MONALISA 2.0 - Activity 3

Define a road map for deployment of the refined B-BS process in MoS

MONALISA 2.0_Deliverable 3.3.1

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1 Foreword

D 3.1.8 presents a general recap of the application of a Human-Centred Design (HCD) approach to the introduction of a B-BS ICT tool to the maritime domain to outline hypothetical guidelines of the application of a HCD approach to the development of an ICT tool in a maritime context.

Herein all the activities performed during the process are describe, from context analysis (D 3.1.2), to the profiling methods to create fictional characters and working environments (D 3.1.3) to the usability/acceptance evaluation (D 3.1.6) phase of the B-BS ICT tool, which is the core of the HCD approach and illustrates how the profiling results were used to define the users and deal with real seafarers while using the B-BS ICT tool.

The highlighted pros and cons of these research activities provides an understanding about the efficiencies and inefficiencies that need to be taken into account in the implementation road map for the application of a HCD approach to the MONALISA 2.0 project.

Moreover, in this D two additional collateral initiatives will be presented by the Italian Ministry for Transportation in order to spread and strengthen safety culture in the maritime context.

2 Introduction

The goal of this Deliverable is to outline the possibility and repeatability of the application of a Human-Centred Design process for ensuring usability in ICT tools development in a maritime context.

Hereinafter all the steps of User Research and Usability implementation activities in Sub Act 3.1 will be recalled and strong points and weaknesses of the process will be highlighted.

According to the standard definition in ISO 9241\(^1\), the HCD approach is the process to implement usability goals of systems, with the foreword that they have to be arranged according to users’ needs and defined tasks, rather than asking users to adapt to already developed ones. The starting point of the HCD process in 3.1 sub-activity in the MONALISA 2.0 project were the IMO guidelines in e-Navigation Strategic Implementation Plan which proved themselves useful, even if about navigation-related software. The drafting of these IMO guidelines has only recently ended, so their effective applicability could only be evaluated in a short time. The MONALISA 2.0 project, which considers the application of a HCD approach to the development of a ready-to-use ICT tool in a real

\(^1\)ISO 9241-Ergonomics of human-system interaction - Part 210: Human centred design for interactive systems
working environment, has proved itself as a good test bed to collect information and to check and rearrange, if necessary, the process as presented in the guidelines. It was useful to have the chance to start a dialogue with the researchers from another EU project, the CyClaDes one, which promotes the increased impact of the human element in shipping across the design and operational lifecycle. MONALISA 2.0 project shares with this the efforts made to involve the ship-owners, the development team and the seafarers along with the key role of the usability/User Experience experts in the ICT tool evaluation and implementation in all phases of development. It was useful to share results since MONALISA 2.0 has a practical approach, while CyClaDes has a theoretical one, whereof one\(^2\) of the stated goals is to regulate the HCD process through an additional, voluntary certification of maritime ICT equipment.

Usability certification of equipment could be used by designers and developers to demonstrate their competence in offering products with higher usability than their competitors. Ship owners could contract shipyards to implement equipment with a usability certificate.

Equipment with better usability typically supports the users in performing their tasks more efficiently and effectively. This could lead to a higher satisfaction and alertness in performing the tasks. Thereby it could also result in safer operations and thus safer shipping.

### 3 Context of use

The first phase should be considered to be a general and explorative stage to be performed before the start of the design in order to identify the actual conditions under which the software is used, or will be used in a daily working situation.

The first step was a strategic meeting with the ICT tool development team in order to share thoughts about the design process and the expected goals. Unfortunately, the design process was already started, for timing reasons, when this process was performed in the MONALISA 2.0 project. At this point, it was possible to see that the developers did not know about the benefits of a HCD approach, as to say reducing unnecessary re-design stages and focusing on the functionalities which are fundamental to real users only by getting to know final users and a realistic scenario in which the software would be used.

This shortcoming made it difficult to accurately apply the HCD approach during the first phases, considering the difficulties in communication between the developers and another category of professionals, whose role was unclear for them. These difficulties were also clear in the definition of the hierarchical task analysis (HTA) (see D 3.1.3) at different stages such as:

\(^2\) CyClaDes project Deliverable 2.1 Part E - Handling of usability requirements from a regulatory perspective
• Identification of the main activities that different users should perform within the software with the development;
• Sharing of results gained through the HTA with the development team.

In regard to the definition of the main activities, the explanation to the development team of the distinctions between the activities that different users need to perform with a B-BS ICT tool and the software designed functionalities was most critical. An important purpose of the HTA in fact is firstly to define the main activities of the users within the software and then to translate them into software functionalities. In this case, it was hard to identify the main goals, firstly with the development team without considering the software functionalities already implemented.

With respect to the sharing of the results gained through this activity, instead, the main issues were related to how to translate the activities identified into software changes that could improve the following version of the ICT tool.

For the same reasons as of the unawareness of the HCD process mechanism, it was complicated to arrange the interviews with the final users since it was difficult to persuade an Italian ship owner to let crew members be interviewed about their habits during work shifts and in using new technologies (i.e. smartphones, tablets, personal computers) at work and/or in their free time. Even if the goal of this activity was clearly explained to be aimed to create personas and scenarios, the consulted ship owners mistook it for an official interview on a voluntary basis by the Italian Ministry for Transportation for a formal assessment; so they decided to decline.

The contrived choice to interview Spanish crews of CIMNE pilots on the one hand permitted User Experience researchers to collect the desired information to create users and context of use archetypes, but on the other hand it created a discordance later to set the evaluation activities with users, who were Italian, as explained in 3. Evaluation of use. For all the previous reasons, this first phase was probably the most critical one in the HCD process, but it was essential to make the ground for all the other activities involving the development team and maritime subjects.

4 User requirements

User Experience researchers presented the results of the interviews with Spanish crews as personas and scenarios to development team (as in D 3.1.3) in order to help them in identifying the essential functionalities needed to satisfy the users’ needs.

Using realistic characters with a maritime background allowed the developers to really understand the context, since they, according to their own admission, until that moment were not aware of real seafarers’ habits and needs and of the specifications of working activities in a maritime context.
Learning that the maritime population had little experience with new technologies and tools made developers realise that some software functionalities were too complex for the users’ real needs and knowledge (for a detailed analysis see D 3.1.6).

Furthermore, since the software presents a complex architecture, the sharing of these results was useful and strategic in this phase of the project because it became the basis of the choice and the prioritization of the sections and functionalities of the software that were tested with users.

5 Evaluation of use

As mentioned in D 3.1.6., evaluation activities were performed both with experts only and with the involvement of real users to focus on how well users could learn and use the software in order to achieve their goals and how satisfied they are with the process. As for the experts’ evaluation, through heuristics it was possible to investigate potential issues concerning the B-BS ICT tool. With regards to the difficulties related to this activity, the presentation of the results was rather critical. In particular, the main difficulties were related to the presentation of the output that this kind of evaluation delivered with remarkable emphasis on the violations (see D 3.1.6 for further details). The heuristic evaluation highlighted several potential critical issues which developers had never considered earlier and it was difficult, then, for them to accept some and to identify by themselves new technical solutions on how to re-design (an activity that should entirely carried out by the development team with HCD team external support).

In a HCD process, when involving real users is possible, usability testing with users is the most fundamental phase, since it provides direct information about how people use systems and what he criticalities are with the concrete interface being tested. In this phase of the project, seafarers were directly involved through a usability test on a beta version of the ICRT tool, that documented how the design satisfied usability requirements and that provided input for further improvements.

As early presented, for this session it was possible to recruit Italian seafarers only, given to the untimely and unexpected ending of Spanish pilot studies.

According to the “discount usability” approach with very few users, test participants should be as representative as possible of the intended users of the system, so a few average users were chosen (from a maritime context with habits and personal data that were similar to those of the personas) instead that a more significant number from outlier groups.

As extensively presented in D 3.1.8, test participants had quite severe problems in completing some tasks not for interface-related criticalities but for the contents. Even if a partial attempt was made by the experts, this proved the additional need to have trained
users with respect to those aspects of the interface that were unfamiliar to them but were not relevant and/or related to the main goals of usability testing. This was necessary even more since testing a beta version of the ICT tool in the maritime was a completely new tool for users, which have little and/or no experience at all in using new devices for working activities.

Given the nature of the Italian pilot study, which considered one session only of testing with seafarers, it was not possible to investigate the learnability dimension, as to say the usability aspects that need to be implemented so as to make it easier for users to learn how to use the software.

The acceptance evaluation was carried out to understand how users would consider the introduction of the B-BS ICT tool. With respect to this activity, the main criticalities concerned the administration of the questionnaire (see D 3.1.6) to evaluate seafarers’ acceptance of the B-BS ICT tool. In particular the evaluation revealed that, due to the operating methods, safety procedures and work shifts to whom seafarers are accustomed (and that in general the maritime domain often imposed), it could be challenging to involve users in a questionnaire compilation both for lack of time of seafarers and for different phases that a questionnaire administration could required, as for the instrument used to evaluate user acceptance (see before and after measurements of acceptance evaluation in D 3.1.6).

This phase was probably the more challenging for practical organisation issues (test participants’ recruitment, sharing of heuristic results), but it was the fullest of interesting results for design and development stage.

6 Produce design recommendations

In this phase the results of activities were shared with development team to give them a set of recommendations for designing or re-designing and ending the development of the software.

For communication and sharing issues between experts and developers, as recalled in 1. Context of use, it was more difficult to make them accept the results of activities with users and the subsequent proposals for the improvement of the software at the first attempt, showing them report and graphics.

Developers’ resistance was born by the wrong belief that User Experience researchers were offering them their personal opinions or preferences regarding testing results. During the presentation meeting, however, the development team was invited to see how experts derived their insights by videos and direct quotes from seafarers’ usability testing sessions. It is easier to remember findings them when it is possible to relate them to the user sessions that generated the findings themselves, instead than present them in reports (J. Nielsen, 2010).
Moreover, when developers heard by themselves actual seafarers make reasonable requests for a design that suits their needs, accepted more quickly the findings and found nearly instantly new improving design ideas that were going to work for users.

7 Conclusions

The application of a HCS approach to the development of an ICT tool in a maritime context was a complex process. It is no surprise, nor an isolated case, since, as indicated in ISO 9241, stakeholders’ acceptance of a HCD approach to systems development is critical and could be detected throughout all the advancement steps of the process. So, at the end of the research activities, it is possible to indicate the general issues about all the involved stakeholders’ (ship owners, ICT tool developers, seafarers) acceptance of a HCD approach.

In the maritime domain - as in others - the most common stakeholder reaction to a process implementation proved to be a general resistance to change. Indeed, it was argued (Beecham, Badoo and Hall, 2008) that the most onerous obstacle in introducing any new approach in a system development is the unwillingness of the concerned users to take it up. This resistance could effectively work even for the HCD approach which is intended to introduce gradual changes, that are based primarily on users’ suggestions. Moreover, there were organisational obstacles (Bauer, 1991) in recruiting professionals as participants to HCD activities, both due to the intense work rate and for the constricting physical working environment. In this case, the ship owners were not very willing to offer space and time to develop the research activities and they were also worried about a possible sanctioning approach of the activities with seafarers.

Developers’ and ship owners’ difficulties in understanding the HCD process, and in actively participating in it come from the lack of a clear explanation of HCD benefits in terms of time and money saving in the maritime context (the return on investment of usability, ROI), as broadly calculated in other working contexts.

On the other hand, as far as the debate about the effectiveness and ease in applying a HCD approach in maritime context is still in progress (Maguire M., 2011), there are many pieces of evidence in other fields (i.e. medical, aviation, aeronautical, transportation) of the positive effect of stakeholder involvement in knowing real users and of real users’ participation to the development stages. Through observation, interviews and testing it is possible to analyse and foresee how users are likely to use software before development goes to far. In practical terms, a HCD approach revealed itself in a more serene changes acceptance by users and a general improvement in working safety and performances (Endsley M.R., Boltè B., Jones D.G., 2003).

Moreover, MONALISA 2.0 project was a test bed to examine and test some topics of the guidelines on HCD by IMO: these guidelines do not refer clearly to the necessary recourse to experts (i.e. User Experience, Usability experts) for a focused and effective
support in some activities in HCD process, assuming that the guidelines themselves could be sufficient for the audience of stakeholders\(^3\), which are interested in developing, testing and evaluating systems, without further explanations on ROI benefits. Similarly, there is no a clear indication, benefit description and practical examples of user research methods (i.e. card sorting, contextual interviews, focus groups, heuristic evaluation, personas, prototyping, task analysis, usability testing, use cases).

MONALISA 2.0 project demonstrated that a process based on real users’ participation to development phases of an ICT tool permits to better understand their needs and goals and as a consequence to adjust development accordingly. Experts are fundamental to present and perform all needed research activities and to offer to all stakeholders the right interpretation of the results of activities with users, but the sharing of these evidences and, more generally, the explanation of HCD benefits (saving development time and stakeholders’ money) has to be improved to simplify and enhance all the process.

8 Beyond ICT tools – communicating safety culture through a HCD approach

8.1 Introduction

Seafarers’ safety is a critical component of the maritime context. As maritime organisations continually strive to improve, there is a growing internationally awareness of the importance of establishing a culture of safety. Achieving a culture of safety requires an understanding of the values, beliefs, and norms about what is important in an organisation and what attitudes and behaviours related to seafarers safety are expected and appropriate.

In line with this tendency, the Italian Ministry for Transportation decided to add two additional research activities with users in MONALISA 2.0 project, which are aimed to spread safety culture (as to say the set of enduring values and attitudes regarding safety issues, shared by every member of every level of an organisation) in maritime context through informative/formative materials, after investigating the existing extensiveness.

8.2 Safety culture questionnaire

The goal of the first activity with users was to assess the level of knowledge of safety culture in the maritime context to better direct raising awareness on this topic. To reach the biggest number of users and simultaneously to assure a depth analysis it was chosen to use a questionnaire to collect seafarers’ opinions.

\(^3\) In IMO guidelines, stakeholders include equipment designers and manufacturers, system integrators, maritime authorities and regulators, shipbuilders, ship owners/operators, Vessel Traffic Service authorities and Rescue Coordination Centres.
To choose the most appropriate questionnaire for maritime context, researchers conducted a review of the literature pertaining to safety, accidents, errors, error reporting, safety and organisational climate and culture. In addition, the researchers reviewed existing published and unpublished safety culture questionnaires. In particular, seven questionnaires were examined and at the end of a careful analysis on the topics, the Italian translation of the questionnaire that was developed by the American Bureau of Shipping\(^4\) was decided to be used, especially because it is the only one to be expressly developed for a maritime context.

The ABS safety culture questionnaire contains forty statements; five statements about each safety factor which participants are asked to rate, which are: communication (communications are open and effective), empowerment (individuals feel empowered to successfully fulfil their safety responsibilities), feedback (management responses to safety issues and concerns are timely), mutual trust (relationships are characterised by mutual trust), problem identification (potential problems are readily identified), promotion of safety (managers promote safety as a core value), responsiveness (crew members are responsive to the demands of the job, including unexpected events and emergencies), safety awareness (a strong sense of safety awareness pervades the organisation). Italian seafarers were asked to fill in the questionnaire by promotion through social networks and dedicated websites. The research activity is still on-going and the questionnaire is visible at the following links:

- **Italian version:**
  
  https://docs.google.com/forms/d/1zAoUxQ1h08LG7eWzqMMJ0Slb_r6bG9BWpDKWpYAJyGc/viewform?c=0&w=1

- **English version:**
  
  https://docs.google.com/forms/d/1jgDvwq6lVb59eCriEFe3Lb3T_4OBaXvX1lFZ5dA/viewform?c=0&w=1

The questionnaire is going to be online until the achievement of a statistically significant number of answers.

### 8.3 MIT communication tools

Besides and simultaneously with the Safety Culture Questionnaire development, the Italian Ministry for Transportation began also a process to realise a series of communication tools to spread safety culture related topics to increase seafarers’ consciousness.

To reach this goal, several activities with users were carried on:

- Interviews with 3 expert witnesses to understand their previous knowledge, their habits and needs with the aim to define the topics to be included in the

\(^4\) Guidance notes on Safety Culture and Leading Indicators of Safety (ABS, 2012)
communication tools and to investigate their use experiences of health and safety on board materials;

- A focus group session with a small group of 6 expert seafarers to categorise their formative/informative needs and the assess the first graphic solutions proposed by the communication team;

- An iterative evaluation in two sessions with 10 and 11 standard seafarers each to test their reactions and interactions with the drafts of the communication tools, considering in particular the comprehensibility of text, the intelligibility of illustrations and coherence of the general disposal of elements.

The results of these research activities permitted to specify the incorrect behaviours that more frequently lead to injuries. It was possible, then, to realise a series of prevention safety posters to help raising awareness amongst crewmembers of some of the common causes of injuries on board accidents and thinking about the potential consequences of not taking the correct action before it is too late.

Furthermore, it was realised a booklet on the principal “rules” about safety culture applied to maritime context with direct references to most common injuries and wrong attitudes by individual seafarers and related to organisational issues.

All the tools are available in a repository of the Italian Ministry for Transportation and of Ergoproject Srl.
9 Bibliography

The complexity of this essay does not allow you to insert the bibliography “quote by quote”. We chose to collect all the used sources below, indicating the language in which they were made.

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39 partners from 10 countries
taking maritime transport into the digital age

By designing and demonstrating innovative use of ICT solutions
MONALISA 2.0 will provide the route to improved

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