Museum Affinity Spaces

www.masproject.eu

Collaborate. Learn. Include

Deliverable D23

Formative usability report on the early and final prototype of the MAS Portal

Authors: Stefania Savva & Nicos Souleles

Museum Affinity Spaces (MAS): Re-imagining Museum-School Partnerships for the 21st century through a Multiliteracies Lens

DIDAKTOR (POST DOCTORAL RESEARCHERS) - POST-DOC/0916/0248

ΙΔΡΥΜΑ ΕΡΕΥΝΑΣ ΚΑΙ ΚΑΙΝΟΤΟΜΙΑΣ

ART+DESIGN elearning lab

Cyprus University of Technology

Formative usability report Deliverable 23

Executive summary

This deliverable demonstrates the initial and final usability report of the MAS-Portal website. Providing front end solutions is important to improve usability, findability and user experience. This deliverable provides an overview of the results from usability reports, used to identify, update and integrate, continually, the requirements for developing the MAS Portal, the website of the project. The preferred methodological approach towards this end, involved participatory design (PD), grounded in established User-Centred Design (UCD) frameworks, which also involved Usability and User Experience (UX) methodologies.

The bulk of the data collection took place in the first six months since the project initiated. All strategies are mentioned explicitly in this document, and presented in relation to different specifications and design artefacts and functionalities of the MAS Portal.

Overall, the insights from educators and students significantly benefited the development of the different tools for the MAS Portal Infrastructure, and benefited the project holistically. Any feedback was incorporated into the design and were addressed by the MAS team to inform the next stage of development. The completion of this work was realised in M10, according to WP5, however improvements and user feedback is considered throughout the project life cycle.

Table of Contents

1. Introduction 4
   1.1 Overview of WP5 Tasks in M1-M10 4
   1.2 Resources and Opportunities 5
2. Conceptual and Methodological Frameworks 5
   2.1 Overview of the WP5 Frameworks 5
   2.2 Synopsis of Key HCI Concepts Applied in MAS 6
   2.3 Objectives of the PD work 7
   2.4 Three major UCD approaches 8
      2.4.2 Remote PD Approach: Core Group of Educators 9
      2.4.3 Researcher-based Analytical Evaluation Approach 9
   2.5 Strategies for Managing PD Work 10
      2.5.1 Challenges 10
      2.5.2 Structuring and sequencing the study programme 10
3. Participant profiling 11
4. Overview of Results and Recommendations 11
   4.1 General Findings 11
   4. Findings from different user populations and study methods 12
5. Conclusion 13
6. References 14

1. Introduction

1.1 Overview of WP5 Tasks in M1-M10

The overarching goal of Year 1 of the MAS project, was to complete the development of the project website, the MAS Infrastructure including the MAS Portal repository, MAS Hub, MAS Archive and MAS Cabinet application. This deliverable provides an overview of the results from usability reports, used to identify, update and integrate, continually, the requirements for developing the MAS Portal, the website of the project. The preferred methodological approach towards this end, involved participatory design (PD), grounded in established User-Centred Design (UCD) frameworks, which also involved Usability and User Experience (UX) methodologies.

The bulk of the data collection took place in the first six months since the project initiated. All strategies are mentioned explicitly in this document, and presented in relation to different specifications and design artefacts and functionalities of the MAS Portal.

In general, the approach involved providing educators and students with access to prototypes of parts of, or the whole system, in increasing levels of fidelity, in some cases iteratively to refine according to feedback on the usefulness, enjoyability, learnability, memorability, effectiveness, and other pragmatic and aesthetic qualities. Where possible, and given the time and staff restrictions of the project, a number of complementary human-computer interaction approaches where adopted adapted for PD data collection and analysis.

We also incorporated a number of complementary HCI approaches, which were adopted and adapted for PD data collection and analysis. Some include:

- *-2 Face to face workshops with certain engaging activities that encourage participants to provide feedback on the artefacts under investigation;*
- *Online Core Group Educators with 12 participants from nine countries in Europe;*
- *Heuristic Audit Evaluation applied to evaluate the MAS Infrastructure.*

All activities undertaken as part of the formative usability work for the MAS Portal prototype, were taken with consideration of the contextual restrictions in mind, such as the limited timeframe of the project team, the heavy workload and busy schedules of educators and students. For WP5 tasks to be delivered, it required substantial inputs from WP1, WP2 and WP3. Besides, WP5 unfolded keeping in mind the tasks in WP6, concerning the community building recruitment of teachers/schools and museum educators/museums and with WP7, to scope the focus of the respective evaluative activities.

1.2 Resources and Opportunities

The IT MAS team member in collaboration with the Multimedia designer, begun preliminary work specifications of the MAS Portal and have handled the reporting of it. All team members worked to engage participants for the usability reports, conduct evaluations and report them. These insights in return informed aspects of WP3. In-school and in-museum studies were supplemented with other methods, to accommodate for physical limitations and therefore we conducted evaluations remotely on a regular basis and used a core group of educators.

2. Conceptual and Methodological Frameworks

2.1 Overview of the WP5 Frameworks

One critical aspect of the design methodology for MAS, lays in co-creation and involving representative end-users of the final system, both educators and students, who will understand the requirements for such a system. In this respect, it was important to engage end-users in the design process and to encourage them to provide creative input. This will ensure as much as possible that the final system will correspond to the needs of a wide range of educators, other practitioners and students. The intention is that they will choose to use it and find it effective, enjoyable, satisfying, efficient and worthwhile. To achieve this goal, we looked into successful examples of designs by experts in pedagogical frameworks, educational technologies, and human-computer interaction paradigms. Still, it was highly valuable to have design input and feedback from user communities, especially in terms of usability and user experience.

WP5 overall focused on formative evaluation to identify diagnostic information how to improve the system under development. The approach involved providing educators and students with access to prototypes of parts of, or the whole system, in increasing levels of fidelity, in some cases iteratively to refine according to feedback on the usefulness, enjoyability, learnability, memorability, effectiveness, and other pragmatic and aesthetic qualities. Where possible, and given the time and staff restrictions of the project, a number of complementary human-computer interaction approaches where adopted adapted for PD data collection and analysis.

The completion of this work was realised by M10, according to WP5, however improvements and user feedback is considered throughout the project life cycle.

2.2 Synopsis of Key HCI Concepts Applied in MAS

It was decided to summarise here the key HCI concepts applied in MAS, namely, *User-centred Design (UCD), participatory design (PD), usability, and user experience (UX).* We present a synopsis of these concepts in order to provide a backdrop of our empirical and analytic work.

UCD is a broad philosophy which involves users in the process of designing a system from the early conceptual phase, to the final deployment phase. This ensures to a greater degree high usability and thus higher acceptance and adoption. UCD has been the cornerstone of the field of Human-computer Interaction (HCI) since the 1980s. It is considered optimum to use the UCD framework for enhancing software development processes.

UX, broadly speaking, descends from UCD, focusing on the experiential aspect of human-machine interactions. User experience has seen significant shifts of emphasis along several dimensions in the past 15 years: from cognition to emotion, from pragmatic to hedonic, from productivity to experiential quality, from quantitative to qualitative methods, and some other evolvements (e.g., Hassenzahl, 2008; Hassenzahl & Tractinsky, 2006; Bargas-Avila & Hornbaek, 2011; Law et al., 2009; Vermeeren et al., 2010).

What contributed to this shift is primarily the focus on gamification, games research, and more recently edutainment. In the particular framework of the MAS approach, we attribute great importance to the issue of flow experiences users have. The term flow refers to a particular state of consciousness that is sometimes experienced by individuals who are deeply involved in an immersion activity. Csikszentmihalyi (1997) introduced flow and described it as a feeling of enjoyment and psychological immersion, energized focus, and involvement, accompanied by positive emotions. A review of the literature by Rodriguez-Sanchez and Schaufeli (2008) suggests that a more condensed definition of flow as an optimal experience can be composed of three basic elements, including: absorption, enjoyment, and intrinsic interest. The benefits stemming from being in a flow state, have turned it into a meaningful goal for building virtual environments for online business, health care, education, and gaming. As there is evident focus on gamers' affective responses such as fun, challenge, affect, immersion, flow, the traditional usability metrics of effectiveness

and efficiency are deemed insufficient (Law & van Schaik, 2010). Nonetheless, the fuzziness of experiential qualities, makes them difficult to be measured (Law et al., 2014). Furthermore, the UX evaluation methods (UXEM) are largely drawn from the traditional usability ones (UEM) (e.g., Tullis & Albert, 2008; Hartson & Pyla, 2012). Nonetheless, UXEMs are mostly qualitative with heavy use of narrative-based methods (e.g., Tuch et al., 2013). Despite attempts to demarcate usability and user experience (Roto et al., 2010), their relations remain ambiguous. Some researchers and practitioners opt to use UX as an umbrella term to subsume usability (e.g., Thüring & Mahlke, 2007) and its associated metrics, whereas some (erroneously) treat them as synonyms (e.g., Tullis & Albert, 2008).

Participatory Design (e.g., Muller & Druin, 2010; Simonsen & Robertson, 2012) is a methodological approach to design, which places a strong emphasis on involving users or potential users or representatives of users in the end to end development of artefacts which are intended for their use. The process involves determining needs or establishing requirements; carries on with involving them in contributing creatively to design ideas; continues further by involving users in reviewing design ideas or trying out mock-ups or early prototypes to provide confirmation of efficacy or critique or suggestions for improvement. Finally, it concludes by involving them in evaluating the final product. In a PD team, it is recognised that users are experts in their own needs; they are the best to judge on what functional and usability features will be beneficial to them and what usability obstacles might

be most detrimental to product acceptance, adoption and usage. PD aims to create designs that gain widespread acceptance and come to be used effectively, efficiently, enjoyably and safely by the target user groups.

2.3 Objectives of the PD work

The purpose of PD work in MAS, is to support the ongoing processes of product design, development and refinement. To address the latter, we engaged in a flow of feedback from end-users, particularly in areas of usability and user experience. This will likely lead to the development of a highly usable and attractive system.

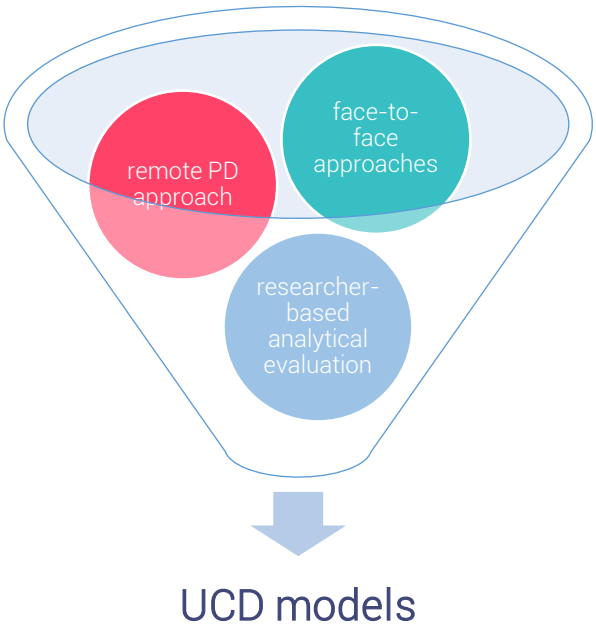
Each PD study is expected to correspond to one or more of the following needs:

- to test developed system components for usability, user experience and whether they provide valued functionality;
- to assess educators' and students' acceptance and engagement with aspects of the system, or system concepts;
- to verify (or challenge) working assumptions;
- to provide additional design ideas or to evaluate early design ideas illustrated with mock-ups.

Preliminary work is employed to provide design ideas, critique and suggested improvements; later studies tend to be more evaluative. Based on results from PD activities, necessary modifications will take place for the design of specific components of the MAS artefacts and for informing the plan and implementation of future evaluative activities.

2.4 Three major UCD approaches

In this research, we employ three models of user participation in PD: *face-to-face PD approaches*, *remote PD approach* and *researcher-based analytical evaluation,* to address different needs and contextual constraints.



Face-to-face PD approaches involved a Layered Elaboration method (Walsh et al., 2010), where users provide feedback on acetate sheets put on top of mock-up printouts. This alternative method allows for the mock-up to stay intact, so we avoid participants feeling like they are ruining something. What is more, the acetate sheet of the next participant can be layered on top of the existing feedback, so it allows for comments on both the original mock-up, as well as redesigned ideas of previous participants. From the researcher's perspective, the advantage is that all acetates from a mock-up printout can be reviewed in one for feedback.

To engage in face-to-face PD, we used Software-supported PD – PDot, as a Participatory Design Online Tool, which enables remote engagement of participants in usability studies, but is also useful in a face-to-face PD setting. The decision was taken following the line of other similar projects, as we were looking for: (i) involving distributed users and (ii) disseminating results to distributed stakeholders within the project; (iii) addressing the limitations of existing online annotation tools (Heintz et al., 2014).

Given the universal approach in MAS, it is important to gather inputs from a variety of prospective users. And even then, the requirements and personalisation features differ among individuals and different professionals. Capturing requirements from these distributed users can be very costly and time consuming because of travelling costs. Digital tools can support participants and researchers in their respective tasks of sharing and analysing feedback.

2.4.2 Remote PD Approach: Core Group of Educators

With time constraints and budget restrictions in mind, a remote approach with a core group of educators to act as end-users was developed. During the WP5 preliminary design, we recruited a group of teachers, known as *Core Group of Educators,* which currently consists of 17 teachers from 8 countries across Europe. The approach was as follows

-Contact via email;

- Asked to carry out some specific tasks and return us with feedback within a certain period of time. The tasks were given on a bi-weekly basis.

This ubiquitous and asynchronous approach was meaningful, as educators engaged easily in the given tasks. Furthermore, such continuous user involvement aligns well with the UCD philosophy. On the downside, a limitation of this remote approach is the fluctuating response rate, depending on the workload of CGE in their everyday job.

2.4.3 Researcher-based Analytical Evaluation Approach

Supplementary to the previous methods, we decided to perform analytic evaluation such as Heuristic Evaluation (HE) to identify significant issues of a system by usability specialists prior to testing it with end-users (e.g., Nielsen, 1994).

HE, unlike user-based evaluation, does not involve any end-user, and relies on the expertise and experience of a usability specialist, who is knowledgeable of the heuristics and ideally is also a domain-specific expert ("double experts"). Going through this process resulted in a list of usability problems (UPs), usability principles each UP violates and the impact (i.e., severity and frequency) each has. With this type of evaluation feedback the IT members of MAS can fix the UPs, thereby improving the overall usability of the prototype and eventually enhancing end-users' acceptance.

A team of three usability specialists had performed HE on a set of MAS artefacts, which were subsequently evaluated with the CGE.

2.5 Strategies for Managing PD Work

2.5.1 Challenges

Tackling the challenges of different languages, different subjects, varying levels of IT competency and montivation, as well as addressing the needs of different age groups of users and curricula needs, were all taken into consideration during development and continually refined for the first year of the project. Given the different components in MAS Infrastructure, it was critical to pursue a diversity of PD studies varying in the following variables:

(i) the type of MAS artefact to be studied;
(ii) the number of teachers and/or students involved;
(iii) the amount of time available for the study;
(iv) the physical setting and equipment available (e.g., shared computers or one each);
(v) curricular constraint (e.g., meeting specific learning/teaching objectives);
(vi) any particular research questions that the pedagogical and technical team may have about the artefact under study;
(vii) (vii) the amount of data already collected on the usability of the artefact being studies.

In view of the complexity of the above variables, before anything it was essential to prioritise the artefacts to be evaluated.

2.5.2 Structuring and sequencing the study programme

The MAS end-user usability tests can be conceived of in three levels;

- level 1 are formative foundational studies testing of individual components, ideas or mock-ups;
- level 2 are also formative evaluations, testing segments of the system (e.g., using PLSs or mini-PLS);
- level 3 involves end-user tests of the whole system and are the summative evaluations.

During the formative studies, new requirements can arise leading to new components and more level 1 studies. It is often the case that the lower level studies can often be more qualitative and creative, whereas higher level studies are more quantitative.

3. Participant profiling

Following careful examination of different parameters, it was recognised that it was important to elicit feedback from both students and educators, being museum educators and school teachers. It was also targeted to gain as much diversity as possible in terms of the profiles of participants, to ensure a greater representation of potential end-users.

Over the course of M3-M5, we have conducted 2 face-to-face Participatory Design sessions, lasting from 1 hour to 7 hours (mode: 1.5 hours) in 2 countries, involving participants of 4 nationalities. Seven teachers have been involved; 67% are female.

Maths and Language Arts has been the most common speciality, but they have also included history, chemistry and general science teachers. 25 students have taken part, with an age range of 9-19 (mode: 10-12) years old.

4. Overview of Results and Recommendations

4.1 General Findings

This section describes the different emerging themes from the research conducted. It is an overview of findings communicated to the Development Team of MAS, so they can proceed with changes accordingly.

Overall impression

There was an overall positive feedback from the PD studies conducted, as users suggested important benefits in interacting with the MAS system and the potential it holds. As a general comments, users suggested that they felt motivated to use the different components of the MAS Infrastructure and did not come across with significant challenges. However, in some parts, they reported how some things felt awkward and required to be more coherent and even explicit.

Sign-on security

The complaint from users related to the email-login system, although simple at use, they found it time-consuming and would prefer to have the option to choose between email and social media login.

Storage and retrieval of work

Issues of privacy were often raised, mostly as they related to their institutions and minors' details. It was less of a concern on how their resources will be stored, as they felt the essence of MAS Platform was to share knowledge. The uploading features work rather well and ease, however they reported minor issues with uploading large files.

MAS Cabinet concerns

Users reported issues with using the MAS Cabinet application, as was slow at times and in a few cases, users were not able to install the application in their desktop.

Help features

One of the most frequent comments was how it was necessary to enhance the MAS Portal with help tools. Pop up tips with some text wouldn't mind, and so would the use of manuals across major tools.

Group working online

One suggestion/concern which was raised, related to the absence of some collaborative feature when it comes to students. This option would fit perfectly with the MAS approach and the use of the MAS Cabinet. Having students work collaboratively online, was said to be motivational and enabling creativity and problem thinking.

Multilingual components

A frequent concern has been that tools are not currently available in the participant's own language. This would especially benefit students.

Usable search tool

A number of users complaint about the search tools filter, in terms of not being user friendly, with long lists of content/categories not visible.

4. Findings from different user populations and study methods

It appears from studies with both educators and students so far that:

- Some students seem more tolerant than educators with features of the Portal;

- Students did not report as much usability inconsistencies between different parts of the system as teachers;
- Students appreciate high interactivity and sophisticated graphics, and are less appealed by long text;
- Teachers seem to notice many broader issues – e.g. lesson dynamics, pedagogical issues, whereas students enjoy the moment;
- Students are well informed on latest developments in design;
- Teachers want the system to be scientifically exemplary with text and graphs.
- Researchers' insights add a lot of value to student sessions, as they can report on issues that students encounter which they do not recall or comment upon.
- When comparing the HE studies with later end-user studies accessing similar Go-Lab components, some apparent trends are:
- HE studies identify usability issues quite quickly.
- HE studies may lead to 'false alarms', not retrieved in short end-user studies, and often not found in practice.
- End-user studies allow for far more practical perspective based on classroom practice.

5. Conclusion

The MAS research team succeeded to cope with most of the issues arising from the usability reports and incorporated relevant changes in the MAS artefacts by M12. The core group of educators which has been established to provide rapid online feedback on specific MAS-related questions, will be available for emerging issues. This proves to be a highly effective method for rapid engagement. As an overall statement, it can be said that the participatory design activities proved valuable sources of feedback on different MAS system components, and the research team made use of all recommendations. We also look to address some functionality issues in M12-14. This document will be updated with more detailed feedback from the core group of educators.

6. References

Csikszentmihalyi, M. (1997). *Finding flow: The psychology of engagement with everyday life.* New York: HarperCollins.

Hartson, R., & Pyla, P. S. (2012). *The UX book: process and guidelines for ensuring a quality user experience.* Elsevier.

Hassenzahl, M. (2008). User experience (UX): towards an experiential perspective on product quality. *In Proceedings of the 20th International Conference of the Association Francophone d'Interaction Homme-Machine* (pp. 11-15). ACM.

Hassenzahl, M., & Tractinsky, N. (2006). *User experience-a research agenda.* Behaviour & Information Technology, 25(2), 91-97.

Heintz, M. Law, E. L-C., Govaerts, S., Holzer, A., & Gillet, D. (2014).*Pdot: participatory design online tool.* In CHI Extended Abstracts 2014: 2581-2586

Law, E. L. C., & van Schaik, P. (2010). *Modelling user experience–An agenda for research and practice.* Interacting with computers, 22(5), 313-322.

Law, E. L. C., Roto, V., Hassenzahl, M., Vermeeren, A. P., & Kort, J. (2009, April). *Understanding, scoping and defining user experience: a survey approach.* In Proceedings of CHI'09 (pp. 719-728). ACM.

Law, E. L. C., van Schaik, P., & Roto, V. (2014). *Attitudes towards user experience (UX) measurement.* International Journal of Human-Computer Studies, 72(6), 526-541.

Muller, M. J., & Druin, A. (2010). *Participatory Design: The third Space in HCI.* Handbook of HCI. J. Jacko and A. Sears. Mahway.

Nielsen, J. (1994). *Usability engineering.* Elsevier.

Sanchez, A. M., & W. B. Schaufeli. (2008). *Flow experience among information and communication technology user.* Psychological Reports, 102, 29–39.

Simonsen, J., & Robertson, T. (Eds.). (2012). *Routledge international handbook of participatory design.* Routledge.

Tuch, A. N., Trusell, R., & Hornbæk, K. (2013, April). *Analyzing users' narratives to understand experience with interactive products.* In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 2079-2088). ACM.

Tullis, T., & Albert, B. (2008). *Measuring the user experience.* Burlington, MA.

Walsh, G., Druin, A., Guha, M. L., Foss, E., Golub, E., Hatley, L., ... and Franckel, S. *Layered elaboration: a new technique for co-design with children.* In Proc. CHI'10, 1237-1240.