us to actually go and perform ethnography analysis of Maersk Training but instead we did an online trip to the Maersk Training and used videos of Maersk Training for our analysis. We had an interview with Per Larsen, who is the instructor at the Maritime Department at Maersk Training (in Svendborg, Denmark) he guided us through some simulator environments. We also used video analysis as a tool for ethnography to analyse Maersk training scenarios; these videos represent the actual environment of the Maersk Training thus allowing us to get as close as possible to the natural setting, that is learning about something by encountering it for the first time. So, for example, doing simulations is also performing actions in events encountered for the first time, increasing the crew knowledge. Usually, there is a lot of gap between the experience of virtual environments and physical reality, but in [5], and [6] are explained which are the limitations of the virtual world, thus how it is possible to limit the gap, but Per Larsen affirmed that the accuracy of their systems is like 95 up to 98% compared to the real world. Regarding the holism, that is focusing on the relationship between parts, for example, people are always communicating with each other in order to know the situation in other control rooms or in another place, as is possible to see in [1] 00:54 - 00:56, because supporting how people talk, is also supporting how they work in collaborative work. From the member's point of view, thus understanding other peoples' behaviour by focusing on their point of view, is possible to analyse the way in which the crew is training for acquiring new skills because of a different point of view. The training for an employer is fixed to be done every two years (from two up to five days, eight hours per day), in this way everyone's knowledge is up to date with all the events that can occur while sailing. Finally, talking about the say-do-problem, that is basically the judgements of the people behaviour, in the work environment.

3.1 Video analysis

We used video analysis, as described by Heath C. et al. [10], as a tool for ethnography. We had six videos from Maersk [a, b, c, d, e, f] training and the length of these videos ranged from 1 up to 5 minutes and one video in particular was a 30 minutes long documentary.

3.1.1 Fragmentation

Five fragments were taken from these videos, which were relevant to our research question. The size of each of these fragments was [10-30 sec]. (write about different fragments.)

3.1.2 Transcribe talk

Transcribing the talk actually helps us to analyse the talk and sounds in detail and to understand the actual meaning of the words in an environment. The talk in each of the fragments is laid down in a sequence, and the pauses between the talk is written in brackets(). The underlined words are being emphasised in the conversation and we have used colons in front of words to represent how a word is stretched out. "!" is used before words which are said quietly and "." is used for mini pauses. Double brackets(()) represents the events or description of events. "****" is a missing word or the words that are not properly understood.

3.1.3 Transcribe the visual conduct (gestures)

Transcribing the talk only would not give the proper information and the meaning of the talk; therefore, we have transcribed the visual conducts like gestures in the talk. These gestures are represented inside double "/" on both sides. Transcribe the material conduct (artefacts): In our case of the Maersk training and considering our research question which is related to the affirmative communication and the artefacts, It was really important for us to transcribe the artefacts and to analyse which artefacts which are used during the talk and how they are used. The description of when and how an artefact is used in the fragments is represented between "*" on both sides of the description.

3.1.4 Topic of the transcribed video

For our analysis we will be using one specific video [d] where the training of the complete oil rig crew is happening, In the simulation, the trainer simulates a situated action where the exercise starts with a safety issue, a broken strap which causes one of the containers to drop and causes oil leakage. During the entire video, the crew and the captain are trying to communicate with each other in order to manage this problem. As is possible to see and to hear, "the communication is vital": it is the most important thing for making everything work well like a "well-oiled machine". For our case we have selected a few interesting parts from the Engine control room, Bridge, Rig floor to be transcribed, in particular, these are:

1. 00:34 - 00:50
2. 01:22 - 01:38
3. 01:43 - 02:00
4. 02:25 - 02:35
5. 03:50 - 4:11 (collision)(Broadcasting)

The different control rooms where we manage to retrieve results are bridge, engine control room, rig floor, oil well doghouse and on-shore control room.

4 Results

In this section, we will discuss the different results from our video analysis and interviews. These results were achieved using the theoretical concepts of CSCW and the methods that are described in the method section of this paper.

4.1 Video Analysis

Following are the transcripts of the video fragments that are mentioned in the method section. Each of the transcripts describes the communication across different rooms of the Maersk training in detail in a situated action where due to a broken strap one of the containers fell into the sea causing oil leakage. Furthermore,

the transcripts describe the artefacts used in communication and visual conduct.

4.1.1 Transcript

A: Bridge Control Room

((Container dropped due to broken strap))

00:36 - 1st person - //pointing to the 2nd person in the room with his finger// speak with the boat (pause) //looking at the 2nd person// and tell them what's going on if they are happy to continue or::: ...

After receiving the message from the 1st person the second person carries on forwarding the message to the boat with a telephone receiver (Information Specific to the boat)

((Response from the boat))

00:44 - I'm not sure to continue, for now I've just seen that there are some substances leaking into the water

The response is given through a telephone with the speaker on so that everybody on the bridge can hear

((Response from Bridge to boat))

//The 2nd person looking down at the screen//

Picks up the phone receiver and gives the following message

00:49 - 2nd person- Alright, copy that

Marcell is updating the people in the control room telling them that there is a container drop. The others react saying that they have just been informed and they just received a call about that (duplication of information in order to make sure that everyone is updated). Marcell then asks other people's opinion about whether to continue or not, in a way to have different ideas and different inputs so they can evaluate the situation better from different points of view.

B: Engine Control room

((Person 1 briefing everyone in the engine control room about the situation))

01:22 - Person 1: //Person 1 looks around while talking to everybody in the Engine control room// One container fell at the sea (pause) this container was retaining our ::reboil, there is some oil spill so we will see

how much we have lost.

//Some people in the room listens carefully others interacting with screens and still listening//

01:32 -* Looking into the screen person 2 uses a walkie talkie to communicate * John come up please, We have some problems. We just lost the generator's thrust.

In B we can see how the crew is using a whiteboard for pointing out some notes as shared information. Person 1 is talking about the problem (oil lost) watching different screens, in other words, paying attention to the artifacts, for monitoring some parameters. The other one is talking to John, through a walkie talkie.

C: Rig Floor

((A broadcast message to all stations))

01:43 - Attention all stations, information we are already in situation red //The person communicating the message wants to alert everyone//

The message is heard in every room with the speakers

01:48 - //phone rings the person picks the phone// Rig floor, Dorit.

01:52 - say that again sorry. Do not ***, Do not ***.

* The person use the phone for communication and the information was just for one person on the rig floor with the speakers off *

* The second artifact we can see in this fragment is the loud sounding alarm with the red lights while the broadcast warning message *

In this part of the video it is possible to capture how the different rooms are interconnected with the technology for communicating: at 01:43 someone is talking about a red situation from a room and from the other rooms everybody is able to capture that knowledge. Then the person at the rig floor answers the phone by saying its position (the rig floor) in order to keep the others updated about that, and here we have an example of affirmative

communication, in which if someone doesn't understand something, he requests to repeat that and when someone is telling something important, he will say it few times in a row (01:52).

D: Bridge Control Room

02:25 - //one person talking on the phone and repeating for others// Number five is available.

Use of telephone to communicate

02:27 - // person 2 repeating and interaction with the screens// Number five!

02:28 - Turning number five.

Use of screens to follow the instructions

02:31 - //2nd person responses back while looking into the screen// Ok, we got trusted number ::6 on DP, trusted number 1 on DP.

Also here it is possible to see how they use the repetition of the important sentences, and how many people are collaborating together in order to repeat to each other this information in a way that the shared knowledge is the same.

E

((Broadcasting the collision message))

03:50 - // Marcell looking into the screen and speaking into a mic// *Uses a mic to broadcast the message*Attention on the rig, this is Marcell speaking, for you information we had a collision. //sounds worried//

03:55 - We had a collision with the supply boat, We had a collision with the supply boat. // other people in other rooms listening// *Use of speakers to listen to the message by Marcell*

03:59 - and at this stage we are trying to investigate. // everyone in other room start moving out//

04:04 - I require everybody to go to the alternative master station.

04:08 - I require everybody to go to the alternative master station.

In this part of the video, Marcell, is talking about a collision. Thanks to the screens he is able to try to investigate that,

meanwhile he is talking in a broadcast way in order to ask everybody to go to a specific place (the master station in this case). So here it is possible to see that in these situations a communication one to many is mandatory to solve the problem as effectively as possible.

In all of the above Transcripts, we can see that there are different artefacts used for communication. The most common artefact that is used is the telephone and the speakers, but we can also see some other artefacts like a walkie talkie and alarms with red lights being used to communicate or to insure awareness across different rooms of the Maersk Training. The responses to the communication usually are the confirmation of the information received which is affirmative communication, or it is some other information that is exchanged. In many of the cases, we also see that the response to information received would be interaction with different screens and changing the parameters. Analysing the above transcripts, we came across three different types of communication and a variety of artefacts used depending upon the type of communication. These three types of communication are discussed below with the artefacts.

- *One-to-one Communication:* As the name suggests in most of the transcripts we can see that there is a one-to-one communication carried out when there is a need to communicate some information to only one person in a particular room. In Transcript C, we can see from 01:48 to 01:52 that the information was meant to be received by just one person on the rig floor. Therefore we see the use of the telephone as an artefact for the communication on both the receiver and sender's end. In Transcript B, we can see the use of walkie talkie as an artefact to communicate information to a specific person. In the Transcript D we notice an affirmative communication with the information sent and received with telephone and some interaction being carried out with

the screens;

- *One-to-many Communication:* In one-to-many communication we observed two different subtypes of communications. The first communication is a broadcast message meant to be received by many people in the same room. This type of communication can be observed in Transcript A and B. In Transcript A, we see the use of a speaker on the receiver's end of the communication when the message is passed onto the boat, but on the sender's end, a telephone receiver is used. In transcript B we can see the use of a whiteboard to brief people in the same room;
- *Broadcast Communication:* Although this is a one-to-many communication, we differentiate it from the first type of one-to-many communication because here the message that is being communicated is not only meant to be heard by different people in a specific room but the entire setup and every room. This type of communication can be seen in Transcript C and E, where one message is communicated to all the stations or rooms. In both cases, the type of information communicated was a warning. Therefore, there was a need for the broadcast of the information across different stations. This type of communication is carried out in the same way as the first type of one-to-many communication and the artefacts used are a microphone or telephone used on the sender's end and a speaker used on the receiver's end, but in addition, we observed the use of alarm sound and red lights buzzing in different stations.

5 Discussion

In the results discussed in the previous section, we can see three different types of communication which are one-to-one communication, one-to-many communication (communication with one person in a room) and the broadcast communication which are usually the warnings given to people in different rooms. We can also

see different artefacts used for each type of the communication for example use of telephone and a walkie talkie in one-to-one communication and use of speakers and telephone to communicate messages to many people in a specific room and the use of telephone, microphone, alarms and lights to broadcast messages and to warn across the whole stations. This detailed analysis of the communication and artefacts would help the developers to develop and use the right type of artefact for each type of communication when developing the Maersk training in a Virtual reality setting thus allowing affirmative coordination between the different participants present in different rooms. The smooth communication between different participants will enhance the coordination that is required to carry out the different tasks in a situated action like the one analysed in the video analysis where a broken strap has caused an oil leakage and to handle the situation strong coordination, and increased efforts of articulation work are needed. The Virtual Reality setting with strong affirmative coordination and the right use of the artefacts for each type of communication would result in participants experiencing the same level of articulation work and would actually represent the actual environment of the Maersk Training which will result in fewer errors in the actual environment. Also, to allow participants to train in a single virtual reality setting from different geographical locations, smooth communication is really important so that the participants can coordinate as they were present in the same location. This paper helps that problem by giving a detailed analysis of the types of communication and the use of artefacts.

Conclusion

What is the connection between affirmative communication and artefacts in Maersk Training control room? This research question guided us among a research-based teaching method in which we have been able to define a context, and through different techniques, answer the starting question. As explained above, we used ethnography, video analysis and liter-

ature review as methods for figuring out some information, and we have been able to participate in an online-trip made by Maersk Training in its simulator environment.

Thanks to that, we managed to analyse the case and give some useful information to CSCW research, to people working at Maersk Training, and last but not least to us, indeed we learned a lot about how to do a research-based project, how to read through papers and how to use ethnography as a tool for gaining information. The research-based teaching also helped us investigate our research question which was to find the relation between the affirmative communication and the artefacts and using all the techniques mentioned in the papers we were able to answer it by describing the different types of communication carried out in Maersk Training and linking different artefacts with each type of communication.

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