A Proposed Methodology for Enhancing User Experience in Mobile Applications Design for Cultural Promotion

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2022 7th South-East Europe Design Automation, Computer Engineering, Computer Networks and Social Media Conference (SEEDA-CECNSM) | 979-8-3503-9858-8/22/$31.00 ©2022 IEEE | DOI: 10.1109/SEEDA-CECNSM57760.2022.9932994

***Abstract*—User Experience (UX), as a theoretical and practical field of research, is based on the theory of Human Computer Interaction (HCI), studies systems, products, and services in the field of (mainly) Information Technology (IT), and aims at user satisfaction and better, more pleasant and more efficient interaction with systems. The popularity of Mobile Device Applications (MDAs) in the last decade has introduced new interaction environments and thus the need to formulate, develop and adapt to them, theories, and methods of UX. We present UX as a theoretical and practical framework and record its methodology - both the general one for various systems so far, and the specific one for Mobile Device Applications and more specifically for those that project cultural content in conventional ways and through augmentation. As part of the research, high-fidelity prototypes were designed and were tested during a user survey (usability test, questionnaire) for extracting conclusions to improve the design of the application.**

***Index Terms*—User Experience, Interactive Design, Augmented Reality, Cultural Promotion, Human Computer Interaction, Prototypes**

I. Introduction

User Experience (UX) is a research field within the Human Computer Interaction (HCI) domain that attempts to understand how humans experience interaction with technological objects (computers, mobile phones, cameras, etc.). Multidimensional and based on different theoretical models, UX has received many definitions by various stakeholders in terms of achieving a commonly accepted clarification [1]. A general definition comes from ISO $9241-210$ [2], which specifies UX as *a person's perception and response from using or expecting to use a system, product, or service; user perceptions and responses include users' feelings, beliefs, preferences, perceptions, comfort, behaviours, and achievements that occur before, during, and after use*.

The basic principles of UX are user focus, measurement, and repetition [3]. It is studied through pre-existing processes and standard methodologies from the field of HCI and systems development, such as User Research and Evaluation that are iterated throughout the design process. The first investigates the user, their needs and expectations whereas the second measures aspects of use and its effects. With these methods, designers gain information about how users perceive and value products in order to design better and more desirable products [4]. UX methodologies are applied to the development of systems and applications at all stages of design and implementation, from the early stages and concept analysis, the prototyping and development phase, through to integration and the error correction or improvement phase before or after the initial release. Research findings are taken into account in the design through iterative cycles of evaluation and re-design leading, from initial analysis, to prototype design, and then to the final product.

In UX methodology, we examine the usage of systems in terms of their usability, the context in which they occur and the emotions they generate and fulfil [5]. Similarly, in UX for Mobile Applications, usability and emotion are studied, while maintaining a focus on the multifaceted context of use with its specific attributes. In Interaction Design, the designer's understanding of the user environment is essential for the implementation of appropriate practices [6]. The use cases are constantly expanding as the technological capabilities of

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mobile devices find practical applications in many different areas.

Application accessibility through multimedia recording, location tracking or connectivity would create novel possibilities and contexts of use. An example is their adoption by Mobile Cultural Promotion Applications to better highlight their content, information and navigation as well as effective interaction with the user. More recently, Augmented Reality (AR) has been widely adopted by relevant applications to enrich their visualisation and create new, parallel or complementary exhibits. The application of the AR methodology to these applications can lead to valuable conclusions about their usefulness and effectiveness, while the answers to the questions regarding the area of AR can provide useful information for their improved design.

II. Related Work

The work in [7] developed a prototype context-aware and service-based tourism application where users participated in the design and evaluation processes. The results indicated that trust, security, adaptability and reliability are important factors for users, especially in unfamiliar environments. Also, authors in [5] present two case studies of Augmented Reality for Mobile Applications (ARMs) and evaluate them from an UX perspective. The results of their research can be used to improve the design of the UX in the implementation of future ARMs.

Another paper introduces an empirical research by expert evaluators that compares two sets of heuristics, those of Nielsen and SMART heuristics, in order to identify usability problems in a mobile application for a museum [8]. Prototypes were created for evaluating Augmented Reality in Mobile Applications in [9]; their prototypes are visual and material and by using them, users can interact, form opinions and express their experience accurately.

In [10], a framework for mobile application interaction and a number of heuristics for successful interaction is presented. The proposed model depicts the limitations imposed by the context of use, such as one-handed use, limited screen size, etc. The research by [11] aims to explore and understand the potential uses of AR in indoor and outdoor cultural venues and how it can add value to both visitor experience and the venues themselves.

A research is presented in [12] on mobile apps designed by cultural and historical museums that analyses the broader issues their findings suggest, such as the uses these apps intend to have (most are guides to collections), the overlap of content and the type of user interaction they support. Finally, authors in [13] propose quantification models for capturing key elements of UX within a catalogue. By carrying out a case study, they examine and evaluate 22 different aspects of UX and rank them in order of importance, with the aim of creating a list of indicators that will help designers and those involved in the design of products and services to better understand the overall concept of UX.

A. User Experience (UX) in Interactive System Design Models

At this point, it is noteworthy that UX offers value in the design of interactive systems, products and services, by adapting its methods to the various design models already developed, with origins in HCI and Software Engineering. Furthermore, these models recommend the kind of mindset and work that a multi-disciplinary design team should have and describe the steps and processes that need to be followed from the design's inception to its finalization. Herein, two wider design practices and models will be presented, in the context of which the philosophy of UX was developed and which it serves with its methods, namely, User Centered Design (UCD) and Agile development. The above are related to holistic models of description and visualization of processes as well as associated with processes of facilitation and organization of planning, which in turn lead to the development of different sub-models of implementation [14].

B. User-Centered Design

User-centric design is the model for the development of interactive systems, in which the design and development team takes into account, at all stages of the process, the human user and their needs, which are thoroughly defined and analysed. The end user affects the design in various ways, from being considered as a hypothetical entity (user personas), answering questions about their needs and preferences, to even actively participating in the design process (participatory design) [15]. Also, the user is involved in all stages of the design process, but in a slightly unique manner each time.

The design process consists of phases that start with the identification of user needs, requirements and development while end with the evaluation that confirms that the final product fulfils the usability criteria set [6]. These stages and their correlation define the life cycle model that will be followed. Defining the model to be adopted for development gives a visible schema of the process from the outset, describing when and how the transition from one activity to the next takes place and what the deliverables/products are for each phase [6]. Therefore, this helps the team to maintain an adequate supervision and control of the process, to set time and deliverable objectives and to collect the information they need each time.

In the UCD, the basic life cycle model consists of the following stages *"Analysis - Design - Prototyping - Evaluation"* as illustrated in Figure 1. Initially, during the Analysis stage, the understanding of the object and the needs of the users is taking place. It is the stage in which information is collected through user research and user requirements, and the task analysis of the project is carried out.

In the Design stage, the conceptual design model that will be used (i.e. conceptual model), the interaction behaviour and the look and feel that the system should have, is conceived and created. The stage is performed by repeatedly returning to the previous stage of analysis and correcting alternative designs [6].

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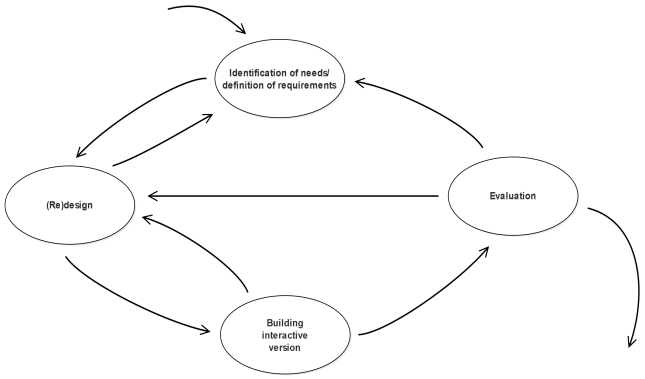

Fig. 1. The Process Representation in Utility-Centric Design

The Prototype stage consists of the implementation stage in which interactive versions of the projects are developed and evaluated. Based on the evaluations, the team may need to return to identifying needs or requirements or return to re-design. This stage constitutes the implementation stage in which interactive versions of the projects are developed and evaluated. Based on the evaluations, the team may need to return to identifying needs or requirements or even return to re-design.

Finally, in the Evaluation stage, the interaction design is selected, verified and improved. The final product is displayed and evaluated in order to correct, refine errors and failures and finalize the final version. The preceding stages identify the main UX activities [16], which are more thoroughly described below, in separate sections with their respective methodologies in each of them.

More to the point, the whole cycle is complemented and driven by UX goals, methodologies and measurements. There are different UCD models which differ in the different alternation of processes and iterations between the key stages they propose, such as the waterfall model, the star model, the spiral model, etc. UCD has been developed and proposed, both at the academic and industrial level, by large or even smaller organisations, creating and implementing thus popular working or reference frameworks for teams wanting to develop a design process.

In this context, the methodology to be followed is chosen based on the needs of each particular project and with the concept of efficiency in mind, it sometimes describes strict and complex procedures and sometimes more flexible and quick ones. Examples include Microsoft's Synch and Stabilize and Deloitte's Deep-Dive methodology. Authors in [17] propose the Mobile Application Development Life Cycle (MADLC) model for mobile application development.

C. Lean UX, Agile Development and Design Thinking

The need for more agile and faster processes, especially by smaller organisations and within industrial use [18], led to the development of the Lean UX philosophy, which is a faster approach to user-centred design. Lean UX is a way of thinking about systems development based on shorter sprints and short but well-defined iterations [19]. This way of thinking incorporates methods such as Agile Software Development and Design Thinking.

In Lean UX, the goal is to produce deliverables as quickly and with the fewest resources as possible to meet the production goals and of course the user's needs [18]. Key elements of agile type methods are short iterative cycles, minimal documentation of specifications, as well as early and continuous involvement of the user or customer in validating options [19]. In the agile methods, the scheme, the design, the development along with the user testing are performed in successive cycles (sprints) by smaller teams working more closely together to achieve project efficiency. This scheme includes phase 0 in which user research, project visioning and initial prototypes are designed. This phase is followed by cycles of design, development, and testing, defined in terms of timescales and deliverables, which gradually lead to a more integrated project. Each cycle must produce a "minimum value product" that can be tested, which is why prototyping is done from the beginning [18]. The user tests the produced system or prototype at the beginning of each development cycle and their feedback drives the re-design in the next cycle to meet their needs and solve their problems. Instead of long cycles of testing done at the end of a rigorous waterfall process, the tests are shorter and at each cycle. Similarly, user research is shorter and relies heavily on hypothesis building techniques such as early planning; Big Picture Up Front [19], User Stories and Personas and then testing the validation or not of the initial hypothesis. In Design Thinking, and especially in the initial stage of understanding, designers are suggested to empathise with the needs of the user in order to gain insights that may reveal new ways of designing to achieve the intended outcome.

This is a key principle of UX User Research in which a gradual progression, from a chaotic and fuzzy pool of information gathering and learning, towards points of clarity until a desirable, feasible and viable solution emerges. An early definition of the selected ideas that will occupy the design and rapid coding of potential solutions, will allow the team to gain insight into the viability of solutions and reduce risk when launching a new product before too much time or resources are spent. The user-centric approach and the continuous user testing add value and utility to the final product. This is why the agile method guarantees the production of more useful and reliable software, faster and with better control than traditional development [19].

Many different approaches to agile development are currently popular: XP, Scrum, Feature Driven Development (FDD), and Crystal as cited by Liikkanen et al. [18] and Google Design Sprint and IBM Design Thinking [20].

D. Mobile Applications

Mobile design is a new field that is changing quickly and unexpectedly[1] [10]. The development of mobile technology

[1]It is worth noting that smartphones were predicted to overtake the global desktop and laptop market in 2012. They did so in the last quarter of 2010 http://bkaprt.com/mf/4 - two years ahead of schedule

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and the connectivity of more and more devices to the Internet and the Internet of Things (IoT) requires an understanding of the new usage contexts for the appropriate application of UX methods. The spread of the use of computers and their passage from the workplace or industrial space, to the personal space and home, but also on the move everywhere, through the use of mobile devices, has led to new user experiences. The mobile device itself is a specific context of use with its own characteristics and peculiarities (portability, connectivity, etc.) while the technological capabilities of mobile devices (cameras, sensors, etc.), motivate researchers and designers to develop new applications [21] and create new potential contexts and environments of use. These applications include a range of different functions, such as utilities, media playback, social networking, productivity tools, games, navigation, etc. [21]. In addition, the integrated camera created new possibilities for data input and interaction with the real world. An example is Augmented Reality (AR), which is mainly implemented through mobile applications and extends the context of use to a 3D environment. The concept of Ubiquitous Computing, which describes the interaction of the user with their environment anywhere and anytime [22] is practically implemented through mobile applications and AR [9].

E. Cultural Promotion through Mobile Applications

Venues related to the promotion of cultural content, such as museums and archaeological sites, are predominantly fields of application and use of the technological possibilities that are emerging and developing internationally [23], [24], [25]. Their rich and complex content, their multifaceted themes as well as their size (municipalities, large public or private organisations) and the breadth of their impact on culture and the public, create high demand for the services they offer. Even their physical size (large spaces, multi-storey, etc.) creates functional needs to introduce additional information beyond what they present or display, such as signage, navigation, accessibility, etc. Implementing technological applications for the services of these spaces requires a thorough analysis of the needs and the application of appropriate design methods and practices available or imposed by industrial and scientific practice. In museums and other places of cultural interest, technologies with dedicated software and hardware for displaying content or providing services, such as kiosks with touch screens, projection systems and multimedia applications to enrich the experience, etc., as well as mobile devices as digital guides for visitors, have been implemented in previous decades [8].

In recent years, the evolution of mobile devices and their increasing popularity have made them ideal tools for the development and use of applications - previously done through other devices, replacing them - and new possibilities that they offer, for their use in cultural content projection spaces. This makes it easier for visiting users who are not required to learn to use any device other than their familiar mobile phone and can thus focus on the content being viewed [8]. Cultural spaces such as museums are being transformed into interesting interactive high-tech places, where the possibilities of augmented reality and artificial intelligence are applied [11]. Having dramatically grown since the beginning of the 21st century, Augmented Reality is now widely used in similar applications to enhance and enrich/outreach communication. Museums worldwide are beginning to incorporate these technologies into their exhibitions, and the adoption of these innovations will continue to grow as these technologies become cheaper and more accessible [11]. The design of the experience, created through mobile applications, requires the application of good practices as well as the research of user needs and expectations to ensure good acceptance and success [9].

III. Preliminaries

A. Basic Concepts of UX

UX is studied at multiple levels of use and interaction with the device: from the interface and navigation or the execution of tasks, the material and mechanical operation of the device, its use within specific conditions, to the emotional, aesthetic or experiential perception of the studied experience by the user. The object of UX concerns the characteristics of use that constitute the user's experience, from usability to the feeling evoked.

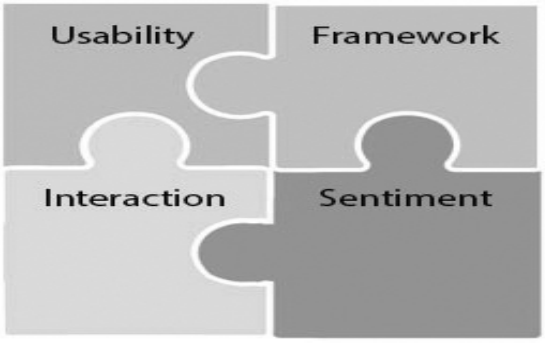

Fig. 2. Basic concepts of UX

B. Mobile Devices

Mobile devices are distinguished from other technological products and devices that provide services via internet connection (such as desktop computers), in terms of their increased capabilities [26], but also in terms of the limitations [10] that exist in their use. These limitations deal with both the human, such as one-handed use, parallel activities or information overload, and the device, such as small screen, text input, poor connectivity or low battery [10]. On the other hand, the capabilities of mobile phones involve portability combined with the integration of technologies and sensors for the environment, motion, speed, etc. These parameters affect in a dynamic and complex way the user's perception of them, and the evaluation of UX in these devices should take them into account [21]. The design of UX on mobile devices is based on the theoretical background of UX: usability, interaction, context, emotion, and thus extending it with concepts related to their multiple contexts of use.

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C. Usability

Usability is an important parameter that determines the success of a mobile application [1]. A mobile application, if it lacks functionality, may be rejected by users, no matter its design [27]. The term usability concerns a separate discipline that investigates various systems and products, and has received various definitions [1]. Below, usability is defined by the ISO $9241-210$ standard (which also defines UX): *Usability is the extent to which a system, product or service can be used by specific users to achieve specific objectives with effectiveness, efficiency and satisfaction in a defined context of use.*

Usability measures the two aspects of a system, i.e. the physical and tangible aspect (hardware), such as screens, buttons, construction, etc., and the intangible aspect (software), such as the quality of the design of the user interface and the ease with which the various tasks within the system are performed. Important parameters of usability are ease of use, learn-ability, functionality, utility, user-inspired security, as well as the pleasure derived through fun and aesthetic simplicity. Authors in [27] note as primary rules for usability in mobile applications the visibility of the system by the user and the options of actions available, the feedback from the system and continuous information on the results of actions, the good conceptual model as well as the image of the system. Baharuddin et al. [1] conclude 18 parameters that define it, among which are ease of understanding, attractiveness and instinctive use. For usability in a system, the technology should be an extension of the human ability to perform tasks, with processes as transparent and seamless as possible [16].

As shown above, usability measures objective parameters such as efficiency, which is measured by objective metrics (number of errors, task completion times, etc.), as well as subjective parameters such as opinion-based satisfaction, which is measured by methods such as questionnaires and open thinking techniques. Both aspects of usability - and more so the subjective one - are complemented and extended [28] by the field of UX research. Usability is a structural concept for UX evaluation and is a prerequisite for good UX. That is, UX investigates usability first and then other subjective concepts that arise from use, such as emotion.

D. Interaction

Interaction is the primary means in experience design and as a concept is studied on the basis of AY and Use-Centered Design, which describes the cognitive processes that take place during the learning and use of a system by the user [29]. Such are, the mental model that the user creates during use, which must be identified with the design model used by the designer, for the interaction to be successful and problem-free. This ”perception” of the system is implemented through the interface and its appropriate design. The main space in which the interaction takes place, is the User Interface (UI). The interface elements must hint at their role and its use through design metaphors and appropriate perceived affordances [29]. Usage should be instinctive and interaction with the application and its environment should be seamless [8]. Users should get appropriate feedback from the system so that they know at all times where they are, what their goals are and what the possibilities of performing actions are, and can assess the outcome of their actions. The design should ensure that there is no gulf of execution/evaluation. The conceptual model formed by the design should be characterised by coherence and consistency, so that the user becomes familiar with the system's image and its mappings.

In addition, UI must be distinguished by its aesthetics and by an environment with a visual identity that the user needs to feel comfortable and familiar. The term ”beauty” was introduced very early on as an attribute of the UI [29]. That is, the user's emotional interaction with the product starts with the UI and its proper design is the other primary goal of the UI beyond usability. In addition to the ”aesthetic interaction” and the recognition of the beauty of the UI, there are deeper emotions generated and related to the ease of interaction, competition, stimulation and safety that the interaction evokes. The aesthetic interaction of a system is related to the overall pleasant user experience created by the feeling of fun, involvement, trust or satisfaction inspired in the user [21].

The image of the system that is created in the user's mind determines the user experience and influences the relationship with the system. In many systems, this relationship is personal and the user is required to learn the system for himself. Learning takes place during use (exploratory learning) and not otherwise (e.g. manuals). Mobile devices having a highly personal character, make this learning experience even more personal and therefore the learning process, and how quickly and easily it is achieved, plays an important role in the overall experience of using them.

E. Framework

In mobile applications, the concept of context can be classified into five categories: User, Environment, System, Social and Services [30]. Each of the five categories has distinct characteristics. The user context concerns human factors and personalization. System refers to a non-functional context, mainly related to technological limitations. The context refers to location and conditions or time. The social context, which is becoming increasingly important, refers to communication, collaborative environments and sharing. The service context is related to the services and functions offered by mobile drivers. Context awareness is an important capability available in mobile device technology, introducing them along with other smart devices into the Internet of Things and Ubiquitous Computing [31].

Devices communicate with the environment through sensors, 'sensing' its phenomena and data such as space, time, temperature, presence and identity and triggering the transmission of information or events programmed into a transmitter. The main objective is to provide relevant information, in the right format, at the time and place needed. In Ubiquitous Computing, the use of computing systems is physically integrated into the real world and information is accessed through intelli-

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gent interfaces. According to [22], the computer "disappears" and use is done in a deep and invisible way, without the user thinking about it. The user focuses on the foreground and the task they are performing, while the technology is put in the background [27]. Context recognition can improve applications and systems, enabling a more personalized interaction that offers experiential learning through the actions of use and information sharing [31].

In UX, the context of use is studied, both in terms of the device and the wider context which includes additional social and cultural factors that influence the experience [16]. In user-product communication, the user operates on the basis of their norms, values, emotionality and generally their personality. On the other hand, the product is governed by its own factors that influence and determine the interaction, such as material factors (size, weight), technical characteristics (such as brightness or interface environment), media it uses (text, symbols, images, sound), and intangible concepts such as usability, connectivity, mobility and adaptability [32].

Finally, mobile use is continuous and takes place at multiple levels. An application is used by different users, in different environments and between other activities and various distractions. These overlapping levels of the context, in which mobile applications operate, need to be understood to design successful interactions [10].

F. Sentiment

Interactive design can touch the user on a more holistic level, which goes beyond the boundaries of usability and touches emotion and aesthetic perception [33]. The main purpose of Interactive design, should be to create positive responses from the user and therefore designers should explore emotion. This exploration of emotion is the basis of the theory of UX, which deals -along with product functionality- with more emotional attributes such as attractiveness, emotion and engagement [34]. Designers try to predict or test the effect that the products or services they design may have on the user's emotions and based on the data they collect, they design products with the most desirable and expected outcomes in mind. In emotional impact, the primary and most desired emotion is pleasure [33], but other emotions can be associated or evoked in the interaction with a product, such as love, loyalty, intimacy, etc. Research has shown that the time spent using the product is proportional to how enjoyable the product is [33]. Especially for mobile apps, studies show that we use a very limited number of apps from the ones we initially install.

IV. Implementation

A. Design Cycle Model

The demo application was designed and developed using a design model based on Lean UX and Agile Software Development philosophy. No specific working framework was strictly used, but a combination with references to Scrum and Rapid Application Development (RAD) was utilized. The development cycle was divided into smaller iterative cycles (SPRINTS), with a fixed timeboxing of one week and certain deliverables for each cycle. During the design, great importance was given to the deliverables so that at the end of each cycle, there is a deliverable material that increases and improves the previous ones and comes closer to the completion of the development. The delivered material should be as functional as possible (minimum-viable-product) so that it can be evaluated. For this purpose, the method of early/rapid prototyping was used, but also the use of prototypes throughout the design cycle as a cycle driver. At the same time, the involvement of programming was set from the beginning of the cycle, participating in each iterative cycle with a certain deliverable and functional material. The whole process was test-driven with the involvement of users in each cycle, for user research and evaluation of the delivered material or the completion of the prototype up to that point. It was important for the design to meet the needs and stories of the users. For this purpose, a user group of seven users was used according to the Useful-Centric Design and the Nielsen rule [35].

User opinion was measured at the end of each cycle and the results were used in the next cycle to guide the design. As part of the user-developer interaction, user testing and A/B testing were conducted to decide on specific options or functions. Planning team and stakeholder sessions were organized in each cycle for face-to-face collaboration with specific agendas and to-do lists and time duration limited as much as possible to about $1/2$ to 1 hour [18]. The theoretical analysis of the Scrum method goes beyond the purposes of our work, however it is deemed appropriate here to mention the main stages and design cycles that were carried out to demonstrate the process of applying the UX methodology.

B. Analysis of the Agile Process

The Agile process that was followed was divided into the following 4 stages (based on the Scrum method):

1) Project Planning (Sprint 1)
   The design stage of the project includes the identification of the users of the application, the research of the competition (corresponding applications), the definition of the goals and requirements of the application, as well as the selection of the technology to be used for the development (developer, mobile platform for which the application will be developed, API, frameworks, etc.). At this stage, the first prototypes were implemented and the first tests were carried out.
2) User Design and User Stories (Sprint 2)
   At this stage, having formed an initial knowledge of the application, the team was able to further explore the user stories and move on to the first interactive deliverables for user testing.
3) Design and Development (Sprints 3-5)
   In these cycles, the most part of the design took place, with iterations of visual design and code writing for successive functional versions (builds) and the realisation of the definitive UX research methods. Content was also entered into the databases.

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4) Completion (Sprint 6)
In this cycle, the visual design was completed, followed by planning for the presentation in the app stores of each platform and completion processes by the developers, such as Quality Assurance (QA), Security testing, Bug-finding, Beta testing, etc.

C. Visual Design

In Agile design, and in the first successive cycles, development is minimal and only what is needed to move the process to the next stage, is implemented. Thus, no element is completed from the start, but everything retains its functionality until it receives additions and is gradually improved. This process involves not only programming and writing code but also visual design. Also, the deliverables at each stage can be as minimal as possible to move to the next stage. Initial drafts were made for the application to test and select the visual identity and brand style. The options were discussed with the team and a sample of users. The colors were chosen regarding both Material design and specifically Google's Arts & Culture application, as well as the conclusions of the research of Oyibo & Vassileva [36], which showed that in tourism web applications, cool colors (blue-green) are better accepted by users. After the initial direction was decided, the logo for the application was then designed. Special attention was given to the branding and visual identity (brand) of the application, as a critical element of the UX that positively influences the usability (user's intention to use) and the sense of beauty (hedonic) experienced during use. The visual identity comprises the logo, the icons of the second introduction screen, the functional icons, the colours and the fonts. At each stage, there were icons as deliverables for placement in the developer, regardless of their completion phase, and then replaced with the newest version.

D. Assessment

The evaluation of the demo application at the different stages of the design was a critical process that took place in iterations and at predefined points in the cycle and contributed to the final outcome. User involvement in the process through user research and in all phases (from start to finish) was crucial in making decisions for further development. Evaluations were carried out from the outset on the rapid prototypes created and then on their successive versions until the final high-fidelity prototype that offered some degree of simulation of use. The evaluation was based on a combination of methods including questionnaires, interviews and user observation in the laboratory and the field.

E. Research Tool

The online Maze platform was used as a research tool to answer the questions. Maze enables prototype evaluation for decision-making with rapid remote testing. It offers collaborative use by teams to improve the UX of systems under design, enabling designers to gain access to valuable user feedback and insights, optimizing user experiences and guiding design.

A key advantage of using Maze and the criterion for its selection in this research is the ability to test prototypes by viewing them on a browser or mobile device regardless of the platform. It offers collaboration with Figma by integrating the interactive prototype and its screens and with the possibility of updating it in real time. This collaboration is perfectly aligned with Agile processes and the utility-centric approach.

F. Research: Usability Test and Questionnaire

The survey was launched by sending an e-mail invitation to potential participants. They were asked to participate in the survey, after being given a brief description of the application to be evaluated, a description of the survey and its duration, and were informed of the anonymity of participation and results and the freedom with which they were invited to respond. The invited participant then clicks on the link and is taken to the survey site in their browser. There, after viewing a welcome page to the survey, they are guided through the next steps, which are the sequential questions. The survey combined a usability test with a trial and a questionnaire with 3 different types of questions: opinion scale questions, multiple choice questions and open-ended questions. The usability test consists of 2 tasks (missions) that the research participant was asked to perform within the application. When defining the tasks, authors of the survey also defined the paths they expect to follow and successfully perform the tasks.

V. Conclusions and Future Work

In interactive design, prototypes are a useful tool for the process at all stages. The design of the prototypes was a key reference in the whole process. By using them in successive planning cycles and combining them with corresponding user surveys, they can be at the center of the processes. Tools like Figma help create rapid prototypes by merging the design and testing stages of interaction, while offering quick sharing of work between teams and fast user research and testing. The end-use simulation that a high-fidelity prototype can provide can reduce risk, leading to a safer and more successful design. However, there are several limitations, such as the inability to interactively visualize the AR for mobile applications in a prototype. In the case of the example referred to, this weakness required the assistance and supervision of the researcher and at the same time either the imagination of the test subject for the final product or the parallel development of integrated material and demonstration to the test subject. Integrating AR into prototyping tools is an area that should be developed.

AR is a key technological addition to cultural promotion applications whereas location recognition technology is used quite frequently, creating new scenarios of use in outdoor venues. Nowadays, there is extroversion, creation of new thematic exhibits and markets and more and more institutions choose this technology for the promotion of places, cultures, monuments, etc. This creates the need to use UX methods in the design of these applications and the user-centric approach by conducting user research. This will lead to the optimization of UX design and, the development of useful applications that

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benefit users. User research is useful to be more accessible and widespread. MAZE research tool can provide a solution for a quick and affordable research process even for very small projects, allowing simultaneous collection and quantification of different data, from usability tests to quality data.

The present research can lead to various conclusions, some formative and others inferential, and to gain information about the user's feelings and aesthetic perception of the application. This kind of multidisciplinary research with a multi-functional tool like MAZE can be a good solution and method for subsequent research. The method followed, and the model of Agile development and Lean UX that was used, including rapid prototypes, their combination with corresponding research and evaluation, and the emphasis on visual design, form a compact but flexible system of designing UX, which can be adopted in similar projects.

ACKNOWLEDGEMENT

This research was co-financed by the European Union and Greek national funds through the Competitiveness, Entrepreneurship and Innovation Operational Programme, under the Call "Special Actions "Aquaculture" - "Industrial materials" - "Open innovation in culture""; project title: "Strengthening User Experience & Cultural Innovation through Experiential Knowledge Enhancement with Enhanced Reality Technologies - MON REPO"; MIS code: 5066856.

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