Usability Analysis and UX Design Recommendations for an Enhanced User Experience of O.R.I.O.N, the Technical Documentation Digital Viewing Platform

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Abstract

The O.R.I.O.N platform is a digital tool/interface used to access Airbus Helicopters technical documentation for maintenance operations. In this human factors study, we sought to test some functionalities that could enhance user experience with the tool and facilitate access and interaction with the technical documentation provided.
After conducting an expert ergonomic evaluation, as well as a user's needs study, we integrated some of the results concerning interactivity and navigation in a software mockup inspired from the current O.R.I.O.N platform using FIGMA, an open source prototyping software. This mockup, which included the new proposed UX (User-eXperience) functionalities was tested using several objective measures such as number of clicks and reaction times, as well as subjective measures such as questionnaires and debriefs.
The results showed a statistically significant improvement when technicians used the new mock-up versus the older version of the platform in performance (faster and more accurate), usability, satisfaction, and in some cases overall safety. The study allowed us to validate this Human Factors methodology use-case as part of Airbus Helicopters support and services' continuous improvement, especially for accompanying IT development and having a validated, intuitive, and satisfactory interface design right the first time and thus economizing on overall costs. It also showed that small easily implementable changes could make a big difference for the end-user and for Airbus in general.

1. INTRODUCTION

The O.R.I.O.N platform has consistently proved its *effectiveness* in displaying and navigating technical documentation, highly useful for and appreciated by helicopter maintenance technicians. In this Human Factors study, we focused on the other two important aspects of usability: *efficiency* and user *satisfaction* (ISO 9241, (2008)).
Efficiency would reduce the workload needed to complete a task accurately; and user satisfaction improves the users' comfort and sense of easy accomplishment. Additionally, having a more competitive, intuitive, and satisfactory interface will ease and secure access to maintenance documentation for Airbus Helicopter products.
Modern aircraft are increasingly technologically complex and inspection is increasingly specialized. With this complexity comes more elaborate maintenance procedures and more workload and time pressure for the technicians. Additionally, it has been noted that as time passes technicians are becoming less specialized on average compared to older generations of mechanics. All of this results in an environment that predisposes humans to err and affects human performance.
An ATSB study (Hobbs. A, (2008)) has shown that technicians spend 25-40% of their time dealing with and navigating technical documentation rather than doing the maintenance itself. It is safe to conclude that as far as technicians are concerned, there is a growing distrust in the documentation.
While this study does not tackle the quality of the content of technical documentation (content issues are currently the object of other HF studies) we hypothesize that enhancing the usability (access, interactivity, easily accessible functions, user experience) will facilitate the cognitive load of technicians (Albers.J, (1997)) and help them economize time and energy to access and prepare their work cards, and concentrate on the maintenance activity itself. We also believe that this could help to a certain extent bring back confidence

in the deliverables that are provided. A better interface projects more seriousness and trust, as shown by Wang and Emurian (2005).

2. METHODOLOGY

2.1 General

Usability is defined as « the extent to which a system, product or service can be used by specified users to achieve specific goals with **effectiveness**, **efficiency** and **satisfaction** in a specified context of use » (ISO 9241-11, (1998)). A product with a good usability would therefore allow us to reach our goals with precision (*effectiveness*), without spending more resources than necessary (*efficiency*), and pleasant to use (e.g. with aesthetic qualities, easy to use) (*satisfaction*).

In this study, we followed the UX research methodology by firstly doing a user's needs analysis and expert evaluation of O.R.I.O.N, which allowed us to build a design solution (hereafter referred to as prototype or mock-up) using FIGMA, and finally to evaluate these design solutions with terrain evaluations.

2.2 Expert Evaluation

We used the 247 items of Travis' Web usability guidelines (Travis,D. (2009)). These are criteria that guarantee the usability of a web interface, distributed in 9 categories. The 8 categories analyzed are the following: Home Page (contains 20 items), Task Orientation (44 items), Navigation & IA (29 items), Trust & Credibility (13 items), Writing and Content Quality (23 items), Page Layout and Visual Design (38 items), Search (20 items), Help, Feedback and Error Tolerance (37 items). The items are rated 1 if the item is in conformity with the observed interface, 0 if it is partially in conformity, -1 if it is not in conformity. The item is not filled in if it is not applicable to the evaluated system.

We chose to do this analysis on two technical documentation interfaces, O.R.I.O.N and another available reference for electronic technical publications comparable to O.R.I.O.N, which had good feedback from technicians we interviewed. We chose to do the evaluation on the other reference interface so we can have a basis of comparison with the O.R.I.O.N interface.

Figure 1 : Results of Expert Evaluation on O.R.I.O.N

The key points that can be identified from this evaluation of O.R.I.O.N are the categories with the lowest scores of compliance, which are Task Orientation (48%), The Home Page (53%), Help, Feedback and Error Tolerance (55%). In these categories, we will probably find areas of improvement.

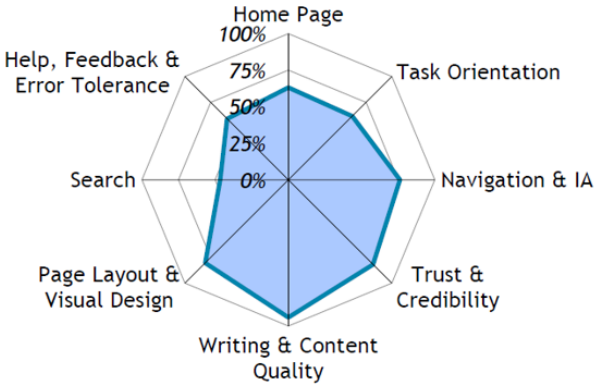

Figure 2 : Results of Expert Evaluation for the Reference Interface

The lowest rated categories are Search with 47% of compliance, Help, Feedback & Error Tolerance with 59% and Task Orientation with 62%.

It is interesting to compare the results on the two interfaces and observe what works well or less well on one or the other. It gives us clues and leads on how to improve O.R.I.O.N. For example, The Trust and Credibility category was better on the other reference interface because it contained more information about the people behind the website, the company, and how to contact them in case of a problem. These results are, for this study, only

preliminary indicators for potential areas of improvement and attention points for the user experience study.

3.2 Users' Needs Analysis

We conducted a study with O.R.I.O.N users to analyze their needs regarding the platform. We made a questionnaire and interviews to know more about what they liked or disliked about O.R.I.O.N, their use of the documentation and what were their suggestions for improvement according to their needs. We also collected usability scores on the SUS (*System Usability Scale*) scale, which is a 10 item scale, based on the ISO 9241-11 standard on usability. It is presented as a Likert scale from 1 to 5.

3.3 Conclusions of the Analysis

According to the SUS score (70.3) and all the feedback made by the technicians, we can say that there are no major problems with the usability of O.R.I.O.N (at least with the effectiveness part, less with efficiency and satisfaction). Most technicians prefer this interface to the paper format they had in the past, and think it is a pleasant tool to use. The most common positive comments were about the search functionality and the ease of use. Regarding the negative comments, by taking all the disliked items about O.R.I.O.N into account, 5 items mentioned 19 times (48.7%) were directly related to the content of the documentation (with the first one being a general category for all aspects of mistakes, omissions, inconsistencies), and 7 items mentioned 20 times (51.3%) were related to user experience issues.

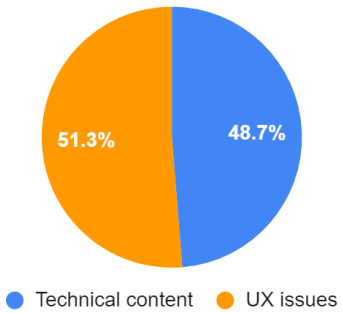

Figure 3 : Issues Related to User Experience and Technical Content of the Documentation

These results confirm that it is indeed useful to work on efficiency and satisfaction even if the system is already effective, and that UX issues constitute real irritants that could improve the navigation and use of the technical documentation.

3.4 Designing a solution

We sorted out the improvement suggestions based on participants and from the expert evaluation, and worked with the O.R.I.O.N development team to find out what was feasible and what was not. We designed a mockup integrating the improvement suggestions. The objective of a mockup is to evaluate possibilities of improvement, and leave some room for criticism and other improvement ideas. We designed a dynamic mockup on Figma in order to test it with O.R.I.O.N users and determine what really improved the navigation and the interactivity of the interface. This dynamic mock-up looks and acts very similar to O.R.I.O.N but in a simplified way, as it does not contain the entire catalog, however it allows us to test out new functionalities without going through IT development.

We included 15 suggestions for improvement in the mock-up that fell into three categories: system interactivity (7 suggestions), navigation (6 suggestions) and brand image (2 suggestions).

Among all those suggested recommendations from our study, we will give only two examples here to illustrate the changes we have brought forth. The following design change has been integrated to improve the navigation on the platform: the addition of a forward arrow which allows easier navigation between publications. This addition provides easier access for technicians who often have to go back and forth between different parts of the manual. The lack of it was declared to be a source of frustration.

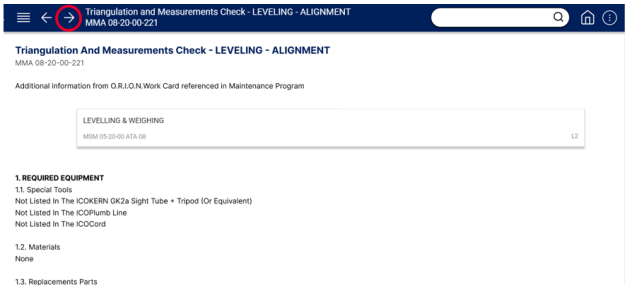

Figure 4 : The Addition of the Forward Arrow

Another example which illustrates a change improving interactivity of the interface: we added an insert on the homepage that allows you to go back to the recently consulted publications when you return to the website. This allows technicians to have quick and easy access to work cards that have been recently consulted.

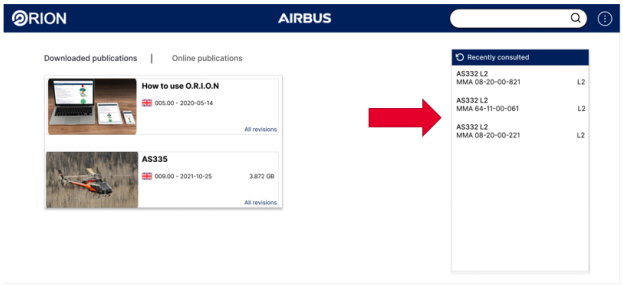

Figure 5 : The Addition of Recently Consulted Publications on the Homepage

3.5 Test Protocol

To evaluate the mock-up, a user test is necessary to collect feedback from the population that will benefit from the product. User testing is used to evaluate the UX of a system by observing how users perform their tasks. It is a combination of quantitative and qualitative methods which allows us to collect precious feedback on the evaluated objects. To compare the usability and the interactivity of the actual version of O.R.I.O.N and the mock-up, we performed a usability test with different scenarios (for instance asking participants to find tutorial videos or consult two work cards at once) once on O.R.I.O.N and once on the mockup in random order. Participants also answered a questionnaire and a semi-directive interview.

In order to test this prototype with technicians, we went to an Airbus Maintenance, Repair & Operations center (MRO) based at Kassel-Calden Airport, in central Germany.

3.6 Procedure

Participants were greeted, seated at a computer, and briefly told the purpose of their participation. The participant is informed at the beginning of the session that he or she will be testing and evaluating a prototype. Participants started with a short online questionnaire to give their consent and fill out socio-demographic data such as their age or profession (all the questionnaires were tested to see if they were understandable). Then, half of the participants started by completing the tasks on O.R.I.O.N, and the other half started by completing the tasks on the model. This was done to randomize the trials and to make sure there is no bias due to order effect. There were 6 scenarios to complete on O.R.I.O.N and 12 on the model. The reason why there are more scenarios on the mockup is that it offers features that were not available on the original interface. After this first part, the participants filled out a second questionnaire about the interface on which they had just completed the first scenarios. The questionnaire contained the SUS scale, already used for the investigation questionnaire, measuring the usability of a system. After the questionnaire, they did the scenarios on the other platform and completed the related questionnaire. We collected data from the same scales in the two questionnaires to see if there was a significant difference in the usability and interactivity between the results of the two versions. We finished the protocole with a short semi-directive interview. This experimentation took generally from 45 minutes to one hour.

3.7 Metrics

In addition to the data from the questionnaires, we collected the duration of the tasks, the number of clicks and the paths taken by the participants on the interface to complete the task. These data were compared to the theoretical shortest path, as well as to a theoretical number of clicks needed to complete the task using the shortest path. These paths and number of clicks were on an observation grid, which allowed us to directly compare with the participant's performance. The participant’s performances have been recorded with the software Microsoft Step Recorder. The number of clicks and the access path serve as metrics to measure the difficulty of navigation, in terms of access to the information or the functionalities sought. It also reflects the interactivity of the system, because the pace of interaction with the system and the accessibility of the content are elements that are part of the perceived control over the system and are indicative of interactivity (Wu, 2006).

3.8 Participants Sample

There were 11 participants, with a mean age of 38 years. All were men except one. The sample was composed of five technicians in mechanics, three technicians in avionics, one mechanical engineer, and two people from certifying staff. Each of them was familiar with O.R.I.O.N.

4. RESULTS OF FINAL EVALUATION

4.1 Results from the Questionnaires

The scores for the SUS scale (spread from 0 to 100) increased from 55.2 for O.R.I.O.N to 82.5 for the mock-up on average for all participants. To see if the difference of scores is statistically significant, we applied a paired-samples t-test. The paired-samples t-test compares subjects with themselves (i.e. their score for one version of the interface vs. their score for the other version). The result of the t-test ($t(109) = -9.849$, $p<.001$) shows that there is a significant difference between the usability scores of the two versions, the usability score of the mock-up is significantly higher.

4.2 Results from the Interviews

100% of the participants think that interactivity is improved with the new mock-up, and 100% think that navigation is improved as well.

4.3 Results from the Collected Objective Metrics

	Theoretical clicks		Actual Clicks		Duration in sec.		Success Rate %	
Scenario	OR.I.O.N	Mock-up	O.R.I.O.N	Mock-up	O.R.I.O.N	Mock-up	O.R.I.O.N	Mock-up
1	1	1	10.3	2.09	1.2	0.18	30	100
2	5	1	9.25	1	2.28	-	36.36	100
3	6	6	12	7.8	2.42	0.53	36.36	45.45
4	4	3	4.5	3	0.32	0.16	81.81	100
5	2	2	2	2.58	0.27	0.30	100	100
6	2	1	5.2	1	0.17	0.08	90.90	100
Total	20	14	43.3	17.47	7.46	2.05		
Mean	3.3	2.3	7.2	2.9	1.18	0.25	63	85

Figure 6 : Table showing the different objective measures of performance and accuracy taken for the 6 comparable scenarios in O.R.I.O.N and the mock-up

On top of the questionnaires, we collected objective metrics to test and compare the efficiency of the two interfaces. We could compare the average time of completion of similar tasks in seconds (in total, 7.46 on O.R.I.O.N and 2.05 in the mockup), therefore significantly faster reaction times. We could also compare the success rate of all the scenarios (percentage of people who successfully completed the scenario task): 63% on O.R.I.O.N vs. 85% for the mock-up. The number of clicks is also significantly smaller in the mock-up (17.47) than O.R.I.O.N (43.3), and interestingly, the number of clicks performed on the mock-up (17.47) is much closer in number to the projected theoretical clicks or fastest possible way to complete the scenario (16) than it is the case for O.R.I.O.N (for the 20 projected theoretical clicks determined by us, participants did 43.3 actual clicks instead). This shows with certainty that the design of the functionality and the reality of their usage are quite far off when it comes O.R.I.O.N, and by implementing the suggested changes in the mock-up, participants behaved as we projected them to, and this caused them less frustrations related to searching and sometimes not finding (or not fast/easily enough) what they are looking for in the interface.

5. DISCUSSION AND CONCLUSION

We applied a UX research, usability, and human factors methodology to enhance the efficiency and user satisfaction of O.R.I.O.N as part of our engagement for continuous improvement and client satisfaction and safety. The methodology consisted in three phases which are discovery, design, and evaluation. The results are very promising as they show that usability was significantly improved using this methodology, and moreover, taking directly and upstream into account the user's needs before designing solutions was very beneficial in delivering the expected results. The proposed recommendations are continously making their way into updated versions of O.R.I.O.N. Furthermore, the study validated a more cost-efficient methodology since prototyping based on prior user needs and HF expert evaluations are more cost effective than having to make changes once a design solution has been developed by IT and implemented in the interface. It also helps reduce the technician's cognitive workload by facilitating interactivity and having more intuitive designs. Lastly, this brings us one step closer to reclaiming technicians' trust and confidence in maintenance technical documentation and the Airbus Helicopters brand.

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