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T-UCD

AN EXTENSIBLE TOOL FOR USER-CENTERED DESIGN BEGINNERS AND PRACTITIONERS

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Abstract

In the industry, User-Centered Design (UCD) has gained increasing acceptance thanks to the community awareness of its relevant benefits that improve the final product quality in terms of usability propriety. That leads to an increase of UCD beginners and currently it has not been found a tool that pedagogically accompanies them during the entire UCD process and its methods. This research has tried to overcome this lack by implementing an extensible web application, called “Tool for User-Centered Design” (T-UCD) which provides a tutorial and a storage manager, in collaboration with the Swiss Federal Office of Information Technology, Systems and Telecommunication (FOITT).

T-UCD has been developed with the User-Centered Design approach by performing user research, prototyping and evaluation and the UCD methods have been modeled with XML technology. By doing that, it has been created a Markup Language for UCD methods that defines and structures them with a sort of language with its vocabulary and grammar. The implementation was made by combining AngularJS and XML which were considered the most appropriate technologies to develop T-UCD because the first is considered a state of the art technology to develop, ease the maintenance and future expansions. The second because it is a technology that is based on models and is extensible.

This tool is intended to give beginners a better and practical understanding of UCD, convince beginners about the usefulness of it and see if there is an interest in actually using T-UCD. In order to assess if the objective were achieved, it has been performed an evaluation with five users who had to perform some tasks and answer some questions. Results showed that T-UCD overcome the existing lack concerning the absence of a unique tool for UCD beginners containing the entire UCD process, methods and a tutorial. Indeed, it actually gave to UCD beginners a better understanding of UCD, convinced beginners about the usefulness of it and some of them would use it personally.

Finally, the challenges for future work would be to add the possibility to organize the UCD project (members, deadlines, dates, tasks and so on), provides connections with existing tools for UCD methods (ex. Balsamiq) and extend it with more UCD methods by modeling them thanks to the advantageous proprieties of XML technology (currently, T-UCD supports ten methods).

Keywords: User-Centered Design, Tutorial, Markup Language, Store manager

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Contents

1	Introduction	6
1.1	Motivation	6
1.2	Objectives	6
1.3	Context	6
1.4	Organization of the report	7
2	Related works and Background	8
2.1	Related works	8
2.2	Background	9
2.2.1	Definitions	9
2.2.1.1	User-Centered Design	9
2.2.1.2	Usability	10
2.2.1.3	User-Centered Design process	11
2.2.2	Benefits and criticisms of UCD	17
2.3	Resume	18
3	Design	20
3.1	User research	20
3.1.1	Online Survey	20
3.1.2	Persona	23
3.1.3	Scenario	23
3.2	Prototyping and evaluation	27
3.2.1	Iteration 1 - low-fidelity prototype: sketches	27
3.2.2	Iteration 2 - medium-fidelity prototype: digitalization	30
3.2.3	Iteration 3 - high-fidelity prototype	35
3.2.4	Iteration 4 - high-fidelity prototype: T-UCD definitive prototype	36
3.2.5	Iteration 5a - high-fidelity prototype: T-UCD implemented	36
3.2.6	Iteration 5b - high-fidelity prototype: Tutorial implemented	42
4	Development	46
4.1	Technology choice	46
4.2	Implementation	47
4.2.1	Discussion	47
4.2.2	Description	47
5	Evaluation	50
5.1	Description	50
5.2	Results	52
6	Conclusion and future works	58
7	Bibliography	60

A Appendix	64
A.1 Online Survey	64
A.2 Analysis First Online Survey Results - Details	66
A.3 Icons Questionnaire	77
A.4 UCD methods XML Schemas	79
A.4.1 generalMethod_Type	79
A.4.2 evaluationPhase_Type	79
A.4.3 intSurObs_Type	81
A.4.4 UCD methods	82
A.5 HTML Forms of UCD Methods	86
A.5.1 Persona	86
A.5.2 Usability evaluation	87
A.5.3 Scenario	89
A.5.4 Sketch	90
A.5.5 Observation	91
A.5.6 Interview	92
A.5.7 Survey	93
A.5.8 Storyboard	94
A.5.9 High-Fidelity prototyping	95
A.5.10 Accessibility testing	96
A.6 Last evaluation	99
A.6.1 Tasks	99
A.6.2 Procedure	102
A.6.3 Analysis Last Evaluation	105
A.7 Attached CD contents - Index	122

1 Introduction

This section presents the motivation, the objectives, the context and the structure of this Master thesis.

1.1 Motivation

In the industry, User-Centered Design (UCD) has gained increasing acceptance thanks to the community awareness of its relevant benefits that improve the final product quality in terms of usability propriety [21] [13] [28] [33]. In fact, companies are the more and more interested in this approach, which leads to an increase of UCD beginners. Many are the UCD processes and methods that has been matured in the last years. That does not facilitate beginners in having a quick first approach with UCD (philosophy, principles, general phases, methods and so on) and furthermore there has not be found a tool that helps them for it. Thus, this research has tried to overcome this lack.

1.2 Objectives

The aim of this thesis is to implement an extensible web application, called “Tool for User-Centered Design“ (T-UCD) which pedagogically supports and goes along with UCD beginners during the entire UCD process. The tool should support both (1) UCD beginners with a tutorial and (2) beginners and practitioners to save the results of their UCD experiment. UCD methods have been modeled with XML technology in order to create a UCD Markup Language. This tool is intended to give beginners a better and practical understanding of UCD, convince beginners about the usefulness of it and see if there is an interest in actually using T-UCD. UCD beginners can be anyone that is linked to the development of a computer system (such as programmers, designers, development managers and so on) or anyone that is interested in UCD.

1.3 Context

This thesis has been made in collaboration with the Swiss Federal Office of Information Technology, Systems and Telecommunication (FOITT). This Federal Office is one of the internal ICT service providers in the Swiss Federal Administration that aims to develop and to provide efficient, secure, user and public-friendly IT solution to the administration. In FOITT, approximately 1'000 staff members collaborate together in 25'000 workplace systems with 4'645 servers and almost 10 petabytes of storage space¹.

In April 2013, a unit of the FOITT, named User Interfaces Development, launched a project that consists in building a team that would be on charge of designing and developing User Interfaces (UI) (the front-end part) and leave the rest of the application (the back-end part) to other units of the organisation. The reason why this project has been launched is that FOITT intends to professionalise UI development in order to create better user interfaces, to achieve a good user experience and

¹<http://www.bit.admin.ch/org/index.html?lang=en>, accessed October 2013

consequently increase customer satisfaction. Currently, there are not specialised UI designers in FOITT.

The mission of this unit is the following:

The User Interfaces Development unit is specialized to the design and development of user interfaces. In doing so, the perceptions of the end-users and the developers are closer to each other providing optimal ergonomic applications.

The strategy to achieve this mission is to have UI developers who are at the same time UCD experts. Thus, those developers will need to be convinced of the efficiency of UCD and to acquire strong UCD skills.

The needs to accomplish this mission are the following:

1. Definition of the UCD development process.
2. A pragmatic description of UCD development process and methods, including standardized forms.
3. In the near future, integration of UCD tool in the agile task manager software (JIRA or Team Foundation Server).

As it can be observed, FOITT and the new born User Interfaces Development unit is a perfect environment to develop and evaluate the objectives of this thesis.

1.4 Organization of the report

This report is structured as follows: Section 2 explores the literature review, Section 3, a brief introduction of UCD, usability, UCD process and its benefits and criticism will be described. The design of T-UCD is described in section 4, the technology choice to develop and the actual development are explained in section 5. Then, in order to evaluate if T-UCD reached the goals of this thesis, an evaluation has been performed which will be described in section 6. Finally, section 7 will present the conclusions and future works of this research.

2 Related works and Background

The purpose of this section is, in Subsection 2.1, to first briefly explores the related works to this thesis in order to observe which tools currently exist having the same objective of T-UCD. Then, in Subsection 2.2, will give to the reader a sufficient overview about User-Centered Design in order to understand this thesis.

2.1 Related works

The best of what could have been look for related tools similar to the nature of T-UCD is not much. There exist tutorials and tools for UCD methods but a unique tool that integrates both concepts aimed for UCD beginners is not known as far as it could have been found.

Concerning tools for storing data during a project there are tools such as Jira Confluence [3], Basecamp [5], Liquid Planner [27] and Teambox (Redbooth) [42] that can be adapted to store UCD data. But a tool specific for user-centered design is not known.

Then, there are tools for some UCD methods which allow to easily perform them and store data. In the user research phase there are: Persona [37] to create persona, StoryboardThat [47] for storyboard, SurveyMonkey [49] and SurveyGizmo [48] where it is possible to create surveys and gather automatically the data. Then, in order to draw interactive prototypes Pidoco [38] and Balsamiq [4] are some of the existing tools. Regarding the evaluation phase, Pidoco, Data Logger [12] and Ranorex [41] are tools that enables to gather data of end-users during the evaluation of a product. Finally, Userzoom [54] is a software that supports the entire UCD process by planning, researching, designing and measuring but only for online products. Each of these tools are really helpful for supporting and performing some UCD methods, but none of them covers the entire UCD process and methods and have integrated a tutorial explaining and giving guidelines in order to perform them headed for UCD beginners.

Finally, existing tutorials of UCD are Usability Methods Toolbox Handbook [51], UsabilityNet.org, Usability.gov, ServiceDesignTool.org, Interaction-design.org and Information and Design [20] are some of the one existing. But they dont provide a tool to store UCD methods data.

As mentioned before, UCD methods have been modeled with XML technology in order to create a UCD Markup Language. Currently, none was found related to it.

As exposed in this section, there are some tools that stores project data (that can be adapted for UCD projects), tools that allows to perform and store some of UCD methods and tutorials that explain UCD. However, as far as can have been found, there is not a unique tool that contains a tutorial and a tool that stores and manages UCD methods data and that cover the entire process for UCD beginners.

2.2 Background

2.2.1 Definitions

2.2.1.1 User-Centered Design .

In the research literature, several definitions about User-Centered Design (UCD) have been proposed over the past years, but a common agreement of a single and precise definition is still missing in the Human-Computer Interaction (HCI) community [15]. The works of Göransson [15] and Gulliksen [16] expose this issue by studying the different definitions found in the past.

In order to understand this lack, some of them are as following listed:

In 1986, User-Centered Design (or User-Centered System Design - UCSD) was firstly coined by Norman and Draper [36] with the following sentence:

But user-centred design emphasizes that the purpose of the system is to serve the user, not to use a specific technology, not to be an elegant piece of programming. The needs of the user should dominate the design of the interface, and the needs of the interface should dominate the design of the rest of the system.

Later in 1994, Preece et al. [39] express that UCD is:

An approach which views knowledge about users and their involvement in the design process as a central concern.

And in 1996, Karat et al. [25] stated that:

A user centred design process is one that sets users or data generated by users as the criteria by which a design is evaluated or as the generative source of design ideas.

By writing that, we can see that the authors consider that the needs of the user are what should lead and what is central during the development of the system.

Furthermore, Karat et al. [25] affirmed that:

For me, UCD is an iterative process whose goal is the development of usable systems, achieved through involvement of potential users of a system in system design.

And one year later, he [24] continues by suggesting to:

[...] consider UCD an adequate label under which to continue to gather our knowledge of how to develop usable systems. It captures a commitment the usability community supports that you must involve users in system design while leaving fairly open how this is accomplished.

According to the notes on UCD of the World Wide Web Consortium (W3C) UCD can be interchanged with human-centred design process². ISO 13407 (1999) states that:

²<http://www.w3.org/WAI/EO/2003/ucd> accessed november 2013

Human-centred design is an approach to interactive system development that focuses specifically on making systems usable. It is a multi-disciplinary activity.

Citing these lines, others important concepts about UCD come to light: the involvement of the user during the design process, its iterative nature and the fact that it engages multiple disciplines. Behind these lines, there is an important notion that characterizes UCD process: the perpetual involvement of the users that allows the members of the UCD team to build progressively the knowledge about their needs. Furthermore, Karat [24] sentences show that during the development of the product the way you will involve users is open and it is not strict; the most important point is that at the end usable systems will be delivered. The latter states the goal of UCD.

2.2.1.2 Usability .

The ISO defines usability as:

The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use.

As we can see from this definition, there are three different components that constitute usability: effectiveness, efficiency and user satisfaction. ISO³ explains :

Effectiveness

accuracy and completeness with which users achieve specified goals

Efficiency

resources expended in relation to the accuracy and completeness with which users achieve goals

User satisfaction

person who interacts with the product is freedom from discomfort and positive attitudes towards the use of the product

The definition of Nielsen [35] about usability suggests that it is a system quality attribute that indicates the ease of use of a user interface. It has five quality components:

Learnability

How easy is it for users to accomplish basic tasks the first time they encounter the design?

Efficiency

Once users have learned the design, how quickly can they perform tasks?

Memorability

When users return to the design after a period of not using it, how easily can they reestablish proficiency?

³<https://www.iso.org/obp/ui/> accessed november 2013

Errors

How many errors do users make, how severe are these errors, and how easily can they recover from the errors?

Satisfaction

How pleasant is it to use the design?

2.2.1.3 User-Centered Design process .

Discussion

Not only the definition of User-Centered Design lacks of a unique agreement within the HCI community, but also its process. In fact, for decades many have been the models proposed for it such as Usability Lifecycle [34], Task-Centered User Interface Design [26], Contextual Design [6], Usability Engineering Lifecycle [30], DIN EN ISO 13407 [21], ISO/TR 18629 [22], Scenario-based Development [44], User-Centered Design-Model [55], Goal-Directed Design [11] and others.

By comparing them, differences and similarities will arise. For example, they adopts different terminology, number of phases, names of roles and detail of description [58]. A common UCD process would be an utopia to apply in practice. Indeed, each company evaluates, decides and adopts the model to follow and it customizes it according to their nature: type of software, its development process and the company organization [58].

For the objectives of this thesis, this chapter will not analyse the UCD process models in details but it will find adequate terminology and division of UCD process phases that could cover the widest agreement within the existing UCD models in order to generalize them in a high level. In fact, by not comparing them in details, clear similarities appear on the whole [58].

Woletz [57] studied and compared nine well-known UCD process models in the HCI community (listed previously at the beginning of this section). In Figure 1 is reported the table where she summed up and compared UCD process models.

In Figure 1 Woletz separates four main phases that are in common within the UCD process models : requirements analysis, conception and modeling, prototyping and evaluation. So, we can consider that generally, the UCD process models follow the same high-level phases.

In this research the first two phases that Woletz divided will be considered as one. That is because in this thesis these two phases are intended similar as it is intended to focus on the user research (who the end-users are and what are their needs). Thus, three phases will be considered and nominated as follow: user research (including requirements analysis and conception and modeling), prototyping and evaluation. See in Figure 2.

Description

It is not in the scope of this thesis to give an exhaustive description and analysis of these phases and their respective methods. Thus, it is provided a brief description

Process model	Requirements analysis	Conception and Modelling	Prototyping	Evaluation
Usability Life Cycle	- Know the user - Competitive analysis	- Parallel Design	- Participatory Design - Coordinated design of the total interface - Apply guidelines and heuristic analysis - Iterative design	- Prototyping - Empirical Testing - Collect Feedback
Task-Centered User Interface Design	- figure out who's going to use the system to do what - track the design	- choose representative tasks - plagiarize	- rough out a design - build it - change it - iterate - change it	- think about it - create a mock-up or prototype - test it with users - track the design
Contextual Design	- Contextual Inquiry	- Work Modeling - Consolidation - Work Redesign - User Environment Design	- Mock-up and test with customers	- Mock-up and test with customers
Usability Engineering Lifecycle	- Anforderungsanalyse	- Entwurf (erste Iterationsschleife)	- Entwurf (zweite und dritte Iterationsschleife)	- Testen - Installation
DIN EN ISO 13407	- Verstehen und Festlegen des Nutzungskontextes - Festlegen von Anforderungen		- Entwerfen von Gestaltungslösungen	- Beurteilen von Gestaltungslösungen
ISO/TR 18529	- HCD 4: Understand and specify context of use - HCD 3: Specify stakeholder and organisational requirements	- (HCD 5: Produce design solutions)	- HCD 5: Produce design solutions	- HCD 6: Introduce and operate the system
Scenario-based Development	- Analyze	- Design	- Design	- Prototype and Evaluate
User-Centred Design-Model	- Planning	- Concept	- Detailed Design and Development	(läuft parallel zum gesamten Prozess)
Goal-Directed Design	- Research - Requirements	- Modeling - Framework	- Refinement	

Figure 1: Comparison between UCD process models (modified after [57, p. 22])

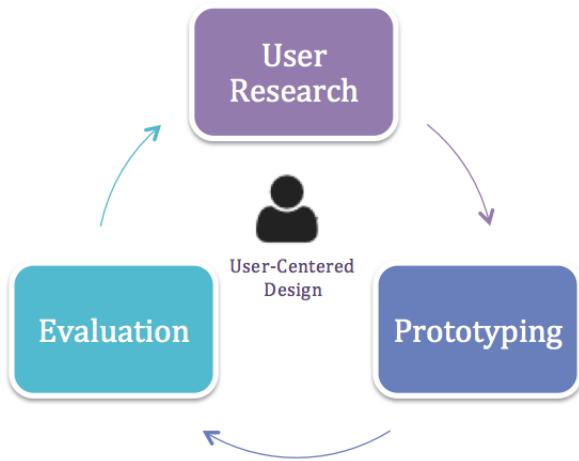


Figure 2: UCD process for this research

of the phases and ten UCD methods: user research (survey, interview, observation, persona and scenario), prototyping (sketch, storyboard and high-fidelity prototype) and evaluation (usability evaluation and accessibility testing). There are several UCD methods that can be performed in UCD approach. For this thesis, 10 have been chosen by following the decisions of FOITT and by considering the most used methods from recent surveys conducted in order to analyse the state of the art of UCD [19] [28] :

1. User Research ([46, Chapter 2], [53])

In order to redesign an existing system or to design a new one that meets the needs of the end-users, it is important to understand them, their tasks and their environment where the system is or will be used. It may appear a simple task, but actually there are many aspects that should be discovered. Firstly, the end-users itself such as biography (age, family, personality, education), professional status (job title, work experience, current work, tasks and responsibilities, professional goals), health (abilities and disabilities), the relation with the technology (easiness, difficulties) and so on. Secondly, its tasks and environment. All these aspects will bring to light the needs of the end-users. Thus, at the end of this research, it should be established what are the elements to consider for the system requirements.

In the UCD process, user research focuses on these goals by applying a variety of methods such as: interview, survey, observation, persona, scenario and so on.

(a) Survey

Surveys are mainly used to gather information of the users (who they are and how they will use the future system). In order to reach this purpose, unambiguous questions and statements are prepared. They are often analysed statistically. They can be sent by hand, by post, online and by e-mail [46, p. 34- 36].

(b) Interview

Interviewing the potential user of the future system is a method to gather information quickly and friendly in order to acquire a deeper understanding of them: facts, attitudes, beliefs, desires and experiences [46, p. 33-34]. Generally, it is composed by an interviewer and one informant at a time and can be conducted face-to-face, by phone, videoconference or via instant messaging system [52].

(c) Observation

This method consists in observing the target user of the future system in their natural workplace or home in order to find out how they work, which are their tasks and their environment. Observation is essential especially during the user research phase but also in a later stage when the system is actually in use. It mainly allows collecting qualitative data by the observer that takes notes and/or audio-/video- records the activities focusing on aspects that are interesting for the design process. The observation can be direct (the observer is actually present in the user environment) or indirect (the users, their tasks and environment are videorecorded) [46, pp. 29- 31] [53].

(d) Persona

Personas are fictive descriptions of a hypothetical actual end-user and their purpose is to embody the key end-users of a product during the entire design process. Personas are created from previous studies of potential actual end-users (based on interviews, observation, surveys and so on). They *are only as good as the research behind them* [52]: qualitative research should have high priority [8]. Generally, the elements of a persona are the biography (name, age, user group, education, personality), the goals he/she has, and his/her professional, health and technological status. *Although they are imaginary, they are defined with significant rigor and precision* [10, p. 158]. To make the persona more realistic, names and personal details are fictional while the rest is *based on qualitative and some quantitative user research* [52]. Even though *it sounds trivial [...] it is tremendously powerful and effective in every case* [10, p. 158].

(e) Scenario

A scenario is a text that explains how users typically perform their tasks in a specific situation and environment through the use of examples [53]. It has characteristic elements such as setting (context, situation), agents or actors, goals or objectives and plot [9, pp. 46-47]. The latter concerns sequences of actions and events such as *appearance and behaviour of the system; what people try to do with the system; what procedures are adopted, not adopted, carried out successfully or erroneously; and what interpretations people make of what happens to them* [9, p. 46]). Furthermore, scenarios are written early and continually during the development process because there is a very little chance to write the right scenario the first time. In fact, they are normally developed and refined over time and, depending

on the stage of the development process, they can be short or long with abstract or detailed content [46, p. 67]. The purpose of writing scenarios is that they help to identify the goals that must/should be achieved and can be used as a source of inspiration to design possible systems and organize a future usability evaluation [53].

2. Prototyping ([32], [43, p. 26 -29], [46, Chapter 3], [52], [53])

During this phase, some prototypes of user interfaces are designed based on requirements previously established during the user research phase. Firstly, they will be drafted on paper with few details (low-fidelity prototype). This allows an easy and cheap way of exploring first ideas from which more detailed prototypes will mature through iterative process of evaluation and redesign. Secondly, when the design objectives are mainly achieved a computer-based prototype and with more details (high-fidelity prototype) can be created. That allows a simulation of the interaction of the end-user and the interface (when clicking on a button a fictive command is executed), which conveys a more realistic idea of the final computer system.

The process of designing interfaces should be based on design guidelines. The most common are listed are [43]: visibility, feedback, constraints, mapping, consistency and affordance.

Producing prototypes of the target system allows making changes before it will actually be implemented. Changes accomplished after the system is coded have a higher cost in terms of time and money. Involving typical end-users in this phase is really important because designers are not the real end-users and may design prototypes that do not meet their needs.

At the end of this phase, few designs should be chosen in order to use it for the next phase: evaluation.

(a) Sketch

Sketch, which belongs to the low-fidelity prototype group, is a paper-based prototype usually created by hand. It is used to sketch interaction designs and interfaces. It allows to easily suggest, explore, trigger questions, propose, make attempts without fearing, as it is not definitive [46, pp. 115-117] [32] [52] [53].

(b) Storyboard

A storyboard is a sequence of sketches or screen layouts. Usually, it is a translation from a written scenario into a visual illustration. In a storyboard, it is showed how users would interact with an application or interface when undertaking a specific task and how the system functions would react. The level of details varies depending on the development stage of the lifecycle: the more it is advanced, the more details are represented [46, pp. 118-119] [53] [52] [17].

(c) High-fidelity prototype

A high-fidelity prototype is often digitalized and with many details of the system. It is based on computer and created with specific software. Usually it allows the users to interact with it because it simulates the behaviour of the system as if it was coded. For example, if a user clicks on a button, the interactive prototype executes the specific command [52] [45].

3. Evaluation ([46, Chapter 4],[53])

Finally, the third phase consists in evaluating if the prototype(s), which has been established in the previous phase, is/are usable: effective, efficient and satisfactory to use. The most commonly performed kind of evaluation is the one that involves the end-users. Typically, they are supposed to accomplish some tasks with the prototype, to give feedback about problems encountered and to explain their expectations. This phase is useful to designers in terms of understanding what should be improved.

Furthermore, it is also possible to hire usability experts that check if the prototype achieves the usability heuristics.

At the end of this phase, designers should have gathered data in several formats such as comments, notes, audio- or video- or screen- recordings.

Some methods performed in this phase are for example usability evaluation and accessibility evaluation.

(a) Usability evaluation

Usability evaluation consists in testing a product or a service with the representative end-users under realistic conditions. The purpose of this method is to detect the usability problems by collecting qualitative and quantitative data such as success rate, task time and user satisfaction with the product in order to solve them and improve the system. The typical procedure of the evaluation is that the users are supposed to accomplish some representative tasks with the system while the evaluator watches, listens and takes notes about the performance and the difficulties the end-users encountered [46, pp. 424] [53] [52].

(b) Accessibility testing

Accessibility testing is part of usability evaluation. It has the goal to verify if the computer system that has been tested is also usable for people with disabilities [56]. There are various kinds of disability such as visual, auditory, physical, speech, cognitive and neurological [56]. In order to allow individuals with such disabilities to use a computer system, an accessible system should provide information in different formats (sound and visual) and support, besides the usual point-and-click interface, keyboard- and voice-based control [56].

Usually, developed systems have tendencies to discriminate people with disabilities. In order to make all equal in front of the law some accessibility

ity standards have been established such as US federal governments Section 508 legislation and the W3Cs Web Content Accessibility Guidelines (WCAG) [56]. In this thesis, the latter will be considered. WCAG is a stable and referenceable technical standard. In order to make content and functionality accessible, WCAG is composed of 12 guidelines organized under 4 basic principles: systems should be perceivable, operable, understandable and robust⁴.

2.2.2 Benefits and criticisms of UCD

The statistics studied in the CHAOS report by The Standish Group in 1995 [50] aims to *identify the scope of software project failures, the major factors that cause software projects to fail and the key ingredients that can reduce projects failures* [50, p. 1] detected in small, medium and big companies. According to this study, the success rate of projects that were accomplished on-time and on-budget, covering all features and functions established at the beginning, was only 16.2%. Then, projects that were completed but over time and budget and with insufficiently features and functions expected, covers the 52.7% Moreover, 31.1% of the projects were canceled during the development.

According to CHAOS report, the three main factors that cause the projects to be challenged were:

1. the lack of user input;
2. incomplete requirements and specification;
3. changing the requirements and specifications.

The adoption of UCD during the development of a system can help to solve these challenges. In fact, the previous listed factors of failure could be avoided thanks to the fact that UCD focus on the end-users by involving them constantly: there will be a perpetual user input, requirements and specifications will be more complete and changes will appear earlier. Consequently, the benefits will be in terms of finance and user satisfaction. In fact, the benefits of considering UCD activities during the product development are numerous and relevant.

According to ISO 13407 [21], the most important are:

- The product will be easier to understand and used by the end-user(s)
- Improvement of user satisfaction and reduction of user frustration
- Increase of product quality

Furthermore, a common agreement within the industry is that UCD is considered as a fundamental factor of increase of success for the product usefulness and usability (79% and 82% respectively [28]). In fact, in many cases there is a reduction of the development time and effort and of the support costs [29] [33]. That means, for

⁴The reference for more information is available here www.w3.org/TR/UNDERSTANDING-WCAG20/ and www.access-for-all.ch/

example, that UCD allows detecting earlier functionalities that are useless thus avoiding to develop them: the earlier changes are detected, the less it will cost because in fact the more back in the process will be the change, the more is costly [7].

Moreover, often there is an increase of revenue and sales [29]. That is due to the fact that the end-users of the computer system are more satisfied in using it.

The reason why there are all these advantages is that UCD allows designers and developers to have a better picture of how the system should be because there is more empathy with the users: designers and developers can put themselves in end-users shoes.

Concerning the main disadvantage of UCD, it is known that it may be time consuming when gathering data from users in an unknown environment for example [1]. But if there are high time and budget constraints it is better to perform some cheap and rapid methods of UCD than nothing at all. Generally, 10% of a project budget should be invested in UCD approach, which increases in average 83% the usability of the system [33].

2.3 Resume

As seen in this section, there is not a unique and clear definition of User-Centred Design. Many are the authors that have contributed to it over more than twenty years and here only some have been cited. From them, the key proprieties of UCD can be summarize which help understanding its philosophy:

- centralization of user needs as the product development leader
- users involvement during the UCD process
- the iterative nature of the UCD process (the knowledge is built step by step)
- it is a multi-disciplinary activity
- its goal is the development of usable systems
- the way the goal is achieved is open

Comparing with ISO 13407 definition of UCD, we find similarities. In fact, it states that UCD is an

approach to human-centred software- and hardware development that identifies four basic principles:

- *active involvement of users and a clear understanding of user and task requirements,*
- *an appropriate allocation of functions between users and technology,*
- *the iteration of design solutions, and*
- *multidisciplinary design.*

3 Design

In order to develop T-UCD, the UCD process has been applied. In this section, it will be presented the process throughout the three phases: user research (Subsection 3.1), prototyping and evaluation (Subsection 3.2). In the first phase, an online survey has been sent to developers of FOITT, then, based on the results of the latter, it could have created a persona and some scenarios. Then, based on that phase, prototypes and evaluations have been performed iteratively in order to achieve the final tool.

3.1 User research

3.1.1 Online Survey

At first, an online survey (Appendix A.1) has been sent to .NET and JAVA developers employed in FOITT, in order to understand who the end-users of T-UCD are and to know about their opinion and awareness of UCD approach. The survey was composed by eight questions mixed in closed, scalar and multi-choice questions and often a comments field has been provided. 16 people answers to this survey: 8 JAVA developers and 8 .NET developers. A summary of the answers of each questions is reported here below (more detailed answers in Appendix A.2):

1. How many years have you worked as a developer?

Figure 3 and Table 1 show that the majority of people have worked more than 11 years as a .NET or Java developer.

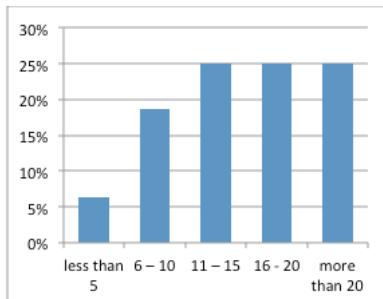


Figure 3: Graphic online survey question 1

Table 1: Table online survey question 1

	Percentage	Count
less than 5	6.3%	1
6 - 10	18.8%	3
11 - 15	25.0%	4
16 - 20	25.0%	4
more than 20	25.0%	4
answered question		16
skipped question		0

2. Which of these roles is the nearest to yours?

Figure 4 and Table 2 show that the half surveyed people were half software engineers, a third programmers and 18.8% software architects.

3. Imagine you are working in a Scrum Team that has the task to enhance an existing User Interface for an Internet Survey application that will be used for the Swiss Census. How important would you rate these aspects during the development process? (1 = not important, 5 = very important).

Figure 5 and Table 3 show the average importance that the surveyed people give to this aspects. Ordered by the most important they are: specifications, user's tasks, program well coded, technologies and techniques. Even though the surveyed people are aware about the high importance of specifications and

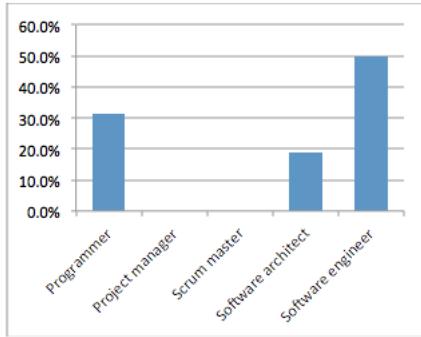


Figure 4: Graphic online survey question 2

Table 2: Table online survey question 2

Percentage	Count
Programmer	31.3%
Project manager	0.0%
Scrum master	0.0%
Software architect	18.8%
Software engineer	50.0%
answered question	16
skipped question	0

user's tasks, the value of user's tasks (3.8) aspect is quite slow comparing the actual importance that should be given (5) following UCD principles.

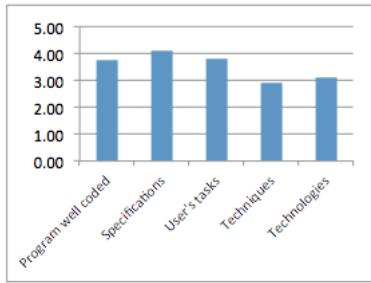


Figure 5: Graphic online survey question 3

Table 3: Table online survey question 3

Aspects	Average
Program well coded	3.75
Specifications	4.13
User's tasks	3.8
Techniques	2.94
Technologies	3.13

4. How important is it to include users in a software development process for you? Imagine yourself in the same situation as in the previous question. (1 = not at all, 5 = absolutely important!)

At this question, more than half (68.8%) think that it is absolutely important, 25% important and only one person believe it is not at all important as showed in Figure 6 and in Table 4. The weighted average is 4.5 which indicates that the surveyed developers are well aware that including users during the software development process is really important.

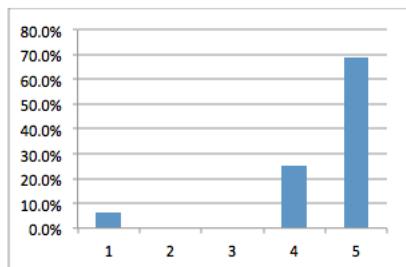


Figure 6: Graphic online survey question 4

Table 4: Table online survey question 4

	Percentage	Count
1	6.3%	1
2	0.0%	0
3	0.0%	0
4	25.0%	4
5	68.8%	11
answered question		16
skipped question		0

5. In your opinion, how useful is it to have methods to understand users' needs and to evaluate the interface of the software you are developing? (1 = not useful, 5 = very useful)

Figure 7 and in Table 5 show that half surveyed developers believe that it is very useful, 37.5% useful and approximately 12% not so useful. The weighted average is 4.2 which demonstrates that in FOITT the JAVA and .NET developers are quite persuaded that methods to involve users is useful.

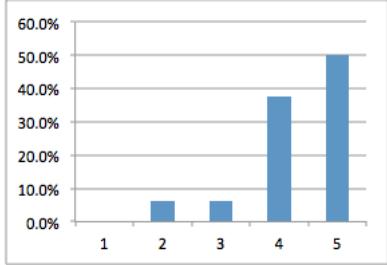


Figure 7: Graphic online survey question 5

Table 5: Table online survey question 5

	Percent	Count
1	0.0%	0
2	6.3%	1
3	6.3%	1
4	37.5%	6
5	50.0%	8
answered question		16
skipped question		0

6. Have you ever heard about User-Centered Design process?

Figure 8 and in Table 6 show that half has heard about it, but don't know much, 25% knows what it is and have already seen someone use these practices in his/her team. Then, 18.8% knows what it is, has already used these practices and 6.3% has no clue (one person) and nobody is not interested!

In the comments field of this question a .NET developer add an interesting answer that is following reported:

To involve the users in the design process is one of the most important things in development. I've seen a lot of examples in the past where everything was well coded, but useless for the user. At the end, everything was more expensive because changes at a later stage of the Project are very difficult.

Table 6: Table online survey question 6

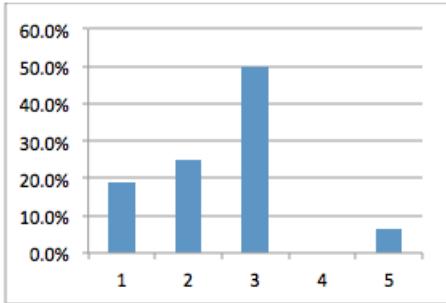


Figure 8: Graphic online survey question 6

	Percentage	Count
1 Yes, I know what it is and I have already used these practices!	18.8%	3
2 Yes, I know what it is and I have already seen someone use these practices in my team!	25.0%	4
3 Mmh, I have heard about it, but I don't know much!	50.0%	8
4 Yes, I have already heard about it. I am not really interested!	0.0%	0
5 No clue!	6.3%	1
answered question		16
skipped question		0

7. Which of these UCD methods have you already heard of?

Figure 9 and in Table 7 show the most heard practices are:

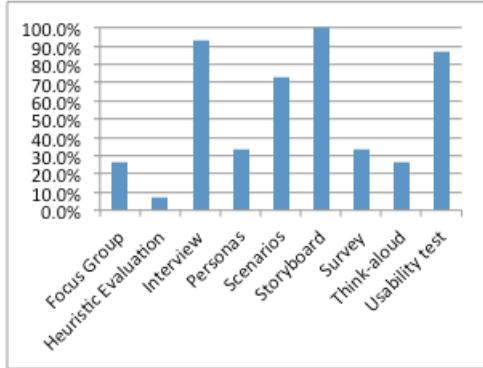


Figure 9: Graphic online survey question 7

Table 7: Table online survey question 7

Methods	Percentage
Storyboard	100.0%
Interview	93.3%
Usability test	86.7%
Scenarios	73.3%
Personas	33.3%
Survey	33.3%
Focus Group	26.7%
Think-aloud	26.7%
Heuristic Evaluation	6.7%

8. In which stage of the development process do you think the UCD methods would be most beneficial? (1 = not beneficial, 5 = very beneficial)

Figure 10 and in Table 8 show that in Design and Analysis phases UCD methods would be the most beneficial.

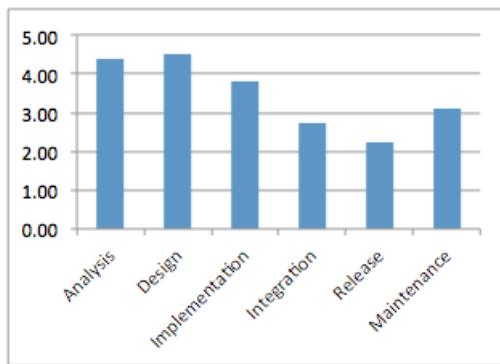


Figure 10: Graphic online survey question 8

Table 8: Table online survey question 8

Phases	Average
Design	4.50
Analysis	4.38
Implementation	3.81
Maintenance	3.13
Integration	2.75
Release	2.25

3.1.2 Persona

Thanks to the online survey presented in the previous subsection, a UCD beginner persona for T-UCD has been created. It is showed in Figure 11.

3.1.3 Scenario

From this survey and the UCD background that has been presented in section 2.2 of this thesis, it has been possible to create some scenarios in order to have an idea about the future application T-UCD. The following scenarios are the final, matured from the primitive scenarios created at the beginning of this project.

General info	
User group	Software engineer (.NET)
Fictional name	Robert Finniger
Age	57
Photo	
Biography	
Marital status	Married
Family status	3 daughters
Education	BSc – Enterprise Economics and Management MSc – Computer Science
Personality	Robert is passionate in railway modeling, travelling around Swiss and reading in his garden.
Job goals and tasks	<p>Robert has been a software engineering (.NET) for 33 years (questions 1 and 2) and currently he has a job in the Swiss government.</p> <p>Now, after so many years of back-end development, he would like to focus more on UI/front-end development. That is due to the fact that he thinks that two of the most relevant aspects of the development process are the gathering of the product specifications and the understanding about the users' tasks (q. 3). In the past, he has seen a lot of examples where everything was well coded, but the final product was useless for the user. In fact, at the end the project was more expensive because changes at a later stage are very difficult (q. 6).</p> <p>Furthermore, he believes that it is absolutely important to include users in the software development process (q. 4) mainly during the analysis and design stage (q. 8). Therefore, having methods to understand users' needs and to evaluate the interface of the software is very useful (q. 5).</p> <p>Recently, he has heard about User-Centered Design process and its methods: storyboard, interview, usability, scenarios (q. 7), but he does not know much about it (q. 6).</p> <p>His company has created a new unit called User Interface Development that will use UCD approach. As he is interested in this field now, he had the opportunity to take part of this.</p> <p>His objectives are to learn and practice User-Centered Design methods and the open-source JavaScript framework AngularJS.</p>
Health	
Health	He wears glasses when he works.
Technology	
Technology	Due to the nature of his job, he is used to work with computers. He has a Smartphone and works on a desktop computer with two monitors on Windows OS. His browser of choice is mainly Internet Explorer.

Figure 11: Persona for T-UCD: UCD beginner

Scenario #1: Plan observation to gather end-users information (Tutorial + T-UCD)

Robert is a beginner regarding UCD. The UI team, where recently he has been involved, has a new project called “Identify”: develop a software for dentists that stores data of their patients. Robert and other members of the team are in charge to gather information about the end-users to understand what are their needs and their tasks. The project manager of this project told Robert that he will have to use observation method for that. He will go to some dentist clinics in the region where he would observe and discuss with the dentists. He should record data by taking notes and with an audio recorder.

Robert is a bit nervous about this assignment, he had a short introduction about observation during the UCD course organized by his company but it is his first time that he will perform it! But no panic, now it is high time to organise it: he needs some tips on best practices and examples to accomplish observations.

So, he opens the UCD tool that welcomes him and offers the following functionalities:

- Recent UCD projects
- Create a new UCD project
- UCD Tutorial

As he needs to have some tips about how to perform observations, he clicks on the UCD tutorial.

A new page loads and presents on the left four sections of UCD phases:

- “Overview”
- “User Research”
- “Prototype”
- “Evaluation”

As the project is in the first phase, he clicks on “User Research” and he finds a list of methods usually used during this phase: “Observation”, “Survey”, “Interview” and so on. He clicks on “Observation” and finds a short description, its benefits, the best practices and some examples in order to efficiently perform this method.

Thus, by learning that, he could learn more about this method and prepare properly the plan of the observation. In order to do it, he clicks on the “T-UCD” button and then on “Identify” project from the list of existing projects. A new page loads. Robert clicks on the “Observation+” button from which it appears a form with the essential required data to perform efficiently this method: dates, objective, place, procedure and so on. When the plan is completed, he could also arrange some meetings with the dentist clinics.

Scenario #2: Store a performed usability evaluation (T-UCD)

Robert has been engaged in a project that consists in improving the usability of an existing mobile application of a newspaper named “VDnews”. The project is in the middle of its development. Indeed, some improvements have already been done thanks to the involvement of the end-users that helped Robert and designers team to find the problems about the application and to solve them. The involvement of the end-users was precious during the evaluation of some prototypes proposed by the interaction designers. Recently, Robert was in charge to accomplish a usability evaluation to test if the new proposed menu was usable. Ten were the representative end-users who had to perform three tasks.

Now, he needs to store what he gained from users feedback so that he and his team could improve the prototype. In order to store all that information, he opens T-UCD where he identifies the project “VDnews” within a list of existing projects and clicks on it. A new page is loaded where on the left is showed a list of existing stored UCD methods (two personas, three scenarios, one sketch, two high-fidelity prototypes and four usability evaluations).

He would like to create a new usability evaluation. Thus, he clicks on the “Evaluation” tab under where he finds a button with usability evaluation and a symbol plus “+” on it. When he clicks, it appears an empty form to be filled up: dates of the evaluation, number of users, descriptions of the tasks and so on. At the end of the form, a field labeled “Findings” is provided where Robert fills in it the problems gathered from the end-users after the usability evaluation. After filled up the form, he clicks on the “Save” button and on left a new item type “usability evaluation” is added to the UCD methods list of the “VDnews” project.

Scenario #3: Edit previous existing scenario (T-UCD)

An estate agency needs a web application that allows users to find apartments and it engaged the Roberts company for that. The project has been started since some months and after a period of user research, two personas and three scenarios have been already created in T-UCD. After a usability evaluation, Robert and his team discovered that one of the scenario created and stored previously in T-UCD must be slightly changed because the end-users gave more explanation regarding the way of how they look for apartments. Robert is in charge to change that scenario. So, he opens T-UCD and clicks on the concerned project. Then, on the left a navigation space is provided, where all the UCD methods of this project are listed. He looks for the respective scenario and clicks on its edit button. On the right, a form appears filled by the data of the scenario previously written. He reads and edits it according to what the end-users said. Then, he clicks on “Save” and the method is updated.

3.2 Prototyping and evaluation

Thanks to the “User research“ phase described in the previous subchapter, it is possible to extract and set the requirements for T-UCD that cover the needs of UCD beginners:

1. a tutorial where UCD methods description, benefits, best practices and examples are described
2. a way of creating a new UCD project and see the existing projects
3. a structured form for each UCD methods as guidelines to perform them
4. a way to create, read, update and delete (CRUD) UCD methods

From that, it is possible to conceive the future user interface (UI) for T-UCD. Several formal and informal prototypes and evaluations have been performed to reach the final UI. In the next pages, the most significant prototypes and evaluations with the most important decisions of changes will be presented.

In order to conceive the UI for T-UCD based on the requirements listed above, three pages will be created:

1. Homepage
2. T-UCD
3. Tutorial

Each steps of the prototype and evaluation process is divided into iterations beginning with first initial low-fidelity prototypes then progressively maturing high-fidelity prototypes and finally reaching the final implemented UI.

3.2.1 Iteration 1 - low-fidelity prototype: sketches

At first, some sketches on pencil and paper have been created for the three pages.

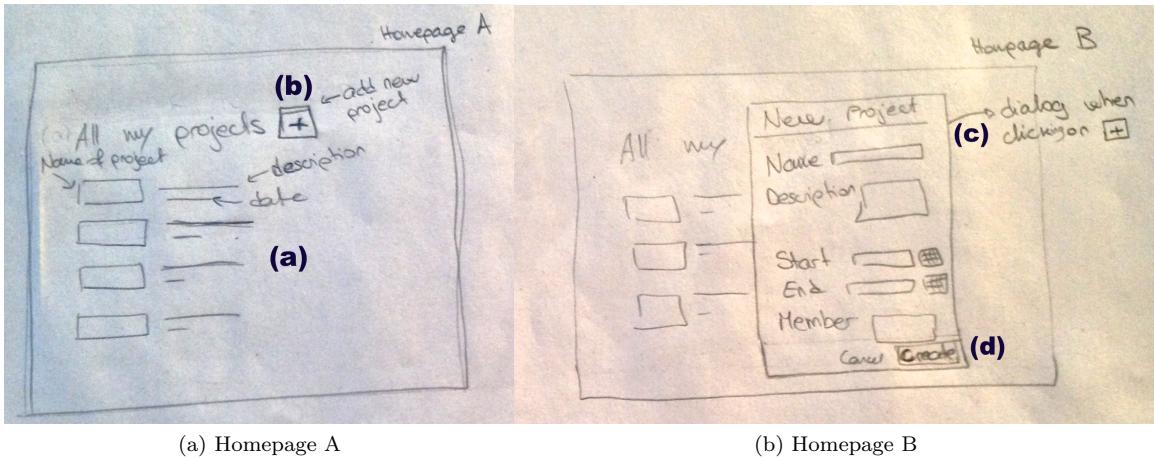
1. Homepage

In homepage, the second requirement concerning the creation of a new UCD project and the list of the existing projects will be placed.

Figure 12a and Figure 12b show the homepage. In Figure 12a, the list of the existing projects with their respective name, description and date is presented (a). In order to create a new UCD project, the end-users should click on the “+“ button (b) next to “All my projects“ title. After clicking on “+“ button (b), a dialog appears Figure 12b (c) providing a form to fill up the data for the new project: name, description, start/end dates and the members.

2. T-UCD

After creating the project by clicking “Create“ button (d) in Figure 12b it will appear T-UCD tool. The latter will provide structured form for UCD methods (third requirement) and CRUD (fourth requirement).



(a) Homepage A

(b) Homepage B

Figure 12: Homepage

To conceive T-UCD three UI options have been created.

Figure 13 shows the first option: on the left (e) it is provided a list of draggable and droppable objects that when dragged and dropped in the workspace the respective UCD method form will appear with fields that matches with its proprieties (f).

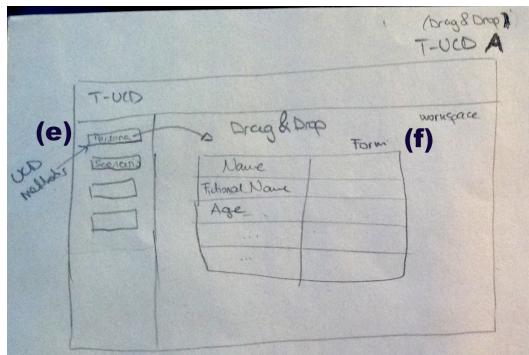


Figure 13: T-UCD A

The same form will appear in Figure 14a (g) and Figure 14b (h) but by clicking the UCD method button (e.g. (i) in Figure 14a (g) and Figure 14b). Two are the options to represent the list of UCD methods: Figure 14a in accordion style by separating the UCD methods that coincide with their phase (e.g. persona, scenario, observation and survey in “User research“ part (l)). Whereas in Figure 14b, the UCD phases are placed in three tabs (m) and the respective methods are placed in each of them (n). When clicking on a UCD methods, a form will appear in the workplace ready to be filled up (h).

3. Tutorial

In the tutorial page, it will be provided the description, benefits, best practices and examples of each UCD methods. In addition, an overview of UCD and its phases (user research, prototyping and evaluation) will also appear. Two are

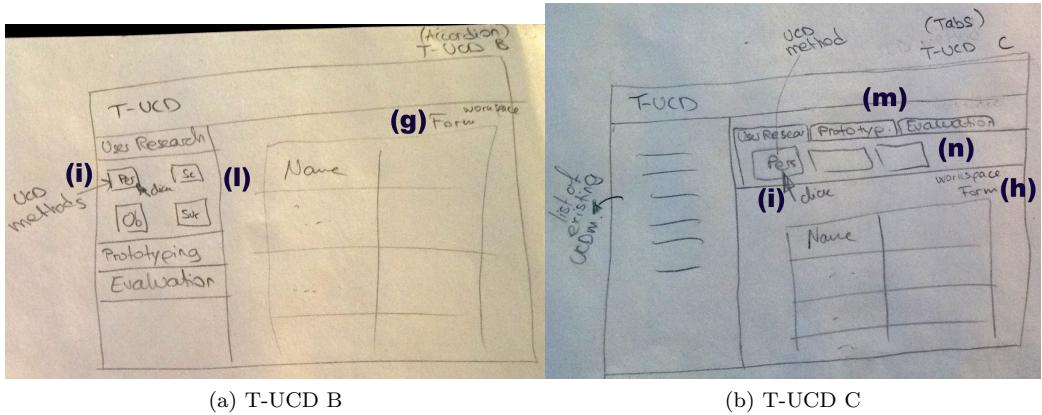


Figure 14: T-UCD B and C

the prototypes proposed:

Figure 15 has the same accordion style like in Figure 14a of T-UCD by categorizing each UCD methods in their respective phase (o). When clicking on a method (e.g. (p)), on the right will appear the information concerning the clicked method (q).

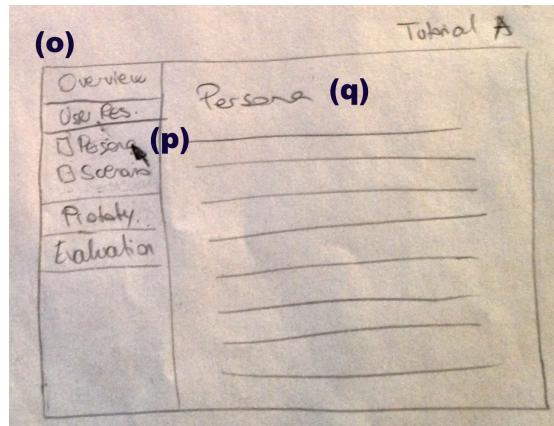


Figure 15: Tutorial A

The second UI option for the tutorial, showed in Figure 16, proposes the same tabs style of Figure 14b of T-UCD. On the left, the Overview is placed where are listed UCD and its three phases (r). In the middle right (s), the description of the phase will appear when clicking on its button. Then, when looking for information about the UCD methods, the end-users should click on the tab (t) of the concerned phase and click on the interested method in the list that is placed on the right side of the screen (u). When clicking on the interested method, the information about it will appear in the middle of the screen, the same area where information of the phase appeared (s).

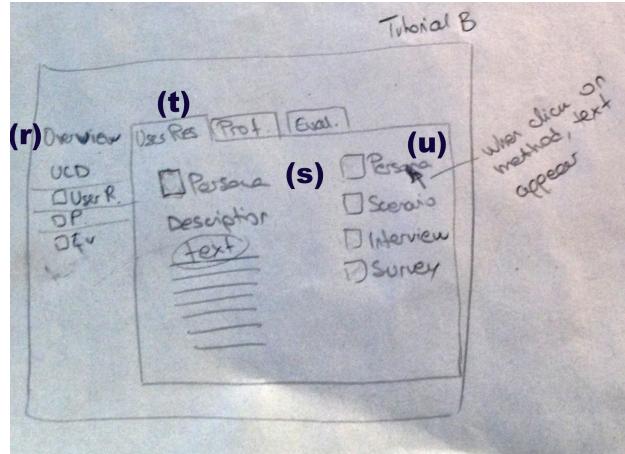


Figure 16: Tutorial B

3.2.2 Iteration 2 - medium-fidelity prototype: digitalization

The previous sketches have been analysed during informal discussions and evaluations after which a prototype among the different options for T-UCD and the tutorial have been chosen.

For both, it has been decided to use the tabs style (Figure 14b for T-UCD and Figure 16 for the tutorial). Firstly because, having a list of UCD methods on the left side of the screen reminds developers the navigation bar that they are used to in the IDE with which they work (e.g. Eclipse⁵ or IntelliJ⁶). Secondly, having two side bars, one on the left and one on the right, like in Figure 13 and in Figure 14a, would have been unpleasing to the eye.

Usability evaluation

After decided the design of the homepage and the T-UCD, a digitalized prototype has been conceived with Balsamiq⁷ in order to perform a formal usability evaluation for these pages (the tutorial was not evaluated at this stage).

The goals of the latter were:

- to detect major usability issues that could have not been identified in the informal discussions and evaluations because the sketches were not interactive when:
 1. creating a project
 2. creating a method
 3. browsing in the project
- to verify that the prototypes reflect the expectation of the end-users

⁵<http://www.eclipse.org/>, accessed December 2013

⁶<http://www.jetbrains.com/idea/>, accessed December 2013

⁷<http://balsamiq.com/>

The evaluation has been performed in FOITT with four UCD beginners and their expected skills and knowledge were:

- be interested in UCD
- have a basic idea about UCD
- have programming skills

The users were asked to accomplish the tasks reported here below on a MacBookPro 13“ laptop by thinking-aloud while the evaluator took notes on the usability issues detected during each the end-user evaluation session.

Task 1

Imagine that it is the beginning of a new UCD project. Please create a new project and a new persona.

NB: You dont need to fill up the text area (i.e. project name). Please leave it and imagine you have filled them.

The prototype in Figure 17 was assessed by the end-users for Task 1. In order to accomplish it, the user was supposed to click on the following buttons:

1. Figure 17a: add a new project (a)
2. Figure 17b: create a new project (b)
3. Figure 17c: create a new persona (c)
4. Figure 17d: fill up the form and save (d)
5. Figure 17e: save persona (e)
6. Figure 17f: the persona is saved (f)

Task 2

Imagine you are in project B. You have performed some observations and would like to store the data you collected in T-UCD. What would you do?

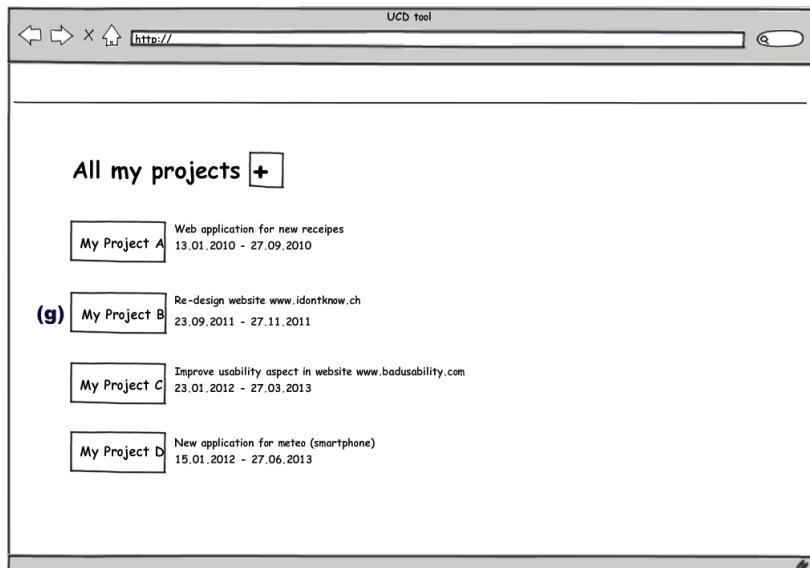
The prototype in Figure 18 was assessed by the end-users for Task 2. In order to accomplish it, the user was supposed to click on the following buttons:

1. Figure 18a: project B (g)
2. Figure 18b: create a new observation (h)
3. Figure 18c: the observation is ready to be created

The figure consists of six screenshots labeled (a) through (f), illustrating the process of creating a new persona in the UCD tool.

- (a) Home:** Shows the main dashboard titled "All my projects". It lists four existing projects: My Project A (Web application for new recipes, 13.01.2010 - 27.09.2010), My Project B (Re-design website www.idontknow.ch, 23.09.2011 - 27.11.2011), My Project C (Improve usability aspect in website www.badusability.com, 23.01.2012 - 27.03.2013), and My Project D (New application for neteo (smartphone), 15.01.2012 - 27.06.2013).
- (b) Create new project:** A modal dialog titled "Create new project" is open. It contains fields for "Project name" (Project E), "Description" (Project test for Master Thesis), "Creator" (Tomas Smith), "Customer" (Jane Grancer), "Project members" (checkboxes for Member 1, Member 2, Member 3), and "Dates" (Start: 15.01.2012, End: 15.01.2012). Buttons at the bottom are "(b) Create" and "Cancel".
- (c) Main:** The main workspace for Project E. On the left is the "OVERVIEW" sidebar with "User Research (D)", "Prototyping", "Evaluation", and "Implementation". The central area has tabs for "User Research", "Prototyping", "Evaluation", and "Implementation". Below these are buttons for "Interview", "Questionnaire", "Observation", "Persona", "User Group", "Scenario", and "Use Cases". A "Task Lists:" section is on the right. A modal dialog labeled "(C)" is open, showing a grid of icons for Persona, User Group, Scenario, and Use Cases.
- (d) Create new persona:** A modal dialog titled "Project E" for creating a new persona. It includes fields for "Personas Group (i.e. web manager)", "Fictional name", "Job titles and major responsibilities", "Demographics (age education ethnicity and)", "The goals and tasks", and "Their physical social and technological". Buttons at the bottom are "(d) Save" and "Close".
- (e) Save persona:** A modal dialog titled "Save Persona" for Persona A. It shows fields for "Name" (Person A) and "Save" and "Cancel" buttons. The background workspace shows the "OVERVIEW" sidebar and the "User Research" tab.
- (f) Persona saved:** The main workspace for Project E. The "OVERVIEW" sidebar shows "User Research (G)", "Prototyping", "Evaluation", and "Implementation (F)". The workspace displays the message "End Task A" and "Please call us for the next task".

Figure 17: Task 1



(a) Home

(b) Main

(c) Observation

Findings

After having analysed this evaluation, it can be observed that the goals previously established have been reached. In fact, each end-users accomplished successfully each tasks (create a project, a method and browse the projects) without any critical error. Then, globally speaking, the users were quite satisfied. In addition, some usability issues, within the most common detected from the end-users while accomplishing Task 1 and Tasks 2, could have been gathered. They are summarised in Figure 19.

Page	Problems	Suggestions
Figure 16a	Consider if there were many projects, it is annoying to scroll down the page	No scroll the page but a subpart of page, so you don't go away from the environment
		put only the last x projects on the top (eg. 5)
Figure 16b	End-users don't like dialog (A)	
	Consider if there were many members, no checkboxes (B)	
Figure 16c	The way of adding Persona is not intuitive. When clicking the Persona button (c), the end-users would expect to have a list of previously existing Personas in the workspace (C). When an end-user had to add a persona he said: "I have no clue on how to add a Persona!"	When clicking Persona button (c) show previous Personas (if existing) in the workspace (C) and put "add", "edit" and "delete" buttons as menu.
		Right-click on a phase (i.e. User Research) in the navigation bar (D) in order to create a new method.
		Add a "+" to each UCD methods button, next to the icon (e.g. (c)), so we stick on the same style as adding new project like in Figure 16a (a).
Figure 16d Figure 16e	Button to save Persona Figure 16d (d) is not intuitive because it is not placed in the same frame I am working on and we save twice Figure 16d (d) + Figure 16e (e).	Put save button in the same frame (the workspace) Figure 16d (E)
Figure 16f	The Navigation bar is not intuitive (F).	The logic of the Navigation bar must be different: do not sort by UCD phases, just a simple list of methods!
		In the Navigation bar put "Edit" and "Delete" button for each UCD methods (G)

Figure 19: Usability issues - iteration 2

3.2.3 Iteration 3 - high-fidelity prototype

The previous evaluation on a iterative prototype allows end-users to identify usability issues that could not have been detected in the first evaluation on sketches. That is thanks to the fact that the end-users could actually interact with the simulated system. For example, when a button was clicked, the prototype simulated the reaction of the implemented system which made the interaction more real. That made end-users to get a more actual impression of the future system.

From the usability problems summarized in Figure 19 the following corrections have been duly made.

Home

Following the suggestions of the end-users, in Figure 17a and Figure 17b the projects list is now in a scrollable frame (a) and for each project it has been placed the possibility of editing and deleting them (b) (as suggested in the navigation bar of the UCD methods in Figure 19). Then, the form for adding a new project is not in a dialog anymore but directly in the page allowing a more rapid insert (c). Furthermore, checkboxes has been removed and replaced with a textarea allowing to add more members (d).

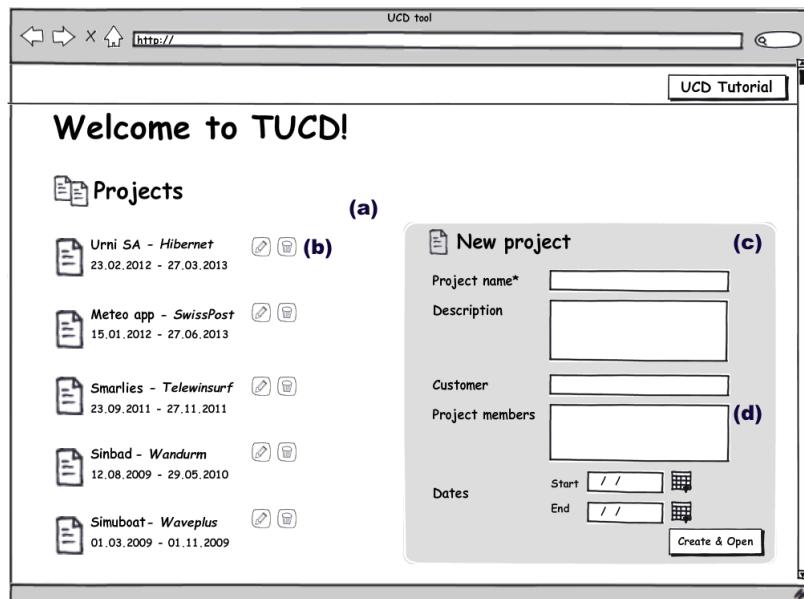


Figure 20: Home corrected

Main

In the main page, there were three aspects to change: the way of representing the existing UCD methods in a project in the navigation bar, the way of adding UCD methods and the location of “Save“ button to save the UCD method form Figure 23d(a). For the first, the end-users suggested to keep just a simple list of UCD methods and add two more buttons in order to edit and delete them. Figure 21

illustrates that (a). Then, two were the suggested solutions for adding a new UCD method. Here below the two possibilities:

1. Figure 21: Add a “+“ on the top of the UCD method icon in its button (b)

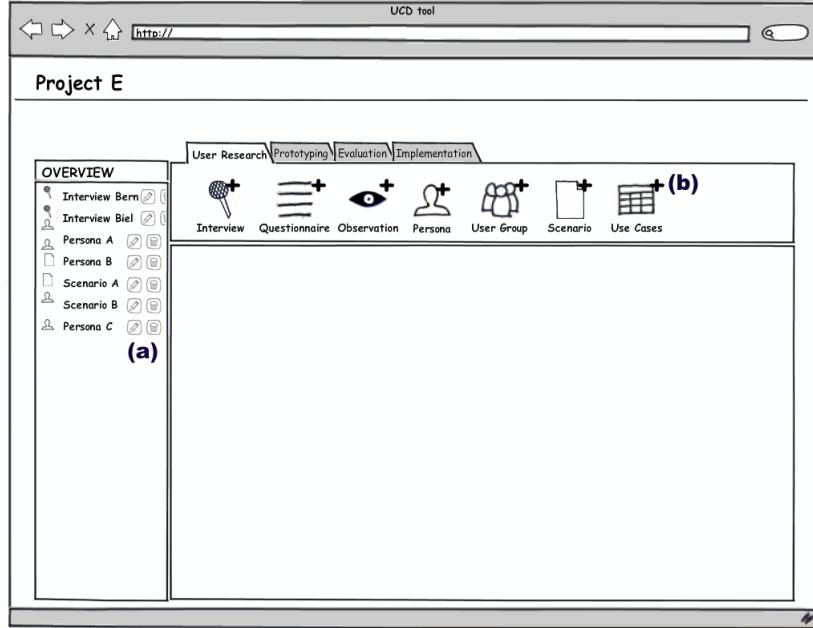


Figure 21: Main A

2. Figure 22a: when clicking UCD methods button (c), show list of existing methods (d) and put “add“, “edit“ and “delete“ in the workspace (e) (in Figure 22b are showed other options for this toolbar in Figure 22a (e)).

3.2.4 Iteration 4 - high-fidelity prototype: T-UCD definitive prototype

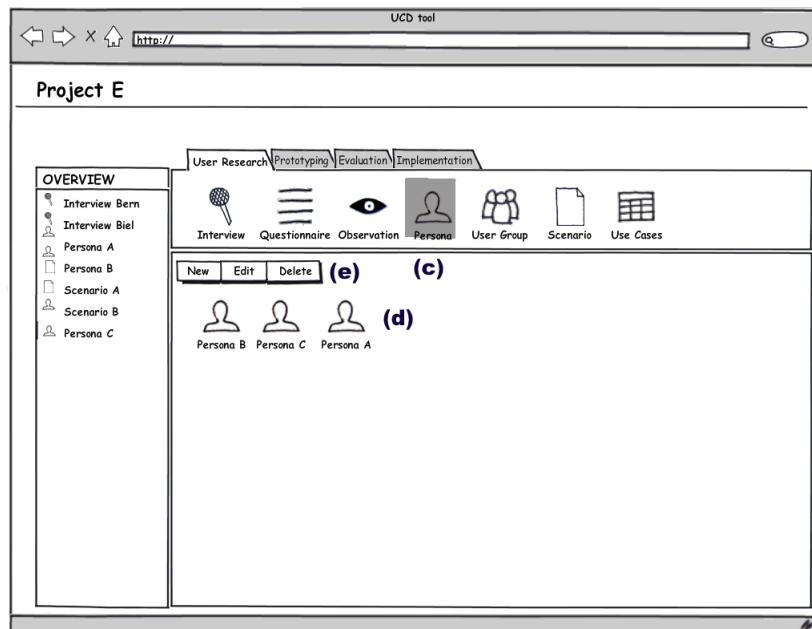
Between the two proposed solutions for adding a new UCD method, showed in Figure 21 and in Figure 22a, it has been decided to choose the first one. That was decided after a quick evaluation with four end-users by asking them to add a new persona with the two prototypes and to choose the one they preferred. Three of them liked the first prototype. Furthermore, also technically speaking, the implementation of this prototype was simpler than the second one.

The definitive prototype of T-UCD that shows the entire workflow of adding an UCD methods (persona in this case) is illustrated in Figure 23.

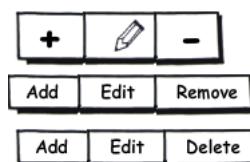
3.2.5 Iteration 5a - high-fidelity prototype: T-UCD implemented

Usability evaluation

The definitive prototype has been implemented and Figure 24 shows how it looks like. With this version of T-UCD, a formal usability evaluation has been made in FOITT with four end-users who were UCD beginners. For this evaluation, the new UCD methods were stored locally: it simulated the connection with the database.



(a) Main B



(b) Toolbar (e) in Figure 22a

Figure 22: Main B

The figure consists of six screenshots of the T-UCD interface, labeled (a) through (f), illustrating the workflow from project creation to persona management.

- (a) Home:** Shows the main dashboard with a list of existing projects (Urn SA - Hibernet, Meteo app - SwissPost, Smarlies - Telewirsurf, Sinbad - Wandurn, Simuboat - Waveplus) and a "New project" form.
- (b) Create new project:** Shows the "New project" dialog with fields for Project name*, Description, Customer, Project members, and Dates.
- (c) Main:** Shows the "Project: Smartline" overview screen with tabs for User Research, Prototyping, Evolution, Implementation, and icons for Interview, Questionnaire, Observation, Persona, User Group, Scenario, and Use Cases.
- (d) Create new persona:** Shows the "New Persona" dialog with fields for Creator name, General information (User Group, Fictional name, Photo, Age), Biography (Marital status, Family status, Education, Personality), and a save button labeled (a).
- (e) Save persona:** Shows the "New Persona" dialog with the same fields as (d), but the "Save" button is now highlighted.
- (f) Persona saved:** Shows the "Project: Smartline" overview screen with the "Persona" tab selected, indicating the persona has been saved.

Figure 23: Definitive T-UCD

(a) Home

(b) Create new project

(c) Main

(d) Create new persona

(e) Persona saved

(f) End subpart of persona form

Figure 24: Definitive T-UCD implemented

The goals of the latter were:

- to assess if T-UCD is usable (efficient, effective and enjoyable to use it)
- to detect major usability issues when:
 1. creating a project
 2. create a method
 3. edit it

The procedure of the evaluation was the following:

1. The end-user is welcomed to sit in front the computer (MacBook Pro 13“).
2. A short introduction of T-UCD and the evaluation (objective, tasks, permission for recording) will be presented to the end-user.
3. A document with the tasks that the users have to perform is given.
4. The evaluator starts the screen-recorder.
5. The evaluation starts.
6. The end-user thinks-aloud while performing its tasks and the evaluator takes notes about the problems encountered.
7. The evaluation is over, the evaluator stops the screen-recorder.
8. The evaluator begins a discussion about the problems encountered while using T-UCD and takes notes about it.

The tasks were the following:

Task 1: Create a new project

Imagine you have begun two weeks ago (the 5th of December 2013) a new project called Jingle it! in your company. Its customer BIT would like that in this project you and your UX team (composed by Graciela, Tina, Valentina, Rainer, Josephine and you) are in charge to create a usable Christmas card in order to promote your group. To support this project, your team will use the T-UCD web application. You are in charge now to create the new project.

Task 2: Create a new persona

After two weeks, you have gathered information about the end-users of the Christmas card: the most important are project managers, aged around 55 years old. You are in charge to create and save a persona. Please fill only the required fields (with the * symbol).

Task 3: Edit the previous persona

After some weeks you realise that your persona is actually younger than what you thought: the average age is 35 and not 55. Please edit respectively the previous persona.

The workflow to accomplish Task 1 and Task 2 will not be described because they are similar to the two tasks in 3.2.2. To perform Task 3, the end-users were supposed to click on (a) (Figure 24e) from which the form would have been filled up with the stored data of this persona. At this point, the end-users could edit the age of the persona by replacing 55 to 35 (b) and then click on “Save“ button (c).

Findings

Analysing the results of this evaluation from the screen-recordings and the notes taken by the evaluator, it can be seen that every end-users could accomplish the three tasks without problems but one. In fact, one of the UCD beginners could do Task 1 and Taks 2 but not Task 3. This is due to the fact that when the end-user had to edit the age of the persona, he or she could not find the appropriate button (a) in Figure 24e. The cause of that was the form of persona. Indeed, as it is long, consequently the “Save button“ (c) in Figure 24f, which was placed at the end of the form, was too down in the page. Thus, the end-users could not see (a) placed up in the page.

The major usability issues found by the end-users have been summarized in Figure 25.

Page	Problems	Suggestions
General	What is persona? The end-user wondered what exactly is this method.	Explanation
Figure 23d Form (A)	Too long, annoying to scroll down	Scroll in the frame, the rest stays. Collapse sections
	No drop down menu (B) and (C), click twice to get the desired option	Rather radio buttons
	The big text areas ex. (D)	Wider and less high
Figure 23e	Not clear where it has been saved the UCD method, a feedback is missing	Put a feedback
Navigation bar (E)	When many UCD methods?	Put search box
Figure 23f	Links field (F) is too short	Longer! Sometimes links are really long

Figure 25: Usability issues - iteration 5a

Thus, globally the goals of this evaluation have been achieved.

3.2.6 Iteration 5b - high-fidelity prototype: Tutorial implemented

From the findings described in Figure 25, it can be observed that the first problem shows that, as the end-users are UCD beginners, a description of UCD methods, in this case of persona, is missing. So, the prototype chosen for the tutorial, (the tabs-style one) described in 3 and illustrated in Figure 16, has been implemented and evaluated by the end-users. Figure 26 shows the implemented UI of the tutorial, and here below the tasks that four end-users had to perform and the respective steps to accomplish them. The tutorial was not filled up with the definitive text of each UCD methods because the goal of this evaluation was to assess the usable aspect of the tutorial.

Task 1

You would like to know what User-Centered Design is. Where would you look for?

1. Figure 26a: click on User-Centered Design (a)
2. Figure 26b: the description appears. The end-users were supposed to look (b) in order to successfully accomplish this task.

Task 2

Imagine, you have to do a think-aloud evaluation and you need a nice example to follow. Where would you look for?

1. Figure 26b: click on evaluation (c)
2. Figure 26c: click on think-aloud ev. (d) where the examples will appear (e).

Task 3

How to perform a focus group?

1. Figure 26c: click on User Research tab (f)
2. Figure 26d: click on focus group (g) where the best practices will appear Figure 26e (h).

Task 4

You would like to know what is a high-fidelity prototype and how to perform it. Where would you look for?

1. Figure 26e: click on Evaluation tab (i)
2. Figure 26f: click on high-fidelity (l) where its the description, best practices and examples appears. The end-users were supposed to look Figure 26f (m), (n) and (o) in order to successfully accomplish this task.

TUTORIAL

(a) Overview

User-centered Design (a)

- User Research
- Prototyping
- Evaluation

(b) Overview - User-Centered Design

User-Centered Design

Description
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Quisque auctor, magna ullamcorper faucibus vehicula, enim dul dictum sapien, eget gravida lectus justo nec lectus. Nam viverra eget odio non blandit. Phasellus condimentum, elit in lacina scelerisque, mauris velit sollicitudin arcu, ac suscipit ipsum felis vitae arcu. Cras a malesuada libero. Proin eget dolor ante.

Benefits
Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Best practices
a good practices is bla bla bla consectetur adipiscing elit. Quisque auctor, magna ullamcorper faucibus vehicula

TUTORIAL

(f) Evaluation - Think-aloud ev.

Think-aloud ev. (d)

Description
Quisque auctor, eget gravida lectus justo nec lectus. Quisque auctor, magna ullamcorper faucibus vehicula, enim dul dictum sapien, eget gravida lectus justo nec lectus. Quisque auctor, magna ullamcorper faucibus vehicula, enim dul dictum sapien, eget gravida lectus justo nec lectus.

Benefits
benefits of dictum sapien, eget gravida lectus justo

Best practices
Enim dul dictum sapien, eget gravida lectus justo nec lectus.

(e) Examples
example

TUTORIAL

(d) User Research

Persona

Observation

Focus group (g)

TUTORIAL

(i) User Research - Focus group

Focus group

Description
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Benefits
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Best practices
Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Examples
example

TUTORIAL

(f) Prototyping - High fidelity

High-fidelity (l)

Sketch

Description
Quisque auctor, eget gravida lectus justo nec lectus. Quisque auctor, magna ullamcorper faucibus vehicula, enim dul dictum sapien, eget gravida lectus justo nec lectus. Quisque auctor, magna ullamcorper faucibus vehicula, enim dul dictum sapien, eget gravida lectus justo nec lectus.

Benefits
benefits of dictum sapien, eget gravida lectus justo

Best practices
Enim dul dictum sapien, eget gravida lectus justo nec lectus.

Examples
example

Figure 26: Implemented tabs-style tutorial

After accomplishing the evaluation of this tutorial, many were the problems that the end-users encountered. They mainly could not do any tasks. The problem was that they could not see the relation that each tabs and methods had: it was a problem of hierarchy. In fact, after this phase, it has been realised that a structure of UCD and its UCD methods was missing in this tutorial for the UCD beginners. By discussing with them, the other prototype accordion-styled described in section 3 and illustrated in Figure 15 was more clear for them. What made end-users confused was the two dimensional structure of Figure 26: horizontal (tabs) and vertical (right side, list of UCD methods).

Icons

Icons have been chosen in order to simplify the recognition of UCD methods at a glance. For the UCD methods, an icon that represents its respective method was quite obvious to find (e.g. for Persona: an icon illustrating a person like in Figure 17c). However, for icons representing UCD and the three phases in the tutorial, the decision was less evident. For this reason a short survey (cf. Appendix A.3) has been sent to people that know UCD. Six of them answered and Figure 27 shows the most chosen icons for each items:

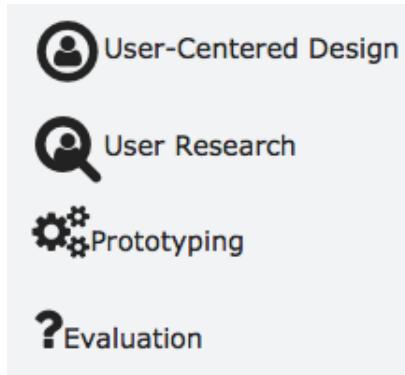


Figure 27: Icon survey results

4 Development

The aim of this section is to present firstly the technology choice to develop T-UCD (Subsection 4.1) and then in Subsection 4.2 it is presented the implementation itself.

4.1 Technology choice

In order to make a decision regarding the most appropriate technologies to develop the T-UCD web application, the following requirements have been considered:

1. a technology that is based on models in order to define and structure each UCD methods in standard models
2. an extensible technology in order to define a sort of language, with its vocabulary and grammar, which describes UCD methods
3. a state of the art technology to develop, to ease the maintenance and future expansions of T-UCD as there are more than the ten UCD methods considered for this thesis

The technology that complies the first and second requirements is the EXtensible Markup Language (XML) [59] because: it allows to define customized tags in the XML document; the structure of a XML document is defined and validated through a XML Schema Definition (XSD) [61]; it can be transformed in another XML document through the EXtensible Stylesheet Language (XSL) [62] and XPath [60] for navigating in it; it is a W3C Recommendation. Thus, with XML the structure of UCD methods will be defined with proprieties and restrictions by a proper language.

Regarding the third requirements, it has been chosen several state of the art technologies in order to develop T-UCD web application:

- AngularJS v1.1.5 [2]: open-source JavaScriptMV* Programming Framework (by Google) used to easy develop web applications based on Model-View-Controller (MVC) pattern
- jQuery UI v1.10.3 [23]: a JavaScript Library with a set of user interface interactions, effects, widgets and themes
- HTML5 [18]: the latest standard for HTML
- MongoLab [31]: a cloud database service, it supports RESTful services
- PureCSS v0.3.0 [40]: small and responsive CSS modules
- Font Awesome v 4.0.1 [14]: provides scalable vector icons easily customizable with CSS

4.2 Implementation

4.2.1 Discussion

The technologies chosen that cover the requirements described at the beginning of section 4.1 rose an issue between the requirements of having a model of each UCD methods and the one asking a state of the art technology. According to traditional technologies to develop web applications, such as .NET for example, representing a model of each object is the usual practice. Indeed, they are represented minutely by well defined and restricted class declaring each properties. Whereas AngularJS, based on JavaScript, do not need to have a model because it builds it up dynamically and on the fly when it receives data. Thus, there is no reason to have a model before, there is no predeclared class definition. So, in the case of T-UCD there is a problem: UCD methods need a well declared model but Javascript do not give the possibility to support that it natively.

Thus, a solution has been found in order to make sure that UCD methods are built on a structured model and T-UCD is developed with state of the art technologies: combine the two worlds by injecting the UCD methods model into the JavaScript framework.

Practically speaking, the workflow to reach that is composed of four steps. Figure 28 show the process and here below it is explained :

1. **XSD.** At first, an XML Schema has been created for each UCD method. In each of them, proprieties, rules and restrictions are declared based on several sources in the literature which define the UCD method.
2. **XML.** Then, from the Schema it will be generated an instance in an XML file. Here, it will be rendered the structure of the concerned UCD method.
3. **XSL.** Afterwards, the XML file will be translated in a HTML page by applying a stylesheet XSL. In this way, the UCD methods is structured in a form based and validated by a XML Schema.
4. **AngularJS web application.** The XSL is actually a combination of technologies: it is an AngularJS application with elements of jQuery UI, HTML5, PureCSS (for the forms) and Font Awesome (for the icons).

4.2.2 Description

In this section, the four steps presented in section 4.2.1 will be explained in more details.

1. XSD.

The XML Schema has been built up based on the proprieties of each UCD methods. UCD methods have common and different proprieties within them. In order to create an XML Schema for each UCD methods, the common proprieties have been put together in three different groups: generalMethod_Type group

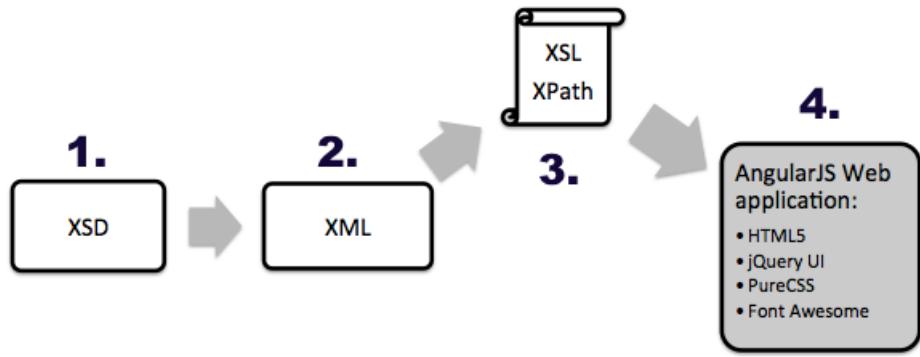


Figure 28: Workflow development

(proprieties common to every methods, Annexe A.4.1), evaluationPhase_Type group (proprieties common to evaluation methods: in this thesis usability evaluation and accessibility testing, Annexe A.4.2) and intSurObs_Type group (proprieties common within interview, survey and observation methods, Annexe A.4.3).

The XML Schema of UCD methods is therefore structured in three levels as showed in Figure 29. In the first level, the root, there is generalMethod_Type group node. Then, in the second, there are evaluationPhase_Type and intSurObs_Type groups nodes that inherit the previous group. Finally, in the third level, the leaves, there are the actual UCD methods that inherit their respective previous group (cf. Annexe A.4.4).

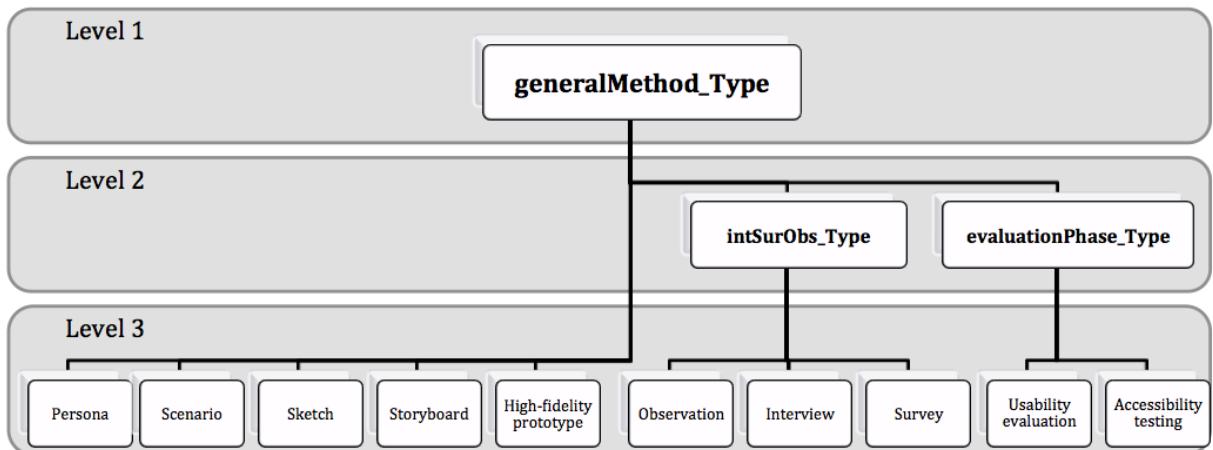


Figure 29: Diagram of UCD methods XML Schema

2. XML.

From the XML Schema, it will be generated an XML file where each UCD method is represented by the proprieties declared in its XSD following their correspondent rules and constraints.

3. XSL and AngularJS web application.

The system architecture of the web application follows the MVC (Model-View-Controller) pattern as it is showed in Figure 30.

The Controller component interacts with the database through RESTful services and automatically update the binded View with the model data when there is a change made by the user. Each UCD methods in T-UCD and project in Home, has a specific controller which contains CRUD functions. The View component is a combination of XSL, XPath, HTML5, jQuery UI, PureCSS and Font Awesome. The Model component, which has been injected with XML Schema, is the base from which the view is built up. In fact, the HTML forms of each UCD method follow their proprieties description declared in the XML Schema (cf. the HTML form in Annexe A.5). Concerning the Tutorial, the system follows the same pattern but it does not connect with the database to take the data of each UCD method. In fact, instead of the database, it takes the data from XML where it is stored the data about description, best practices, benefits and examples of the concerned UCD method. To show it in the view component, XSL and Xpath translate this data in HTML5. Thus, the Tutorial is completed with the appropriate data and can be properly presented in the browser.

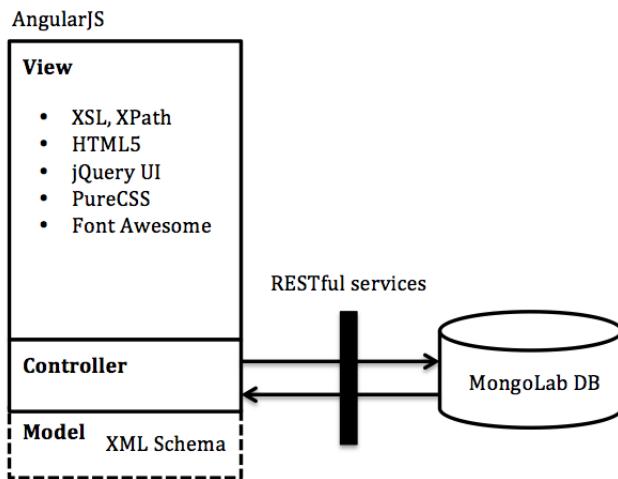


Figure 30: System architecture

5 Evaluation

In this section, it will be presented the last evaluation of T-UCD web application and its results. This evaluation is different compared to the previous ones. Indeed, the former, were performed in order to mainly find usability issues and further users' needs while the aim of this evaluation is to assess if the objectives of this thesis have been achieved.

5.1 Description

In this evaluation, T-UCD and the tutorial were improved once again after the iteration 5a (Section 3.2.5) and iteration 5b (Section 3.2.6) during when some usability issues have been found (Figure 25). Firstly, it was added a search box for the list of existing UCD projects navigation bar in the homepage (a) in Figure 31a and also for the list of UCD methods in T-UCD (b) Figure 31d. Then, it has been substituted the drop down menu in persona form with radio buttons and finally it has been added a quick tutorial for each UCD methods form in close status as showed in (c) Figure 31d and open (d) in Figure 31e. The latter was added because an end-user, while performing the usability evaluation in iteration 5, asked herself "What is persona? " (see Figure 25). So a quick tutorial located at the top of each UCD methods has been chosen as a good solution to overcome this lack. So that, an T-UCD end-user, while is filling up the form, can have quick hints about the concerned method.

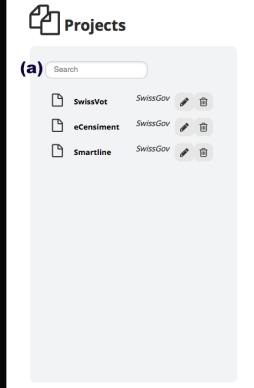
In Figure 31 some screen-shots of the final T-UCD are showed.

In this evaluation, T-UCD web application was tested in order to find out if, after that the end-users use it,:;

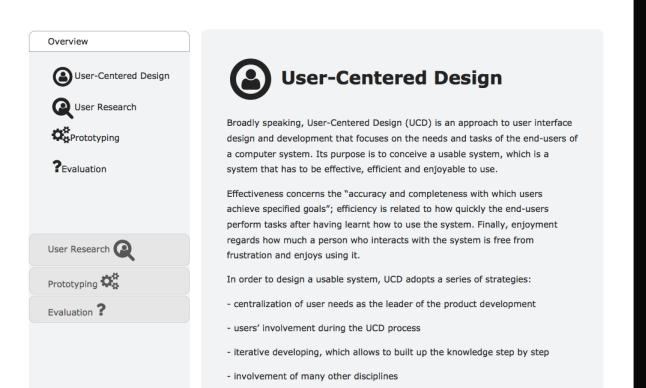
1. there was a better understanding of the UCD process and its methods
2. the tool helped to be convinced about the usefulness of UCD
3. there was an interest in actually using it

The end-users that evaluated the web application were five: four UCD beginners (users 1, 2, 3 and 5) and one UCD practitioner (user 4). The expected skills and knowledge for the beginners were that they had to be interested in UCD, have a basic idea about it and have programming skills. Whereas, the UCD practitioner had to have some years of experience in practicing UCD. The evaluation took place in FOITT and the detailed procedure is showed in Annexe A.6.2. The web application run on Firefox in a MacBook Pro 13" version 10.9 OS X Mavericks with a mouse device.

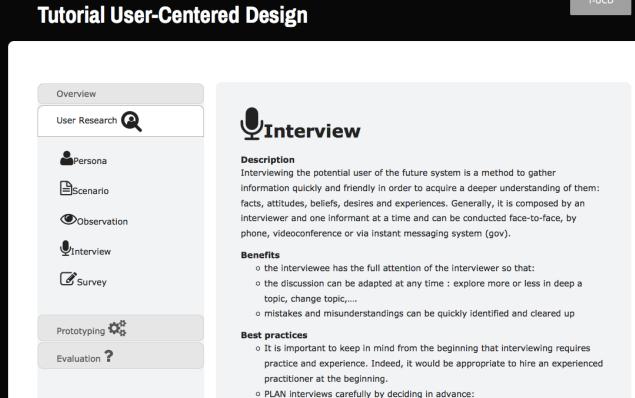
In order to assess if the objectives were achieved, the end-users had to perform a mix of tasks that embraced the whole application (homepage, T-UCD and the tutorial) and the whole UCD process (user research, prototyping and evaluation). Some tasks were more practical and some were followed by questions (cf. Annexe A.6.1). These tasks were of this nature so that the end-users could get to know the whole tool and UCD process and methods while performing them. That allowed to gather mainly qualitative data from the evaluator by taking notes, screen-recording with



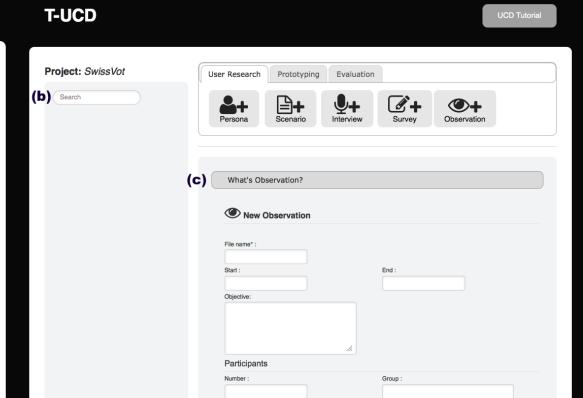
(a) Homepage Last Evaluation



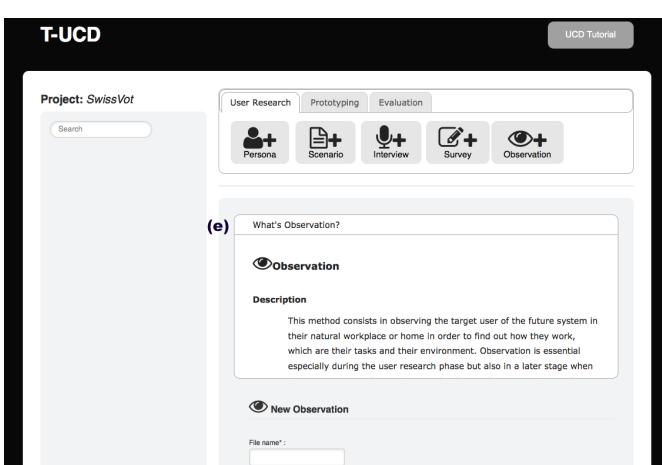
(b) Tutorial Last Evaluation - UCD



(c) Tutorial Last Evaluation - Interview



(d) T-UCD Last Evaluation - Observation



(e) T-UCD Last Evaluation - Observation and Quick Tutorial

Figure 31: T-UCD web application for Last Evaluation

Quick-Time and audio-recording with the application Voice Memos in an iPhone.

To verify if the end-users had a better understanding of the UCD process and its methods (the first objective), before using the web application the evaluator asked the end-users what did they know about UCD and explain it with their own words. In this way, it could be possible to check if they get better understanding after using T-UCD by comparing the explanation the end-users gave with their own words about UCD process after using T-UCD.

Then, after the evaluation, the end-users were supposed to answer the same on-line survey (sent by e-mail) gave at the beginning of the development of T-UCD (Annexe A.1) in order to verify if this tool helped to be convinced about the importance and usefulness of UCD (second objective).

Furthermore, a simple question was asked at the end of the evaluation session so that the third objective (verify if the end-users were convinced about the usefulness of UCD).

5.2 Results

In this section, it is examined the data gathered after this evaluation. In Annexe A.6.3, there are reported the transcriptions of the most relevant parts of the interviews made to the end-users.

Was there a better understanding of the UCD process and its methods?

The first chapter of the Annexe shows the evidence that the first objective was achieved. In fact, by comparing the end-users knowledge of UCD before and after using T-UCD, it can be seen that there is an increase of understanding of the whole process of UCD by giving a better explanation of it. Furthermore, some of the participants explicitly say it: for example user 1 said “the overall goals are clear” and also “So I think this [hesitating] tutorial gives quite a good overview what UCD process is all about“. Then, user 5 said “It was really helpful“and user 2 “Okay, ça c'est clair et précis.“

Did the tool help end-users to be convinced about the usefulness of UCD?

The graphs and tables of questions 3, 4, 5 and 8 showed below, give the possibility to assess if the tool helped end-users to be convinced about the usefulness of UCD (second objective). Indeed, in each of these questions the participants answered clearly and on unanimity.

The question 3 asked: Imagine you are working in a Scrum Team that has the task to enhance an existing User Interface for an Internet Survey application that will be used for the Swiss Census. How important would you rate these aspects during the development process? (1 = not important, 5 = very important).

Figure 32 and Table 9 show that each participant rated with value 5 “User’s tasks“, followed by “Program well coded“, “Specifications“, “Techniques“ and finally “Technologies“. Thus, it can be observed that the surveyed people consider users tasks very important during the development process which correspond to UCD philosophy.

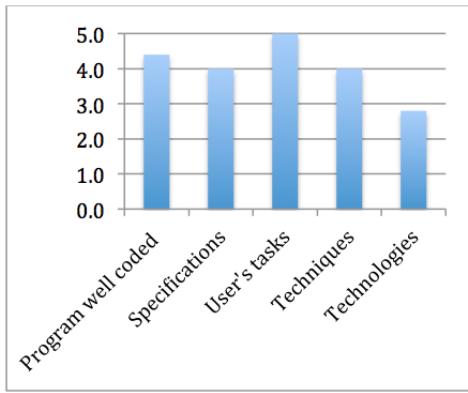


Figure 32: Graphic last online survey question 3

Table 9: Table last online survey question 3

Aspects	Average
User's tasks	5
Program well coded	4.4
Specifications	4
Techniques	4
Technologies	2.8

answered question	5
skipped question	0

Then, question 4 asked: How important is it to include users in a software development process for you? Imagine yourself in the same situation as in the previous question. (1 = not at all, 5 = absolutely important!)

Looking at Figure 33 and Figure 10, it is totally clear that for each surveyed participant, it is “Absolutely important“ to include users in a software development process. Indeed, each participant rate it with the value 5.

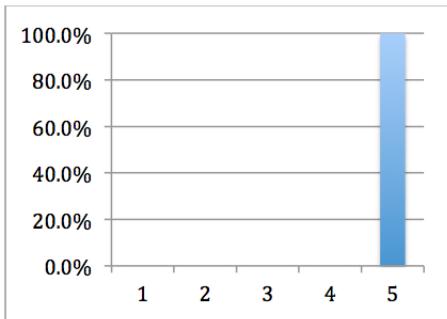


Figure 33: Graphic last online survey question 4

Table 10: Table last online survey question 4

	Percentage	Count
1	0.0%	0
2	0.0%	0
3	0.0%	0
4	0.0%	0
5	100.0%	5

answered question	5
skipped question	0

Question 5 asked: In your opinion, how useful is it to have methods to understand users’ needs and to evaluate the interface of the software you are developing? (1 = not useful, 5 = very useful).

Figure 34 and in Table 11 show that each participant rate with value 5 that it is “Very useful“ to have methods to understand users needs and to evaluate the interface of the software.

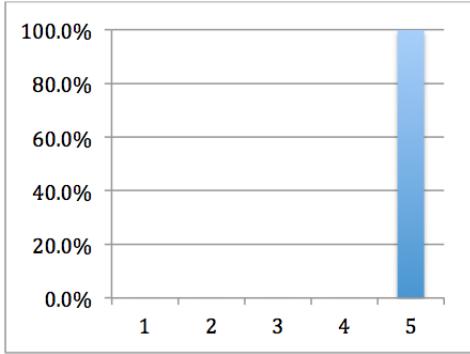


Figure 34: Graphic last online survey question 5

Table 11: Table last online survey question 5

	Percent	Count
1	0.0%	0
2	0.0%	0
3	0.0%	0
4	0.0%	0
5	100.0%	5
answered question		5
skipped question		0

Question 8 was: In which stage of the development process do you think the UCD methods would be most beneficial? (1 = not beneficial, 5 = very beneficial)

Figure 35 and in Table 12 show that the stages of the development process in which UCD would be most beneficial are “Analysis“ and “Design“, each participants rate them with 5 value (= very beneficial).

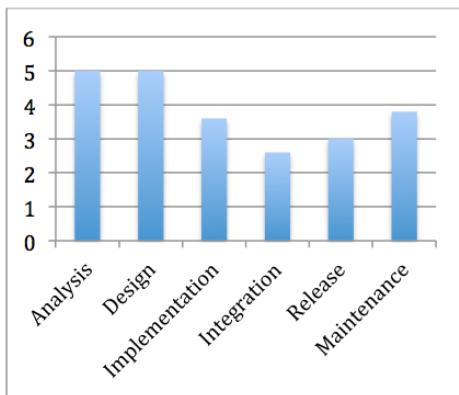


Figure 35: Graphic last online survey question 8

Table 12: Table last online survey question 8

Phases	Average
Analysis	5
Design	5
Maintenance	3.8
Implementation	3.6
Release	3
Integration	2.6
answered question	5
skipped question	0

Thus, thanks to the results of these questions, it can be concluded that with no doubts that after that the end-users, performed the evaluation with T-UCD, they were 100% convinced about the usefulness of UCD approach. T-UCD influences them.

Was there an interest in actually using T-UCD?

Concerning the last objective, in the second chapter of the Annexe it can be seen that there are different answers to the question “Would you use T-UCD? “: user 2 and 5 said yes and user 2 asked also for a pdf version of the tutorial (“D’ailleurs si t’as une version pdf moi ça m’intresse.“); then user 1 said that he will not use it at the current state because it is not mature enough, but the tool is promising, it needs more functionalities; users 4 answered that T-UCD will be used by someone that “have any knowledge about UCD and you want to have some kicks [...] or

checkpoints“.

Finally, user 3, which is a UCD practitioner, will not use it personally all the time because he has its way of doing things and some features are missing. Here below its answer about it:

“Sincerely would you use this tool to document your thing and also tutorial or...?“

No, I wouldn't, I have mine, we have our own folder's structure and system that we use, I mean, to do stuff. So I wouldn't need the digital help to centralize it, I wouldn't, and I would rather prefer if this was a creation tool that could hold, you know, really... I think this is good for structuring, I think is a tool to help people who don't know UCD. For me I would need something I can put the different deliverables more than...you know there's a project in something that manages all my files, where I can note different types of contents, I can manage my videos, I can manage my audio recordings and things like that and then I would use it, with a very smart search that could work, I am looking for the question that I ask, I have a transcript of an interview and quickly find it or I can look in a mind map or in different kind of stuff and then it would be really useful at this stage but not in this form“

“I would love to have this tool where I have I have stored I have my interviews here because these are files and I have thousand of files. I have here, I have Valentina, yesterday, it is an audio file and I have a video of Rainer [laughing] and I have many papers that Graciela sent me that is still an interview but she was not here, she had an exam so she put in a paper and so on and I have tons of files, tons of files, I can filter them because I need to find things I did in this project, you know? And I have a very very smart search in the like of, you know, how do you say, spotlight? On Mac, you know this kind of really intelligent search...I could have also something that could be great for me is to have my phases, to have a plan view where I can plan my activities. I can say I have got an interview work this is some kind of Gantt Chart..I can plan the activities, and I can assign people to it, I say this is Roland, he is going to make the first phase interviews. And then, I will have prototyping and it's going to be Pierre that does some prototyping here and I reserve one week here. Of course I can zoom on the plan, I can really have the plan and it would be interfaced with other kind of planning system like project or there are different planning systems that it would be really cool to have all my stuff and my plan here.“

According to what user 3 said, T-UCD is lacking of some more advanced features (mainly for planning and organizing the project). However, if for example he had to perform a UCD method that did not do it for long time, he would use it:

“What do you think about the tutorial? Do you think for beginners and also for practitioners would be useful? I mean for example for practitioners the part of best practices even if they're experienced;“

“Yeah sure, yeah sure, sure you cannot know everything we all have specialties. If I had to make an usability test now, I should read again how to do it... if is not something I do very often, I'll need instructions to be sure to do it well, sure, sure.“

Moreover, regarding UCD beginners T-UCD would be a good tool in his opinion because it is well structured:

"I think is good because it gives a good structure, a good mental model, so you have the structure, yes, I think is good.“.

User satisfaction and success in accomplishing tasks

End-users were satisfied in using it. For example user 1 said "It's nice how you how you did it“ (9:08 - 9:17) and “So nice look and feel“ (32:10 - 32:13). In addition, user 3 said that T-UCD “is a good work, is a good job, I like the esthetic of it, is nice“ (36:16 - 36:38). Then, user 2 added “Par rapport à ton application, ce qu'il y a de bien, je trouve que l'idée est bonne, c'est qu'en fait tu as directement le tutorial qui est imbriqué dans l'application. Bonne idée. Non, c'est une chose qu'on pense pas, nous on fait des Help pages mais souvent les Help pages ne sont utilisées par l'utilisateur que quand il a vraiment besoin d'aide. Tandis que quand tu démarres l'application et que t'arrives sur la possibilité de lire les informations dès le départ, c'est intéressant et pratique.“ (5:26 - 6:05). Furthermore, he also said “Ça c'est bien, d'avoir un petit bouton pour expliquer avant que tu fasses quelque chose. Tu fais ça partout? Oui, oui, non l'a je dis bravo. Nonon, mais c'est une idée tellement simple mais tellement... c'est fort! C'est mieux qu'une Help page.“ (44:47 - 45:15).

Moreover, every tasks was performed without any critical errors and difficulties, in fact it was easy for end-users to find that was asked (looking information in the tutorial, CRUD the methods and also switch from homepage to tutorial and vice versa. Meaning that T-UCD is usable.

Considerations

So generally speaking, after this analysis it could have been seen that the objectives of T-UCD were achieved for UCD beginners while some more work could be done for UCD practitioners by providing functionalities to plan and organize the project.

6 Conclusion and future works

This research, made in collaboration with the Swiss Federal Office of Information Technology, Systems and Telecommunication (FOITT), tried to overcome the existing lack of tool for UCD beginners that accompanies them during the entire UCD process and its methods. Indeed, as analyzed in the related works of this research, it has been seen that even though there are some tools that stores project data, tools that allows to perform and store some of UCD methods and tutorials that explain UCD, it has not been found a unique tool that contains tutorial and a data storage manager that cover the entire UCD process and methods for UCD beginners. In order to fill that gap, in this master thesis it has been implemented an extensible web application, called “Tool for User-Centered Design” (T-UCD). The latter was developed with the UCD approach by duly and iteratively performing user research with an online survey, persona and scenario and then by prototyping (from low-fidelity to high-fidelity prototyping) and by performing usability evaluations with some end-users in FOITT. The implementation was made by combining AngularJS and XML which were considered the most appropriate technologies to develop T-UCD because the first is considered a state of the art technology to develop, ease the maintenance and future expansions. The second because it is a technology that is based on models and is extensible. The resulted T-UCD tool provides a tutorial and a storage manager for UCD methods which have been modeled with XML technology. By doing that, it has been created a Markup Language for UCD methods that defines and structures them with a sort of language with its vocabulary and grammar.

This tool is intended to give beginners a better and practical understanding of UCD, convince them about the usefulness of it and see if there is an interest in actually using T-UCD. In order to assess if the objective were achieved, it has been performed an evaluation of T-UCD with five users who had to perform some tasks and answer some questions. Results showed that T-UCD overcome the existing lack concerning the absence of a unique tool for UCD beginners containing the entire UCD process, methods and a tutorial. Indeed, it actually gave to UCD beginners a better understanding of UCD, convinced beginners about the usefulness of it and some of them would use it personally. Moreover, T-UCD resulted usable.

However, FOITT will not use it for the moment because, as the head of EUI unit says (see user 1 second chapter of AnnexeA.6.3) : in the current state there are “not enough functionality available”. For example, there is “no integration with other tools that are required for example supporting sketching or mocking phase or actually do an evaluation“. Nevertheless, “all the application is promising“ and the way T-UCD structures the UCD process and methods “is a benefit“.

Future works that can be thought, according also to what has been said by UCD practitioner, would be to build a complete and UCD-focused tool that gives the possibility to also organize the UCD project (members, deadlines, dates, tasks and so on), provides connections with existing tools for UCD methods (ex. Balsamiq) and it could be extended with more UCD methods by modeling them thanks to the advantageous proprieties of XML technology (T-UCD supports ten methods, while there are many more methods that could be covered).

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A Appendix

A.1 Online Survey

User-Centred Design

The purpose of this survey is to know about your opinion and awareness of User-Centred Design (UCD). It will take you about 5-10 minutes. Please be as honest as possible, it is anonymous.

1. How many years have you worked as a developer?

less than 5 6 - 10 11-15 16 - 20 more than 20

2. Which of these roles is the nearest to yours?

Programmer Software architect
 Project manager Software engineer
 Scrum master
Other

3. Imagine you are working in a Scrum Team that has the task to enhance an existing User Interface for an Internet Survey application that will be used for the Swiss Census.
How important would you rate these aspects during the development process?
(1 = not important, 5 = very important)

	1	2	3	4	5
Program well coded	<input type="radio"/>				
Specifications	<input type="radio"/>				
User's tasks	<input type="radio"/>				
Techniques	<input type="radio"/>				
Technologies	<input type="radio"/>				

4. How important is it to include users in a software development process for you?
Imagine yourself in the same situation as in the previous question.
(1 = not at all, 5 = absolutely important!)

1	2	3	4	5
<input type="radio"/>				

5. In your opinion, how useful is it to have methods to understand users' needs and to evaluate the interface of the software you are developing?
(1 = not useful, 5 = very useful)

1	2	3	4	5
<input type="radio"/>				

***6. Have you ever heard about User-Centred Design process?**

Yes, I know what it is and I have already used these practices! Yes, I know what it is and I have already seen someone use these practices in my team! Mmh, I have heard about it, but I don't know much! Yes, I have already heard about it. I am not really interested! No clue!

| <input type="radio"/> |
-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

Others and/or comments

7. Which of these UCD methods have you already heard of?

- | | | |
|---|-------------------------------------|---|
| <input type="checkbox"/> Focus group | <input type="checkbox"/> Personas | <input type="checkbox"/> Survey |
| <input type="checkbox"/> Heuristic Evaluation | <input type="checkbox"/> Scenarios | <input type="checkbox"/> Think-aloud |
| <input type="checkbox"/> Interview | <input type="checkbox"/> Storyboard | <input type="checkbox"/> Usability test |

***8. In which stage of the development process do you think the UCD methods would be most beneficial?**

(1 = not beneficial, 5 = very beneficial)

	1	2	3	4	5
Analysis	<input type="radio"/>				
Design	<input type="radio"/>				
Implementation	<input type="radio"/>				
Integration	<input type="radio"/>				
Release	<input type="radio"/>				
Maintenance	<input type="radio"/>				

Comments

Done

Powered by **SurveyMonkey**
Check out our [sample surveys](#) and create your own now!

A.2 Analysis First Online Survey Results - Details

Survey User-Centered Design

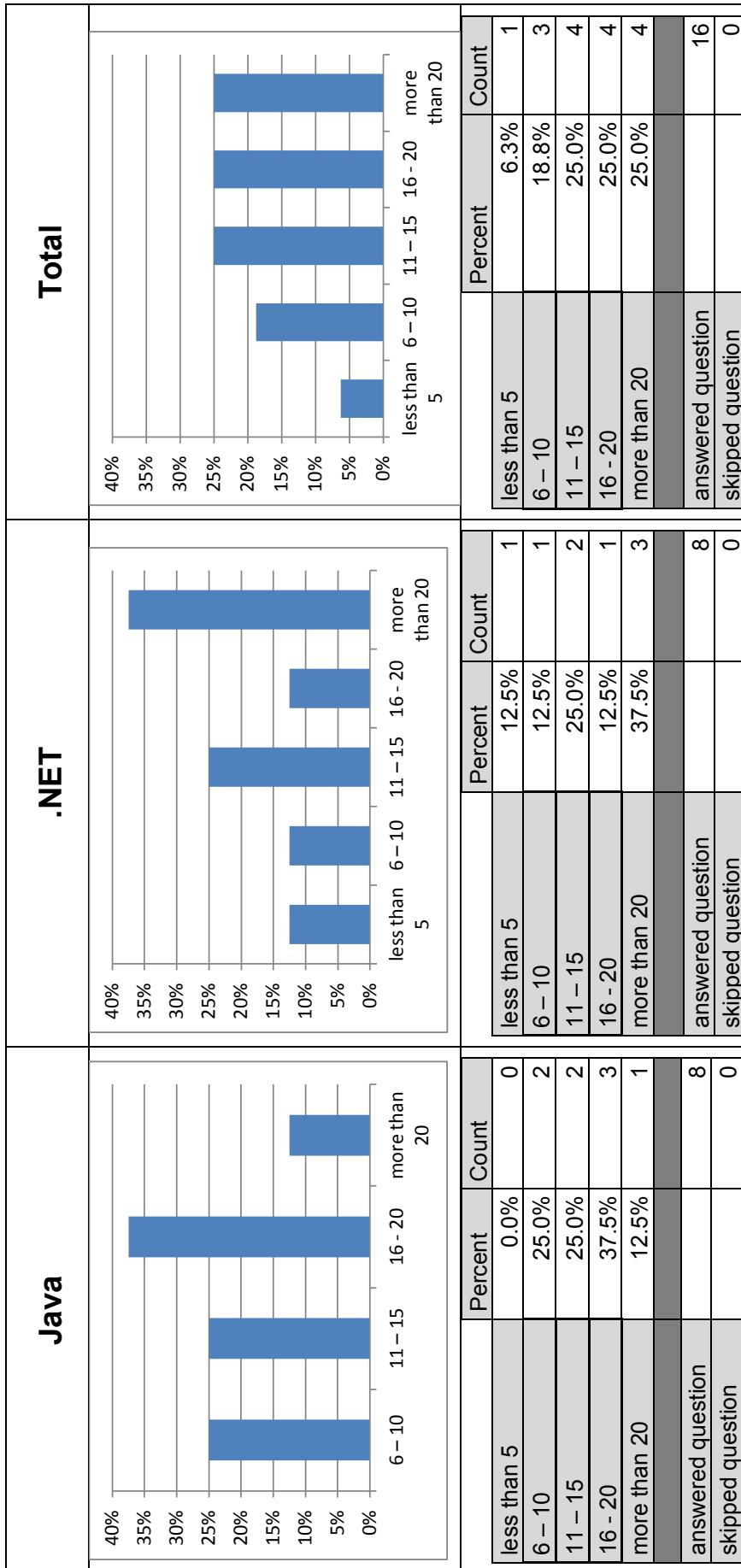
Performed: July 2013

Users	Number
.NET:	8
Java	8
Total	16

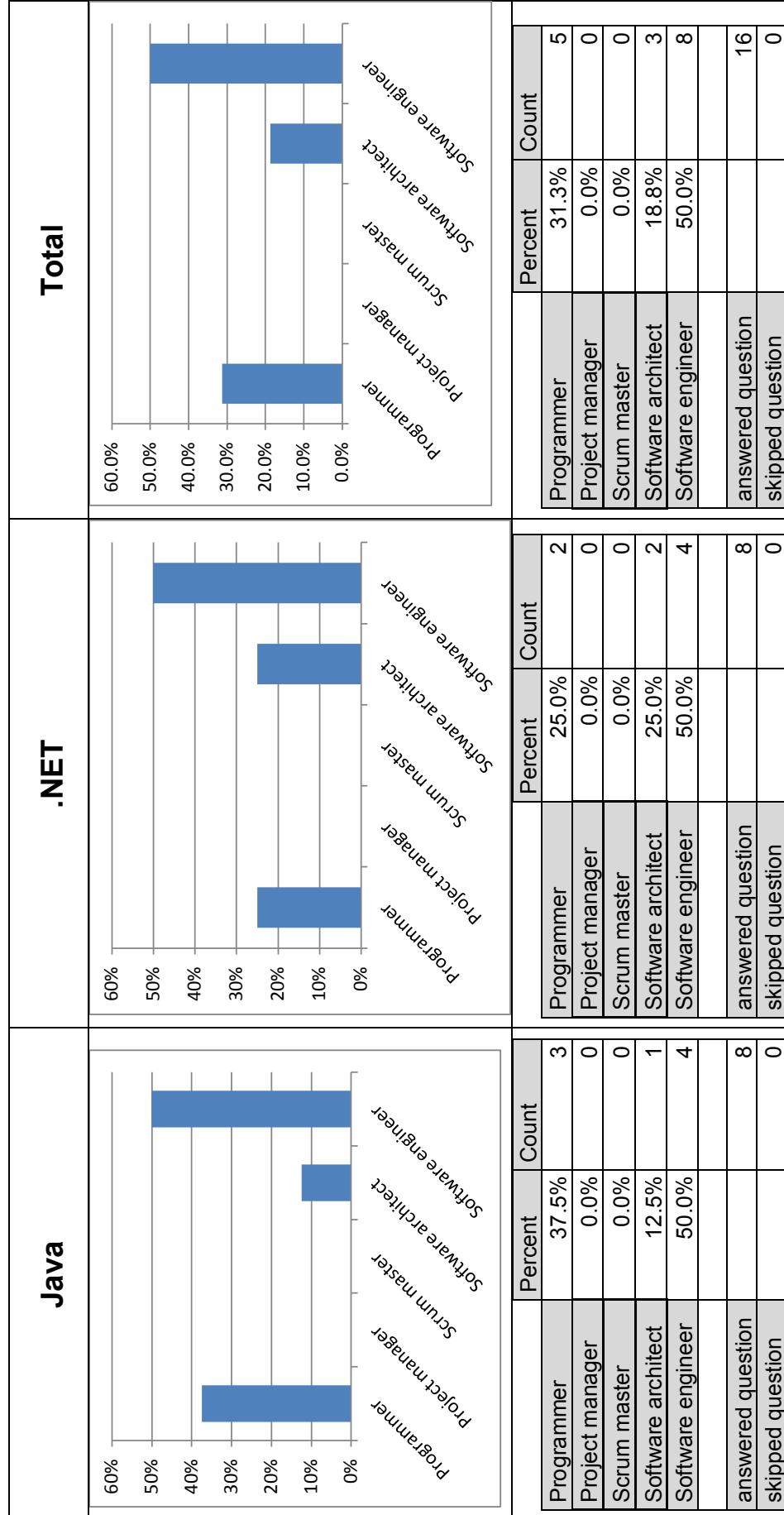
Questions

- 1 How many years have you worked as a developer? **3**
- 2 Which of these roles is the nearest to yours? **4**
- 3 Imagine you are working in a Scrum Team that has the task to enhance an existing User Interface for an Internet Survey application that will be used for the Swiss Census. How important would you rate these aspects during the development process? (1 = not important, 5 = very important) **5**
- 4 How important is it to include users in a software development process for you? Imagine yourself in the same situation as in the previous question. (1 = not at all, 5 = absolutely important) **6**
- 5 In your opinion, how useful is it to have methods to understand users' needs and to evaluate the interface of the software you are developing? (1 = not useful, 5 = very useful) **7**
- 6 Have you ever heard about User-Centred Design process? **8**
- 7 Which of these UCD methods have you already heard of? **10**
- 8 In which stage of the development process do you think the UCD methods would be most beneficial? (1 = not beneficial, 5 = very beneficial) **11**

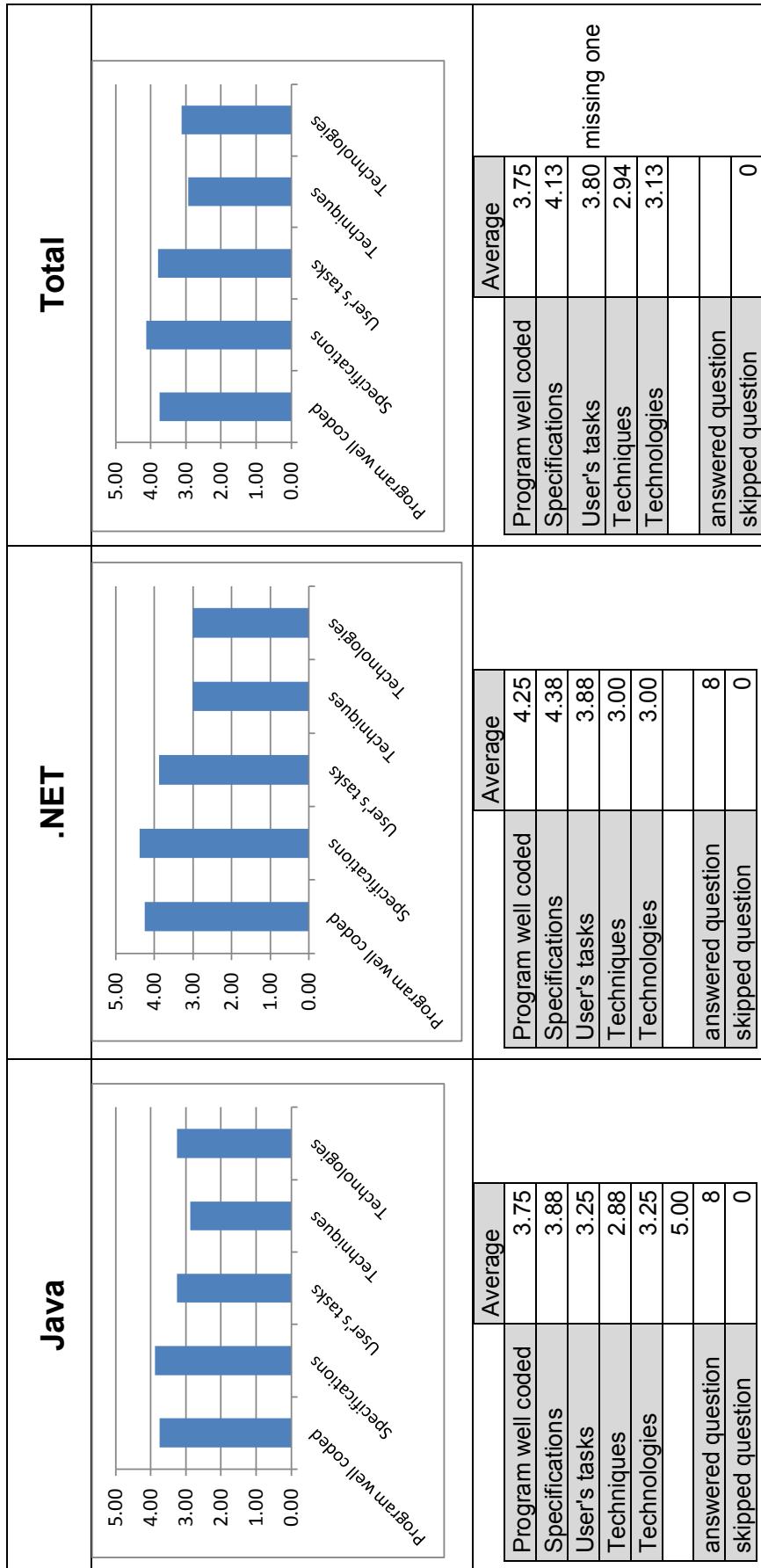
1 How many years have you worked as a developer?



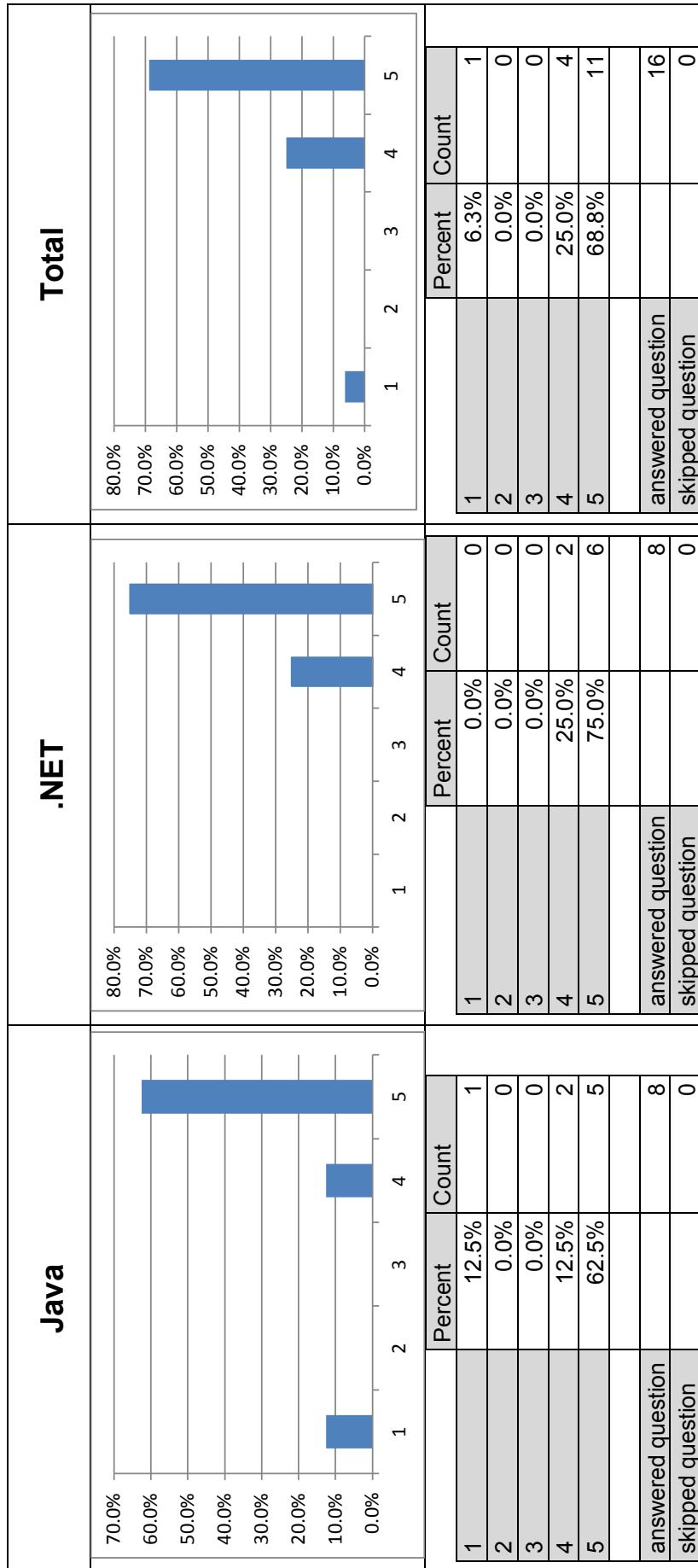
2 Which of these roles is the nearest to yours?



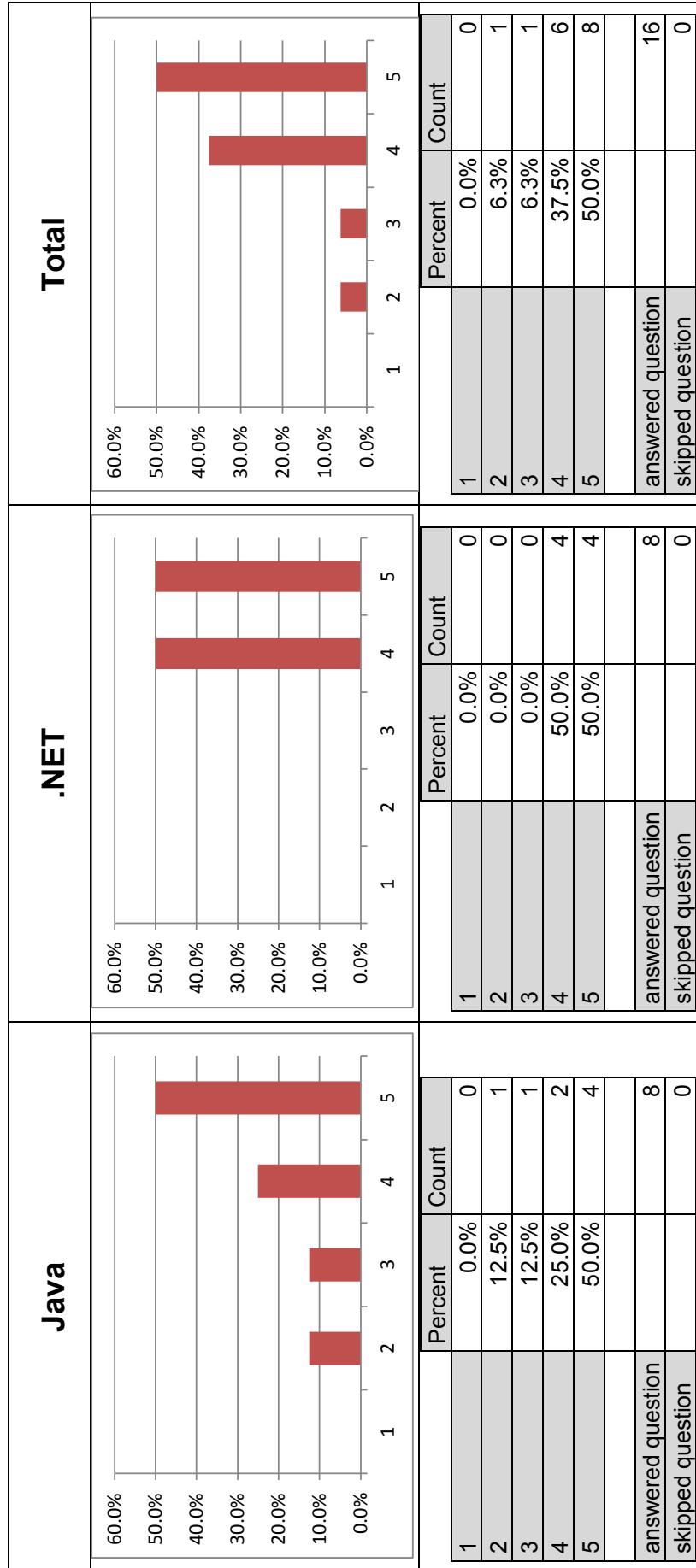
3 Imagine you are working in a Scrum Team that has the task to enhance an existing User Interface for an Internet Survey application that will be used for the Swiss Census. How important would you rate these aspects during the development process? (1 = not important, 5 = very important)



4 How important is it to include users in a software development process for you? Imagine yourself in the same situation as in the previous question. (1 = not at all, 5 = absolutely important!)



5 In your opinion, how useful is it to have methods to understand users' needs and to evaluate the interface of the software you are developing? (1 = not useful, 5 = very useful)



6 Have you ever heard about User-Centered Design process?

		Java		.NET		Total	
Percent	Count	Percent	Count	Percent	Count	Percent	Count
Yes, I know what it is and I have already used these practices!	1	Yes, I know what it is and I have already seen someone use these practices in my team!	2	Yes, I know what it is and I have heard about it, but I don't know much!	3	Yes, I have already heard about it. I am not really interested!	4
1	3	2	0	3	4	4	0
Yes, I know what it is and I have already seen someone use these practices in my team!	2	Mmh, I have heard about it, but I don't know much!	3	Yes, I have already heard about it. I am not really interested!	4	Mmh, I have heard about it, but I don't know much!	3
2	4	3	4	4	4	3	8
No clue!	5	No clue!	5	No clue!	5	No clue!	5
answered question	8	answered question	8	answered question	8	answered question	16
skipped question	0	skipped question	0	skipped question	0	skipped question	0

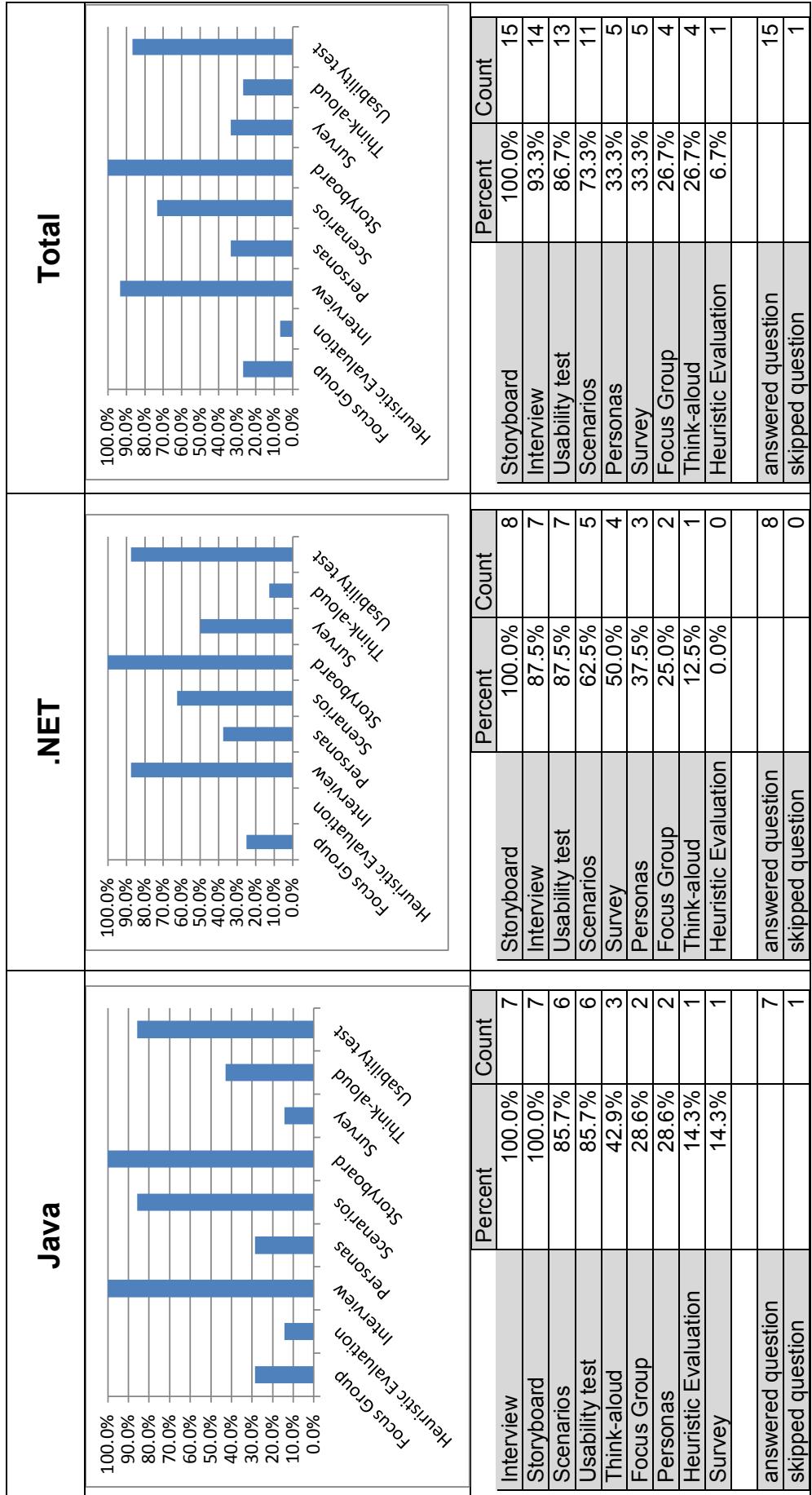
The chart shows the following approximate data:

Category	1	2	3	4	5
Java	37.5%	0.0%	0.0%	50.0%	12.5%
.NET	0.0%	0.0%	50.0%	30.0%	20.0%
Total	18.8%	18.8%	37.5%	30.0%	12.5%

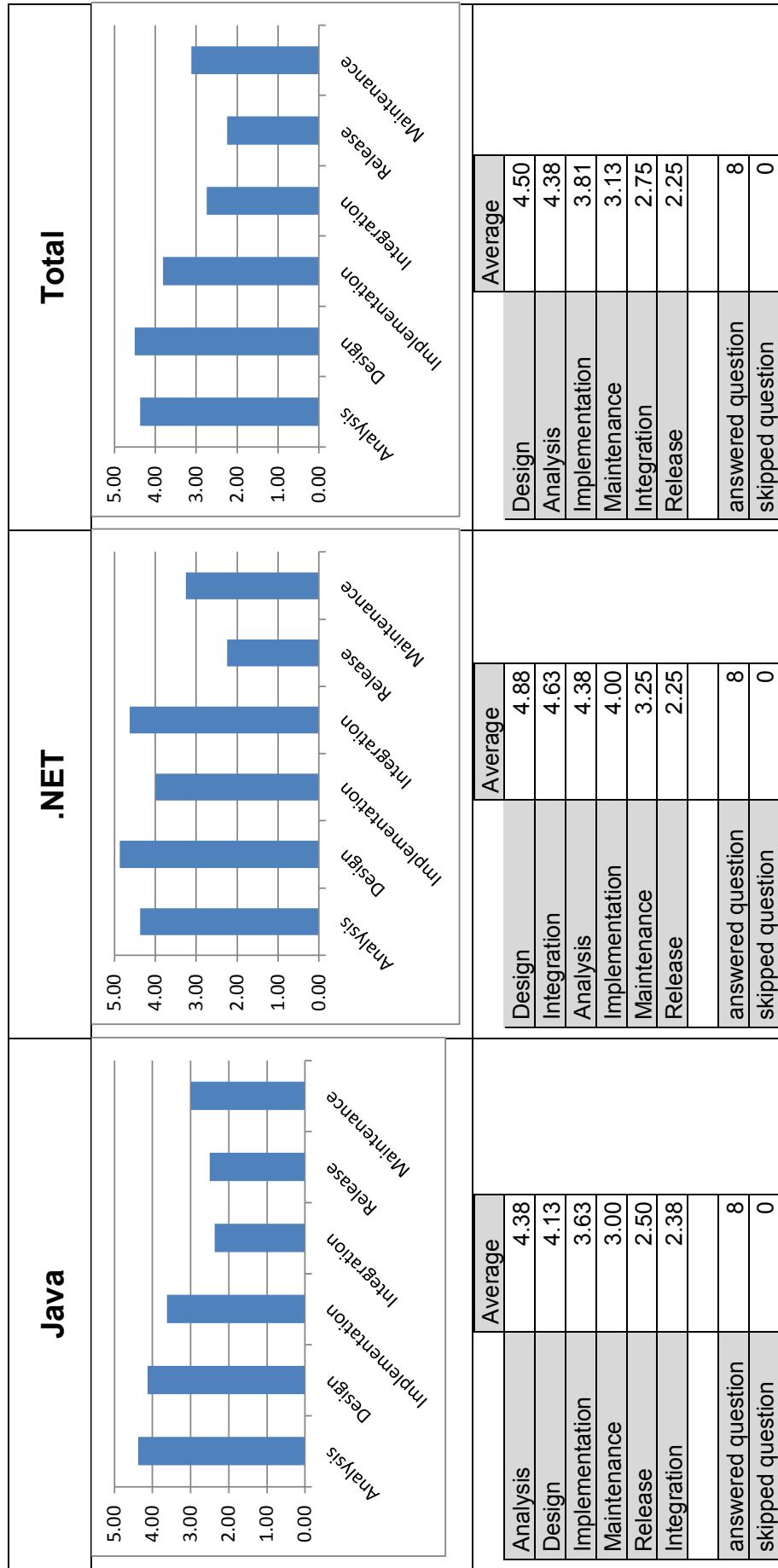
.NET answer:

To involve the users in the design process is one of the most important things in development. I've seen a lot of examples in the past where everything was well coded, but useless for the user. At the end, everything was more expensive because changes at a later stage of the Project are very difficult.

7 Which of these UCD methods have you already heard of?



8 In which stage of the development process do you think the UCD methods would be most beneficial? (1 = not beneficial, 5 = very beneficial)



A.3 Icons Questionnaire

Icons:

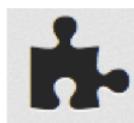
In your opinion, which of these icons is the most appropriate for:
(please cross only one square and/or you can make a proposition by
sketching your idea, here a website with more icons:
<http://fontawesome.github.io/Font-Awesome/icons/>)

User-Centered Design



your sketch

User Research



your sketch

Prototyping



your sketch

Evaluation

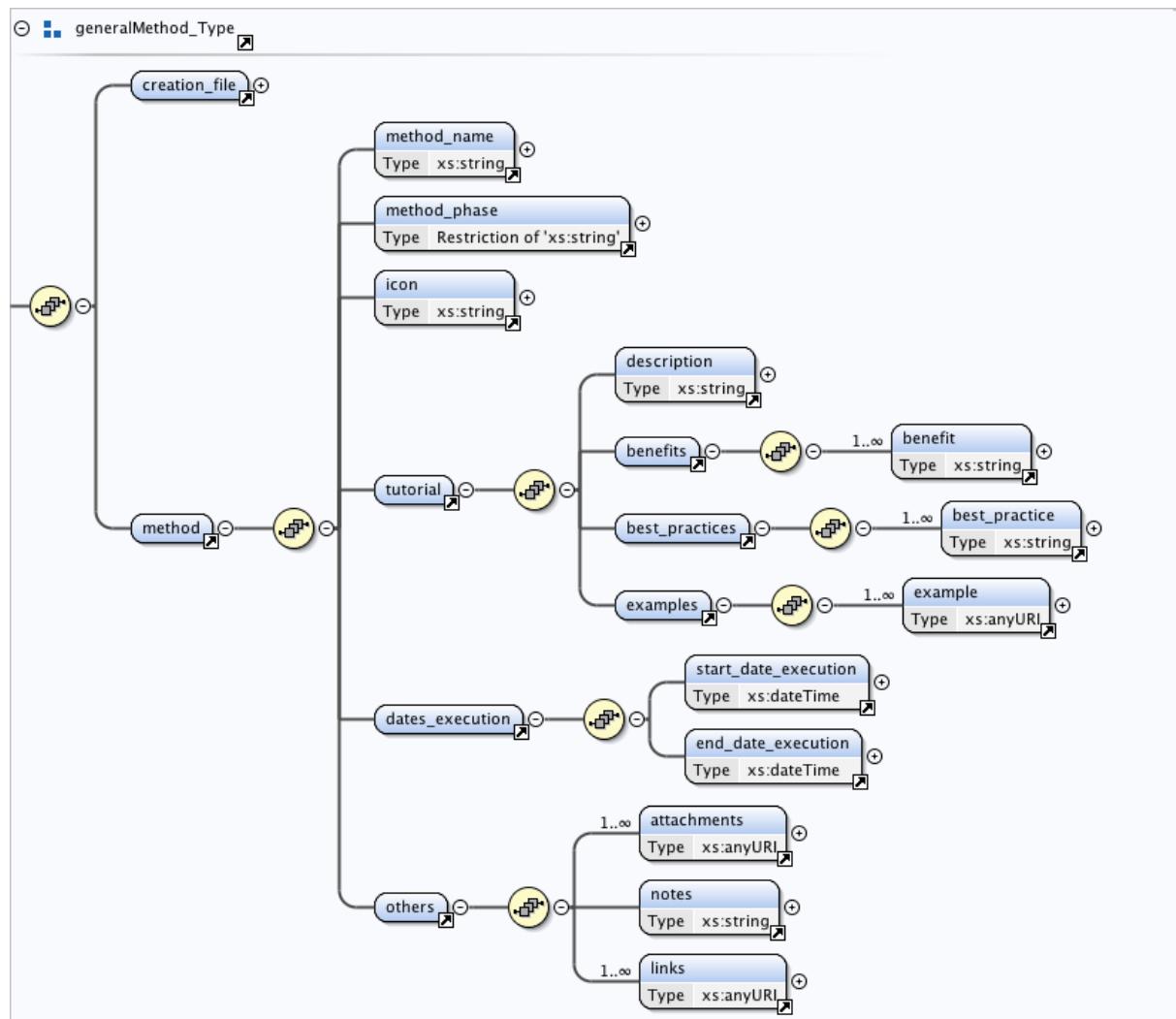


your sketch

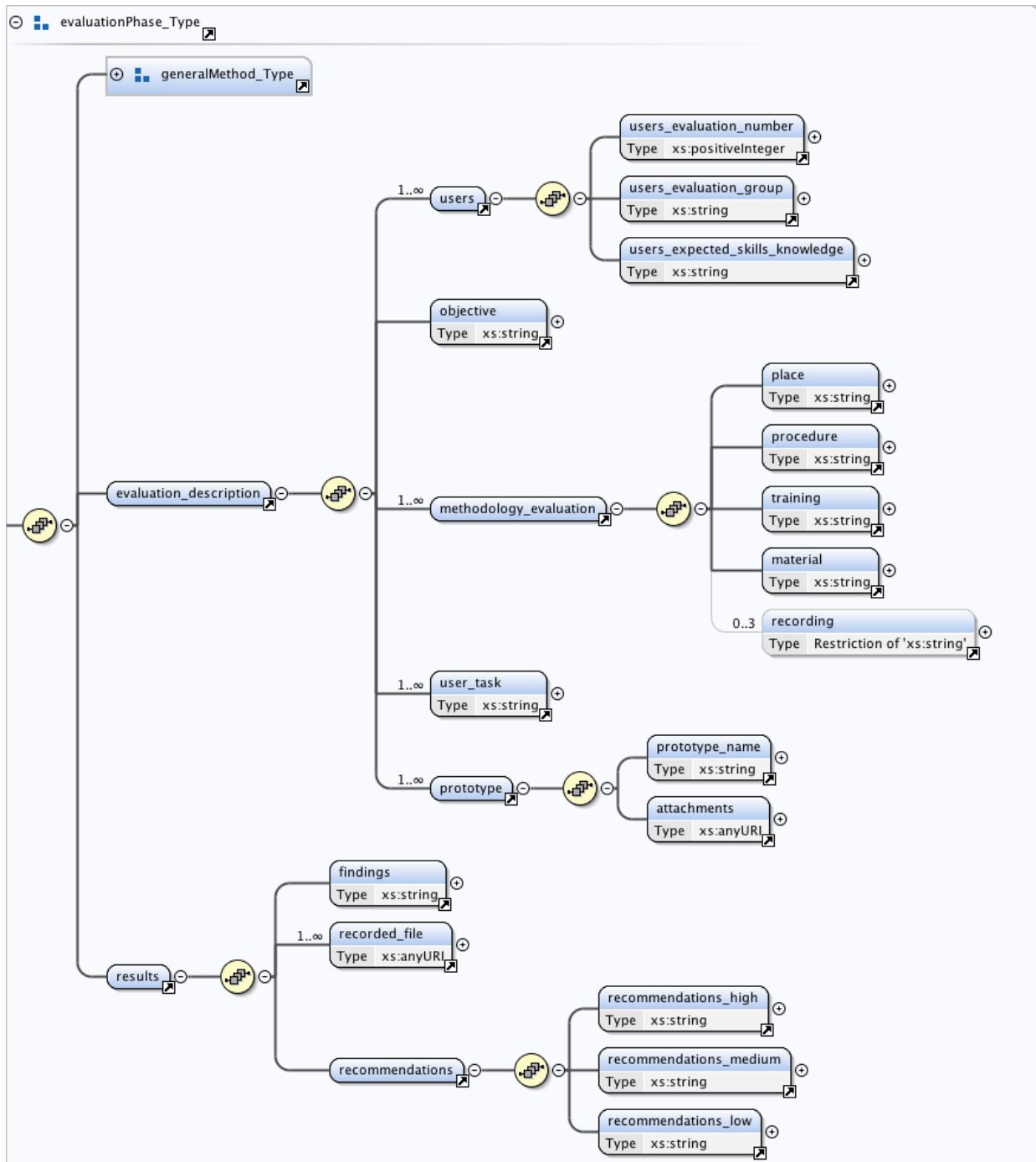
Thank you! ☺

A.4 UCD methods XML Schemas

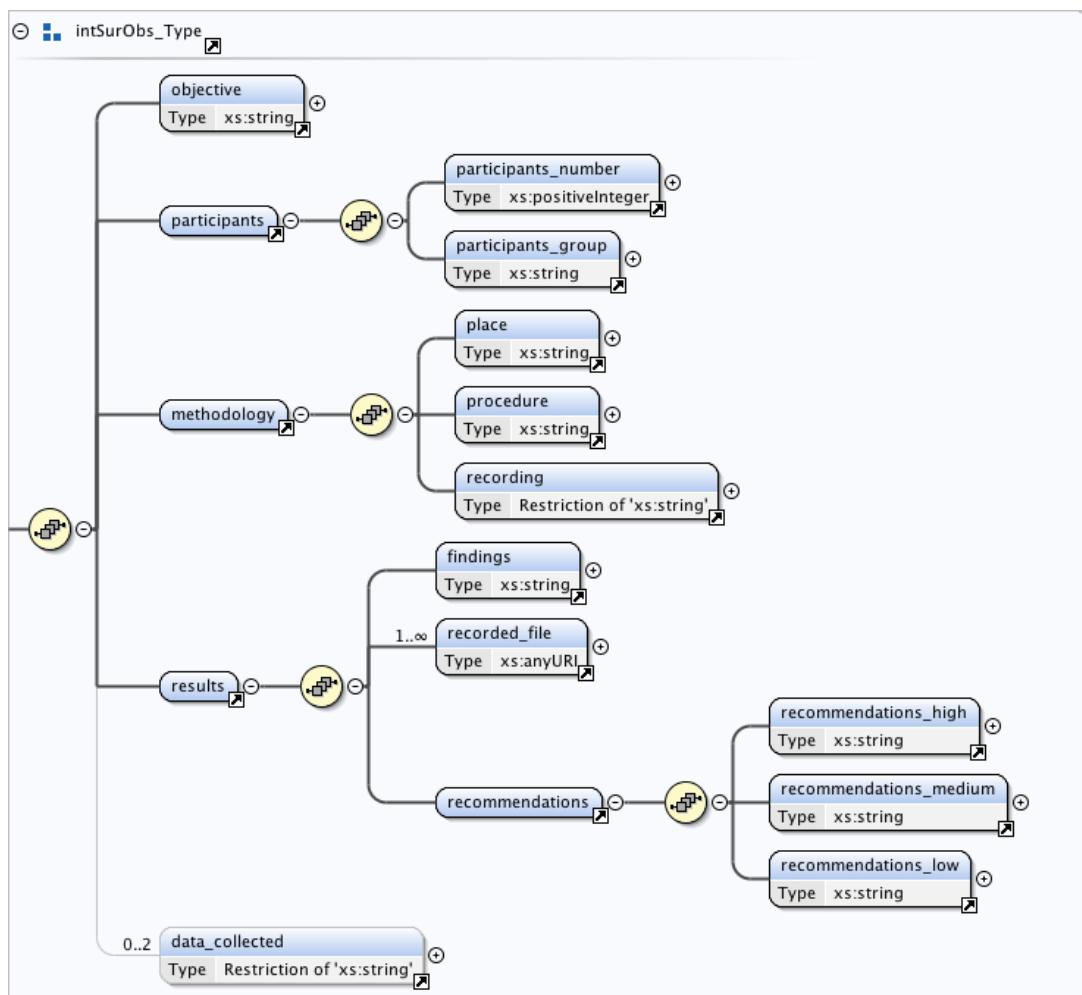
A.4.1 generalMethod_Type



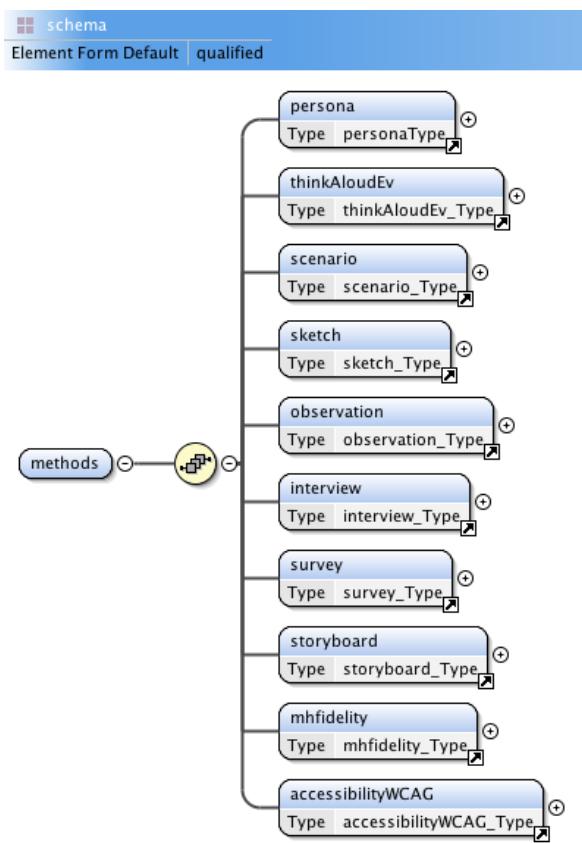
A.4.2 evaluationPhase_Type

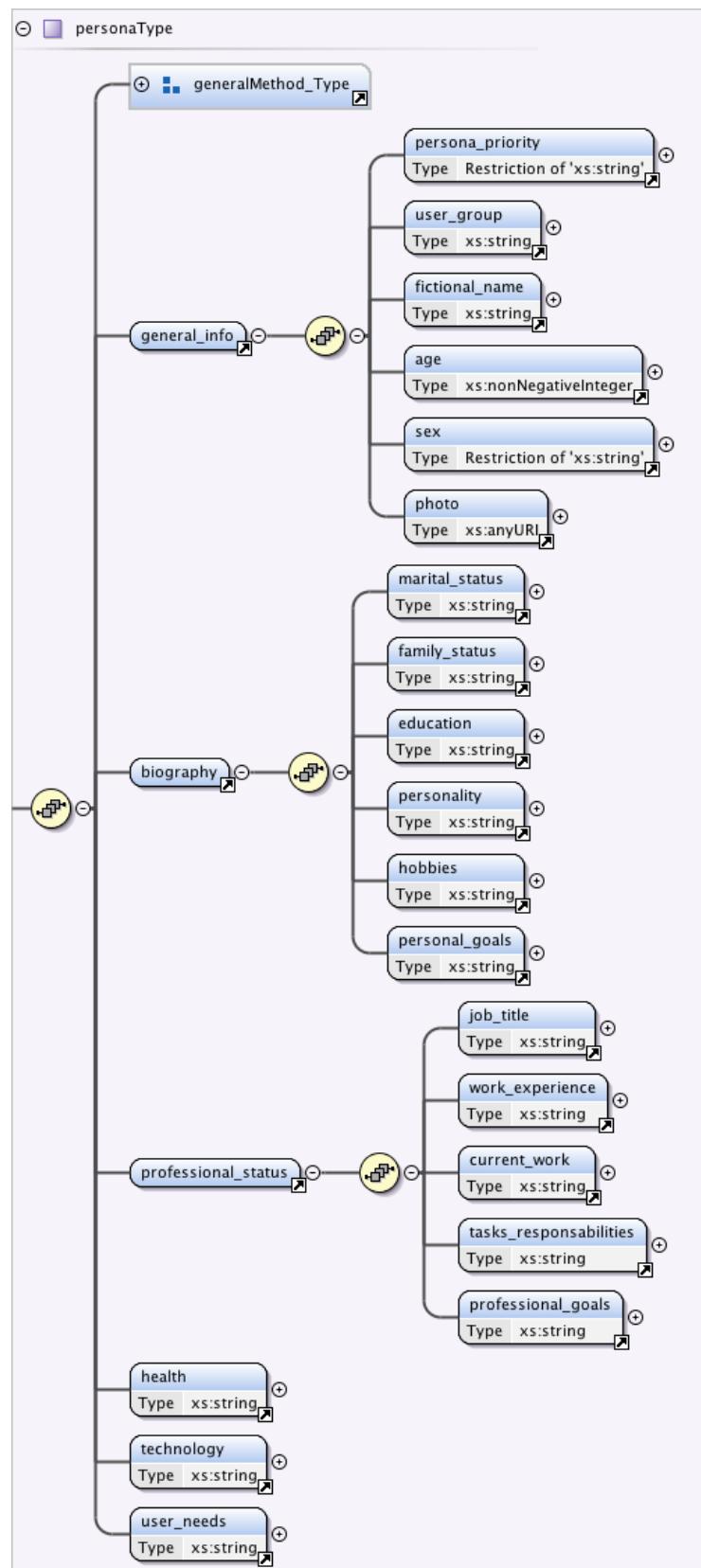


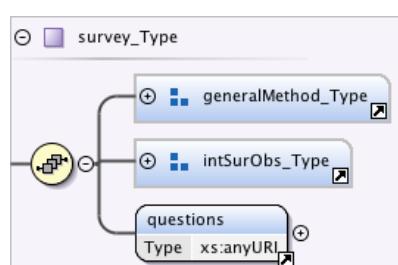
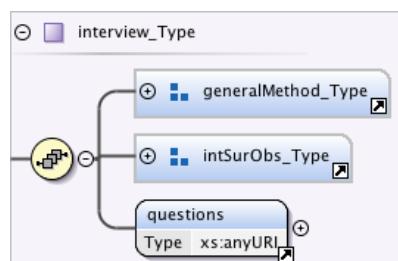
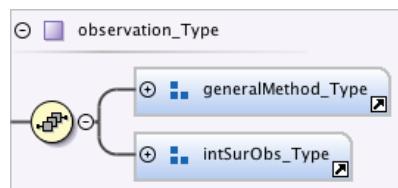
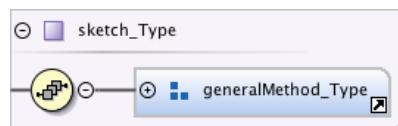
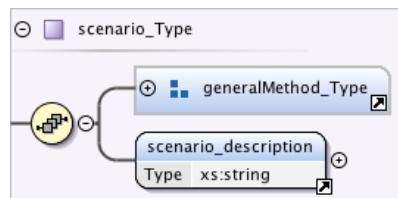
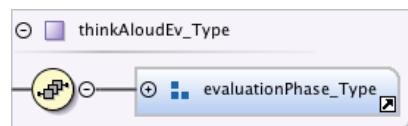
A.4.3 intSurObs_Type

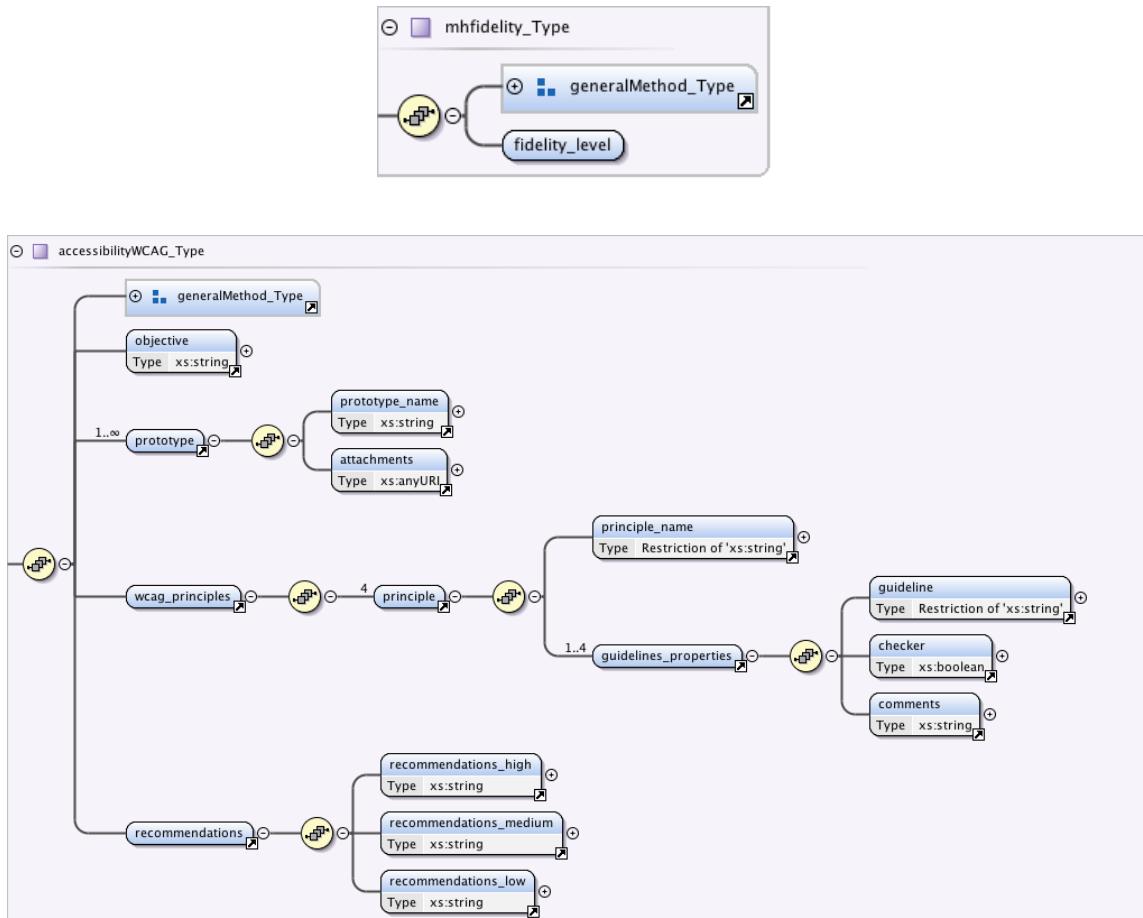


A.4.4 UCD methods









A.5 HTML Forms of UCD Methods

A.5.1 Persona

 **New Persona**

File name* :

General information

User Group :

Photo : Nessun file selezionato.

Fictional name :

Age :

Sex: Female Male

Priority: High (Primary Persona) Medium Low

Biography

Marital status: Single Married

Family status :

Education :

Personality :

Hobbies :

Personal goals :

Professional status

Job title :

Work experience :

Current work :

Tasks and responsibilities :

Professional goals :

Health	Technology
User needs <div style="border: 1px solid #ccc; height: 100px; width: 100%;"></div>	
Others <p>Notes</p> <div style="border: 1px solid #ccc; height: 50px; width: 100%;"></div> <p>Attachment :</p> <p style="margin-left: 20px;">Sfoglia... Nessun file selezionato.</p> <p>Links :</p> <div style="border: 1px solid #ccc; height: 30px; width: 100%;"></div>	
<input type="button" value="Save"/> <input type="button" value="Reset"/>	

A.5.2 Usability evaluation

 **New Usability Evaluation**

File name* : <div style="border: 1px solid #ccc; height: 20px; width: 100%;"></div>	Start : <div style="border: 1px solid #ccc; height: 20px; width: 100%;"></div> End : <div style="border: 1px solid #ccc; height: 20px; width: 100%;"></div>
Objective: <div style="border: 1px solid #ccc; height: 100px; width: 100%;"></div>	
Evaluation description	
Users	
Number : <div style="border: 1px solid #ccc; height: 20px; width: 100%;"></div>	Group : <div style="border: 1px solid #ccc; height: 20px; width: 100%;"></div>
Users expected skills/knowledge : <div style="border: 1px solid #ccc; height: 100px; width: 100%;"></div>	

Methodology

Place :

Recording:

- Written notes
- Audio
- Video

Material :

User tasks :

Prototype(s)

Prototype name : <input type="text"/>	Prototype name : <input type="text"/>
Prototype link: <input type="text"/>	Prototype link: <input type="text"/>
Prototype attachment: <input type="button" value="Sfoglia..."/> Nessun file selezionato.	Prototype attachment: <input type="button" value="Sfoglia..."/> Nessun file selezionato.

Results

Findings :

Recorded file : Nessun file selezionato.

Recommendations

High :

Medium :

Low :

Others

Notes :

Links :

Attachments: Nessun file selezionato.

Save **Reset**

A.5.3 Scenario

 **New Scenario**

File name* :

Scenario Description

Others

Notes :

Links :

Attachments:

Nessun file selezionato.

Save Reset

A.5.4 Sketch

 **New Sketch**

File name* :

Dates of execution

Start : End :

Sketch(es)

Sketch name : <input type="text"/>	Sketch name : <input type="text"/>
Sketch link: <input type="text"/>	Sketch link: <input type="text"/>
Sketch attachment: <input type="button" value="Sfoglia..."/> Nessun file selezionato.	Sketch attachment: <input type="button" value="Sfoglia..."/> Nessun file selezionato.

Others

Notes :

Links :

Attachments: Nessun file selezionato.

Save **Reset**

A.5.5 Observation

 **New Observation**

File name* :

Start : End :

Objective:

Participants

Number : Group :

Methodology

Place : Procedure :

Recording:
 Written notes
 Audio
 Video

Results

Data collected:
 Qualitative
 Quantitative Findings :

Recorded file : Nessun file selezionato.

Recommendations

High : Medium :

Low :

Others

Notes : Links :

Attachments: Nessun file selezionato.

Save **Reset**

A.5.6 Interview

 **New Interview**

File name* :

Start : End :

Objective:

Participants

Number : Group :

Methodology

Procedure* : Place:

Recording:
 Written notes
 Audio
 Video

Questions : Nessun file selezionato.

Results

Data collected:
 Qualitative
 Quantitative

Findings :

Recorded file : Nessun file selezionato.

Recommendations

High : Medium :

Low :

Others

Notes : Links :

Attachments:
 Nessun file selezionato.

Save **Reset**

A.5.7 Survey

 **New Survey**

File name* :

Start : End :

Objective:

Participants

Number : Group :

Methodology

Place : Procedure :

Recording:
 Written notes
 Audio
 Video

Questions : Nessun file selezionato.

Results

Data collected:
 Qualitative
 Quantitative

Findings :

Recorded file : Nessun file selezionato.

Recommendations

High : Medium :

Low :

Others

Notes : Links :

Attachments: Nessun file selezionato.

Save **Reset**

A.5.8 Storyboard

 **New Storyboard**

File name* :

Dates of execution

Start : End :

Storyboard(s)

Storyboard name : <input type="text"/>	Storyboard name : <input type="text"/>
Storyboard link: <input type="text"/>	Storyboard link: <input type="text"/>
Storyboard attachment: <input type="button" value="Sfoglia..."/> Nessun file selezionato.	Storyboard attachment: <input type="button" value="Sfoglia..."/> Nessun file selezionato.

Others

Notes : <input type="text"/>	Links : <input type="text"/>
------------------------------	------------------------------

Attachments:
 Nessun file selezionato.

A.5.9 High-Fidelity prototyping

 **New Medium/High fidelity prototype**

File name* :

Dates of execution

Start : End :

Prototype(s)

Prototype name : <input type="text"/>	Prototype name : <input type="text"/>
Prototype link: <input type="text"/>	Prototype link: <input type="text"/>
Prototype attachment: <input type="button" value="Sfoglia..."/> Nessun file selezionato.	Prototype attachment: <input type="button" value="Sfoglia..."/> Nessun file selezionato.
Fidelity level: <input type="radio"/> Medium	Fidelity level: <input type="radio"/> Medium
<input type="radio"/> High	<input type="radio"/> High

Others

Notes :

Links :

Attachments:
 Nessun file selezionato.

A.5.10 Accessibility testing

 **New Accessibility testing**

File name* :

Start :

End :

Objective:

Prototype(s)

Prototype name : <input type="text"/>	Prototype name : <input type="text"/>
Prototype link: <input type="text"/>	Prototype link: <input type="text"/>
Prototype attachment: <input type="button" value="Sfoglia..."/> Nessun file selezionato.	Prototype attachment: <input type="button" value="Sfoglia..."/> Nessun file selezionato.

Web Content Accessibility Guidelines (WCAG) 2.0

Perceivable :

Provide text alternatives for non-text content.

Comments :

Provide captions and other alternatives for multimedia.

Comments :

Create content that can be presented in different ways, including by assistive technologies, without losing meaning.

Comments :

Make it easier for users to see and hear content.

Comments :

Operable :

Make all functionality available from a keyboard.

Comments :

Give users enough time to read and use content.

Comments :

Do not use content that causes seizures.

Comments :

Help users navigate and find content.

Comments :

Understandable :

Make text readable and understandable.

Comments :

Make content appear and operate in predictable ways.

Comments :

Help users avoid and correct mistakes.

Comments :

Robust :

Maximize compatibility with current and future user tools.

Comments :

Recommendations

High :

Medium :

Low :

Others

Notes :

Links :

Attachments:

 Nessun file selezionato.

A.6 Last evaluation

A.6.1 Tasks

Tasks T-UCD

After so many years of back-end development, you would like to focus more on UI/front-end development. You heard your colleagues mention user-centered design (UCD) and you would like to have more insights about it.

1. You heard that EUI team are using “T-UCD”.

With the help of T-UCD explain Valentina briefly:

- what User-Centered Design is in your own words.
- Which strategies does it adopt?

2. Now that you have an idea about UCD you would like to know what user research is and which methods can be performed.

Again, with the help of T-UCD explain Valentina:

- what user research is in your own words
- what is the first best practice to perform a good observation?

3. The team leader of the User Interface (UI) unit proposed you to join her team and you accepted it. She involved you in a project called “SwissVot” that consists in developing an e-Voting application for smartphone and tablet.

T-UCD provides also a tool for managing UCD methods of your projects. The team leader of UI would like you to begin preparing the observation method with T-UCD.

With the help of T-UCD:

- Go in the “SwissVot” project
- Create a new observation with the following data:

File name	“Observation 1”
Start	6 January 2014
End	9 January 2014
Objective	Gather information about how Swiss people vote.
Number of participants	10
Group	Swiss people with rights of voting

- Save it

- After performing the observation task, the team leader told you to move on to the next phase: prototyping.

With the help of T-UCD, explain Valentina briefly:

- what this phase is.
- a best practice to perform sketch method

- After some weeks of prototyping your team choose two possible interfaces that could be proposed and decide to evaluate them.

With the help of T-UCD, explain Valentina briefly:

- In what this phase is?
- which is the evaluation that is the most commonly performed?

- There is another project called “eCensiment” that EUI team is doing. At this time, you are planning to perform an accessibility testing which has been already created in T-UCD.

EUI leader asks you to:

- add and save the objective of an accessibility testing called “Menu” in “eCensiment” project

Objective	evaluate the usability of eCensiment menu with blind people
-----------	---

- delete “Interview 1”

A.6.2 Procedure

Last evaluation T-UCD

Timetable

Monday 13.1.'14

11h00 User 1
13h00 User 2

Thursday 16.1.'14

9h30 User 3
13h00 User 4
14h30 User 5

Procedure

1. Before the user arrives, the environment of the evaluation will be set (computer, mouse, web application, Quick-time, iPhone audio recording app).
2. When the end-user arrives, he or she will be welcomed to sit in front the computer showing the homepage of T-UCD.
3. A short introduction about T-UCD and the evaluation (objectives, tasks, ask if he or she allows to be audio- and screen- recorded) will be presented to the user:

Welcome to this usability evaluation and thank you to accept to do it.

The objective of this evaluation is to test a web application called “T-UCD” which is a tool for user-centered design (UCD) beginners and for UCD experienced practitioners. It provides a system for managing and documenting UCD methods in UCD projects and also a tutorial with descriptions, benefits, best practices and examples to perform efficiently UCD methods.

So, you are going to perform some tasks with T-UCD and please think-aloud your thoughts while using the tool for example if you don't find something or if something is not clear.

I would like to highlight that I am not going to test you, but you are going to help me to test the system itself. So, fill free to be as most honest as possible.

So, I will record the screen and our conversation in order to study the problems of the system later, is that ok for you? (wait for end-user's approval)

Ok, let's start the evaluation!

Before beginning with T-UCD, can you tell me please what do you know about User-Centered Design? (wait for end-user's answer)

Let's start now with the tool! These are the tasks and this is T-UCD.

In the tasks, there are some questions and I will be sitting here ready to listen to your answers.

Please take your time and be at your ease.

4. A document with the tasks that the users have to perform is given.
5. The evaluator will sit behind or aside the screen in order to not make the user feel under pressure by the evaluator watching what he or she is doing and to be ready to listen the answer of the questions included in some tasks.
6. The evaluation starts.
7. The user will read the assigned tasks and will think-aloud while performing them. The evaluator will take notes about the user behaviour, comments, problems and completion (success or failure) of the tasks.
8. At the end of the evaluation, the evaluator asks what do they think sincerely about UCD, T-UCD and possible improvement and comments.
Does this tool give you a clear idea of the UCD approach and its methods?
Sincerely speaking, would you use it?
Do you have some suggestions of improvements? Any further comments?
9. The evaluator thanks the user and tell him that he will receive by email an online survey that will take 5-10 min to fill it up. It should be done as soon as possible.
10. The evaluator greets the user and stops the screen- and audio- recorders. The online survey will be sent to the user.
11. The whole equipment is reset to the initial state for the next user.

A.6.3 Analysis Last Evaluation

Analysis Last Evaluation

1 THERE IS A BETTER UNDERSTANDING OF THE UCD PROCESS AND METHODS WITH THIS TOOL

What do you know about UCD and its process?

User 1 / audio: user1.mp4 / screen: user1.mov

Before T-UCD	After T-UCD
<p>"I do know the [hesitating] process in general, I know how it applied, when it should be applied during the entire development process but I do not know the details and I've never practiced it in details..." 0:18 - 00:33</p> <p>"[hesitating] I've a high level overview of it, that means I know that there are some practices, some good practices, in order to gather user requirements, and I know that it's a very iterative process, in the sense that you will start with only some sketches of that specific topic, and then drill down and elaborate it a bit more, and find good solutions that you always constantly verify with the clients." 00:40-1:15</p> <p>"It's [hesitating] basically it's...as the name says it's very important that the user that is using the system is in the centre and that you consider the system from that perspective." 1:23-1:34</p>	<p>"Ok. So using the tutorial, the overall goals are clear, when I click on the User- centred Design [hesitating] area then you'll find an explanation, what's the overall goal of that process, it drills down now to the user research (P) here it's all about learning about the user itself, so you really have to do some interviews, learn about the user, categorize the users in [hesitating] in various personas and [hesitating] recording information that you have, so that you can really do some categorization of the users of the system that you will work for actually. Then we have prototyping phase (P) so you learnt about, during the user research, you learnt about the system, about the users requirements, what they're gonna do with the system actually, in the sense that you consider they the life of a [hesitating] whatever type of user, so that's the base for, for the prototyping phase as I see here, and then you, you {drill in} there (P) so it gives an explanation that you should not start with already a computer-based system, so that you implement a lot of stuff up-front. You should use [hesitating] the cheapest possible way to explore your {ideas} I mean you use sketch with paper together with [hesitating] typical users in a very iterative manner, you play the user interface on paper for example, and then, then [hesitating] when that's achieved, so the user ok that looks pretty good already, then you go into computer-based systems, in a low-fi first, so I mean just some sketches, maybe use some kind of sketch tool, so it looks a little bit more professional already, and then you go into a high-prototype and so it's a very iterative process that ehm where you will really try to mature the design using this [hesitating] using a {set} of prototypes that are refined more and more." 4:15-7:30</p>

"Then I do see the evaluation phase, so it's a good thing obviously to design an interface together with the user and get some approval [hesitating] from the users in that sense, but the question is if [hesitating] the result does actually be really effective and efficient, and that's why you really have to perform some [hesitating] some tests with that real users so see if specific tasks can be fulfilled with that prototype in an efficient manner or if a lot of questions [hesitating] arise during this specific tasks. So the evaluation phase really proves if the design is valuable, is usable in that sense. And that's the overall goal so [hesitating] and I was looking the user interface is a good starting point but at the end it has to be {effective}." 7:55-9:00

"So I think this [hesitating] tutorial gives quite a good overview what UCD process is all about, and the look and feel { }"

10:28-10:41

User 2 / audio: user2.mp4 / screen: user2.mov

Before T-UCD	After T-UCD
<p>« Alors, le User-Centered Design pour moi, enfin pour moi, ce que j'en sais, c'est tout {benement} c'est faire des interfaces dont le l'utilisateur est basé, donc c'est lui qui décide de ce que lui il veut. Et c'est pas le développeur ou qui d'autre qui va, comment dire, proposer à l'utilisateur ce qu'il doit. Donc c'est vraiment le client qui décide ce qu'il veut. Et nous on travaille autour de lui.</p> <p><i>Tu connais des méthodes, tu connais d'autres choses sur ça?</i></p> <p>Euh... écoute pour moi le thème il est relativement nouveau, je suis aussi en train de l'étudier, donc je vais pas dire euh... que je connais beaucoup, non, je connais les bases et les principes. Pas les fondements ou [en hésitant] les choses les plus importantes. »</p> <p>00:00 – 00:59</p>	<p>« Ben, là en l'occurrence... tu peux utiliser un de ceux-là, si je comprends bien. Quel type de méthode... ben tu peux demander {soit aux} personnes, scenarios, observation, interviews, ou survey. Okay. Je commence à comprendre ton système, d'accord. »</p> <p>14:23 – 14:36</p> <p>« Donc le prototyping d'après ce que j'en comprends, t'as quand même deux phases, la première qui est une phase papier, donc une phase où tu définis ton prototype sur papier ou... support easy, cheap et compagnie, donc... moi en l'occurrence je serai plutôt {d'habitude, d'avis} du papier, [...] où tu définis le... le design brut de ton application, puis tu passes sur une phase heu... computer, donc ordinateur avec un réel, un design qui existe, et tu fais donc ce que nous on appelle des mocks, ou [en hésitant] voilà des wireframes pour, pour simuler les actions pour l'utilisateur. D'accord. Et après, bien sûr les guidelines ça c'est normal, [lit les indications], bon après ce sont les détails du prototyping. »</p> <p>27:50 – 29: 10</p> <p>« Donc si je dois définir ça, ça serait ça, c'est c'est moi je dis ça en français c'est sketcher, c'est... tu sketches, sketches, sketches, sketches jusqu'à ce que t'obtiens, avec tes collègues, un sketch qui, tout le monde est d'accord. Et pas seulement ben moi je suis d'accord sur celui-ci, {je suis} d'accord sur celui-ci. Donc il y a un travail de groupe qui doit se faire. »</p> <p>36:22 – 36:40</p> <p>« Donc si je comprends bien, après avoir fait la phase de sketching, et que le groupe est okay sur un éventuel [en hésitant] interface design et compagnie, on demande au client de venir pour donner un feedback sur ce qu'on lui propose et de corriger selon ce que le client veut. C'est ça »</p> <p>38:00 – 38:23 (he didn't understand 100%)</p>

« Alors pour répondre donc à la question de "which is the evaluation that is the most commonly performed?" je répondrai par ce qui est écrit, "the most commonly performed kind of evaluation is that which is involved the end-user", donc en fait utiliser le... c'est, en français ça se dit, involver [en hésitant] je sais plus du tout, mais ça se dit pareil, c'est en fait demander à l'utilisateur de donner son avis quoi, et, même pas son avis, c'est... qu'est-ce que lui ressent à utiliser... son application! »

41:19 - 41:58

« Je pense que pour une personne qui commence c'est très bien. Je pense que pour un professionnel - je ne me considère pas comme un professionnel, attention - je pense que pour un professionnel, il demanderait peut-être plus. Mais pour une personne qui voudrait commencer, donc qui a comme tu as dit déjà des bases, c'est parfait. Parfait, pourquoi? Parce que, heu... c'est pas sous une forme de livre, donc un livre, tu vois, il y a pas trop d'informations, y a juste les informations, et je dis bien les informations les plus importantes. Et pour ça, moi je dis bravo. Tu sais, c'est aussi pour ça que des fois, ben t'as remarqué lors de notre entretien, c'est que je lis souvent et je m'arrête à la phrase, je continue pas. Parce que pour moi un document, un bon document, c'est un document où tout est résumé, où t'as pas besoin de lire tout. Pourquoi? Tout bêtement pour aller plus vite. Et là en l'occurrence, parfait. »

54:31 - 55:41

User 3 / audio: user3.mp4 / screen: user3.mov

Before T-UCD	After T-UCD
<p>"I've been practicing UCD for now...what should I say... 5 years, i know globally ucd but I am more kind of interaction designer. I don't have a lot of experience in user research or such things: I did evaluation it is not my point I'd rather design interfaces, but I know the whole process I've a team that does that. It's kind of a passion for me, UCD is a passion, I love doing that, I love learning about UCD... so that's my knowledge. I think i have medium experience with that.</p> <p><i>What do you know about the UCD process?</i></p> <p>The process...you know I know the process...the overview of the process, i know how to do the differents phases, I did everything, I did user research, I did every step of the process, at least once.</p> <p><i>which steps?</i></p> <p>Mh...I mean user research, I did some interviews, I did some...I did some personas, I did some user mental model, modelling, I did some task analysis, I did some observations, I did mix of these, I did stakeholders interviews, I did that for the research. For the concept phase, brainstorming, ideation, sketching, prototyping I did it. The design I also made some graphic design, interaction design, icon design. I create visual contents and I test it with users and I also program I've been a developper for 10 years and....</p> <p><i>Front-end?</i></p> <p>No, I did also back-end, I did I did everything...and I mean I did the whole, what you say, the whole range of activities I did...in UCD, but but the last the last 3 years I'm really concentrating of making concepts and design and i have people that do the users research, and the users usability testing i don't do it anymore.</p>	<p>"In my own words, UCD is to involve users from the start in the design process, that means always designing around the user to make systems that are efficient, effective and enjoyable to use. With strategy does it adapts...strategy...ok what do you mean by strategy here you talk about the approach...oh! Strategy...centralization of users needs as [read the tutorial]"</p> <p>6:53 – 7:39</p> <p>"You need to understand the people who are going to use your software, system or product or anything or even eat your cakes, I don't know! This is not restricted to computer systems. To know them, of course, you have to understand who they are, what they goals are and in which contest they're going to use your product or system or service... and then you have a few methods... you have interviews, observations, surveys and then, what I'm not completely ok, the user research - the research part - is observing or interviewing the people and then you have to model this knowledge."</p> <p>8:31-9:19</p> <p>"Ok the idea is to quickly and cheaply explore ideas and make changes on the medium that that doesn't cost you a lot of time to develop and to interactively make your design better. So yes, this is what prototyping is, and prototype is communication tool to communicate the concept to some people, communicate ideas and it is</p>

So you prototype?

I'm more prototyping right now, yes"

00:12 - 02:51

also an evaluation tool, it allows you to test an aspect of your design depending on how you prototype, what's been prototype and test it in fact and it is also great...it's fun, prototype is fun! yeaah I love prototyping!"
16:55 – 17:45

"[With sketch,] don't get stuck on details, that's true...the goal is to produce ideas very quickly"

18:24 – 18:34

"It is to test if the design work or not. [read the instruction] Two things: there are usability testing and you have...how you call it...expert review on usability heuristic [...] [read the answer in the tutorial]"
19:17 – 20:08

User 4 / audio: user4.mp4 / screen: user4.mov

Before T-UCD	After T-UCD
<p>"It structure the process so...you are.. able to reach the goal, you are, you get some methods that are well proof in practice, and then you work with them and then.... You have success and you don't forget anything, it is base of discussion.</p> <p><i>Which goals?</i></p> <p>Yea, the goal it's that you can, you make interviews, that you can understand the users more precisely and that you can bring it together and define the correction or the path of the solution....and you can also document it also for the management that all the involved persons in the project can see that you bring the benefits."</p> <p><i>0:48 – 2:50</i></p> <p>"The other part is psychological part that the customer [...] when they find another thing to optimize, they call directly you, for a validation so they are sure what bring benefit. It's part of relationship and a part of doing the project better. And decrease the cost and take out."</p> <p><i>3:33 – 4:40</i></p>	<p>"User research is an analysis part to collect, to broad, the bandwidth of users, and then you have to select the most different parts, so if they differ, you take both on each hand of the different. And so you have to structuring, to grouping the needs and...the best is when you can assign it to typical rapresenter of this kind of properties other attributes, and so it's about physical, abilities and the mental and social and these are all a little bit criteria to describe the needs and impacts. and then you have a little bit to need with the all the parts you... will understand the personal needs, you build up the tasks. And with the needs you recognize important tasks they have to do, and what's the motivation behind and so you can create a scenario and then you are validating that, with them and then you optimize, you see the optimization potential what's inside. The persona {it's weird two persons} but the validation you do with real persons, so it can be a conflict with that, so when you assign a persona to real person...you say "oh wow, is not me"</p> <p><i>40:45 – 44:16</i></p> <p>"you have to do interviews and observations. You must talk with the users so you have an input, essential input what are the members or the users they use the system or what is the environment they are working in, then you have to visit them, you can't do it in your office."</p> <p><i>45:57 – 46:32</i></p> <p>"[observation] it's preparing.</p> <p><i>why do you know?</i></p> <p>for good observation</p> <p><i>please, use the tool...</i></p> <p>Ya it's planning.</p> <p><i>You read it on the tool?</i></p> <p>eh?</p> <p><i>on the tutorial?</i></p>

yeah, but and I think it's then you it's also good when you have a template....of an old observation, and I think when you start I think you have to prepare with a person that know, so I think if you start with a direct observation and then there are some socials rules that you have to follow, and this should be written in the template or then you get the feedback from your well known person"

48:42 – 50:10

"You do the work for prototyping, and so the visual things on the information you have generated or defined or find

where?

In the user research phase. And you'll bring all the different requirements on a visual point.

How?

Yeah, in visual you generate pictures, you generate sketches and yeah, and bring it on the wall, the ideas or...so you can discuss on the same visual base with your users [...]

It is not a functionality implementation, it's a implementation about visual, a little bit also a feeling and then you define...you are working with visual elements, and then you check that if is it...you re-use it in other pages and so you can check that if this is usable for the end-users."

1:03:19 – 1:06:05

"[Sketch] The most important is to use it a lot and mostly, I think that's important part, you can speaking picture so a picture is more than a 1000 words, but the other hand don't stop {...}, don't define that, and on the other hand, you have to represent the most common tasks"

1:07:55 – 1:08:24

"In this evaluation phase, you want to validate the...a consolidated prototype, or two prototypes, so they focused on different focus so you want to have the feedback which way you have to go, so it's for.... in the first part ofthe evaluation is also done with in each phase before, but this is public evaluation or

validating event.”
1:09:58 – 1:11:00

“It's involve the end-users”
1:14:00 – 1:14:10

User 5 / audio: user5.mp4 / screen: user5.mov

Before T-UCD	After T-UCD
<p>"The main thing is the user, so you look what are the important things for the user, you create your application around him, really more I don't know because I'm new and I learned that {in}, so..." 00:24 – 00:49</p>	<p>"Okay, I try again to explain you after your tutorial. User-centered Design is to understand better how's your user's work, what he normally do and what he need, and there are some advantages if you're do this UCD process and in your [hesitating] development and sometimes, or... in the end you need less costs for the change because you will see them earlier and... it's really difficult. Your tutorial helps me a lot, but... [...] to say them loud it's for me difficult." 08:05 – 9:27</p>
	<p>"I think it's clear, for me it's easy English so I think I can understand it and when I think it's the same there are the same things like them who I know already. I think it's okay." 9:43 – 10:07</p>
	<p>"The strategy, you should understand your user before you begin to develop something and normally it would be good if you would {investigate/invest} 10% of your budget in UCD process, so the advantage is bigger than another way." 10:33 – 11:07</p>
	<p>"It's... so I think the process where you use some methods like an interview, an observation to look for the... the user's needs and, and what he do, how he do it, so you analyse him in this process, and for this there are some methods who are preferred." 15:17 – 15:56</p>
	<p>"Ok, the first best practice of user research is to plan the direct observation very good. So if you are not ready it's difficult to report and find the real things." 18:20 – 18:41</p>
	<p>"Prototyping this is the phase where you develop an example, so you draw it or you develop one, based on computer but it's not the finished application. You can use some interactions, and you see how it [hesitating] how the behaviour of the system will be." 21:22 – 22:15</p>
	<p>"And then, the best practice, that's clear, so up to the first one you know where you find it P One is to do sketches</p>

as early as you can and a lot of them, so you begin very early to draw..."

24:15 – 24:49

"Okay, {oundation, validation}, you have one, or two, or three examples and then..."

Of what?

Of prototypes.

What are these prototypes?

All about your application idea, and in the evaluation phase you will discuss with other people which one is best, where are the advantages and disadvantages, and you can use usability evaluation, with a usability test, or... accessibility that's not the same thing, accessibility it's for... hem [hesitating] people for example who don't see, and...this this phase is really important because you check, have we... have we... remind us about the things what we, what we... so at the first, the user research, and you compare it. There's a solution for every point which we found in the user research."

26:55 – 28:49

"In the evaluation you... check your... your prototypes with the people who use it in the end. Ehm... It's the same thing like this here. After that you have notes, audio and video records, and you can compare them, and see where are problems.

And why you see that?

You ask the people who use it, and tell them that they should try it and look if the tasks who they have to do are there, if they can..."

31:16 – 32:29

"Also in der Evaluationsphase geht es eigentlich darum, dass die Entwickler versuchen, oder die UX Designer versuchen, in {einer} Prototypen, ob sie jetzt am PC gemacht wurden oder auch von Hand, also noch nicht irgendwie interaktiv sind, auf ihre Qualität eigentlich zu testen. Also zu sehen, sind sie effektiv, haben wir diese Probleme oder diese Punkte, welche wir in der User-researchphase herausgefunden haben, haben wir diese umgesetzt, haben wir diese gelöst, und zum wirklich sicher zu gehen, dass das schlussendlich der Kunden eine

Hilfe ist, {nehmen sie} als Referenz, fragen ihnen, soll das ausprobieren, und machen sie {auch} verschiedene {Art} und Notizen, eben zum Beispiel das Gespräch aufnehmen oder wie sie reagieren, dann halten noch die Notizen, welche der Beobachter eigentlich diesen Test selbst macht, als er bemerkt..."

Warum you do evaluation at the end? What's the goal?

"Schlussendlich soll die Evaluation helfen, zu sehen, ob es noch Verbesserungsmöglichkeiten gibt."

What does is mean?

If there are things you can develop better than now."

33:16 – 34:58

"Does T-UCD clear up ?

Yes, I think it does. There are some points that I even know, but it's all together and you find your points again, so it was really helpful."

38:50 – 39:07

2 THERE IS AN INTEREST IN ACTUALLY USING IT FOR THE PROJECTS OF A DESIGNER TEAM

User 1	<p>"The answer right now is no. And...it was a clear statement blank and white. The reason why is the following: first of all the application is promising, from my point of view, because it absolutely {provide} directions but for the time being, it should show it would be possible later on, but there is no integration with other tools that are required for example supporting sketching or mocking phase or actually do an evaluation and have some questionnaires... already existing in the tool where there is a link to other tools. So for { how } being, it is just about storing some meta information. You could also have some pieces of paper where you just record it, scan it and store it in a database and... then... you almost have the same effect. So the reason why I say no is just about the current situation that there is just not enough functionality available...that is a really really help for a project team. However, saying that there is, there are some benefits in a way that you have to structure your work and {already gives} you the options available in the UCD process, it is chronologically, it structures it, the tool is {} doing that. So, that is already a benefit at {knowledge} by using the tool. But overall, I believe there is not enough functionality available to do UCD.</p> <p><i>It is not mature enough?</i></p> <p>Yea"</p> <p>(from user1 use it?.mp4)</p>
User 2	<p>« D'ailleurs si t'as une version pdf moi ça m'intéresse. » 56:34 – 56:37</p> <p>« <i>Très sincèrement, vraiment dans le concret, est-ce que tu utiliserais T-UCD?</i></p> <p>Alors, moi pour ma part, oui. » 57:00 – 57:17</p> <p>« Mais c'est sûr que un tool qui me permettrait facilement et sans perte de temps de faire mon travail, ben oui. » 58:13 – 58:20</p>

User 3	<p><i>"What do you think about the tutorial? Do you think for beginners and also for practitioners would be useful? I mean for example for practitioners the part of best practices...even if they're experienced?"</i></p> <p>Yeah sure, yeah sure, sure... you cannot know everything we all have specialities. If i had to make an usability test now, I should read again how to do it... if is not something I do very often, I'll need instructions to be sure to do it well, sure, sure."</p> <p>22:59 – 23:39</p> <p><i>"This is good for structuring, I think it's a tool to help people who don't know UCD"</i></p> <p>24:23 -24:30</p> <p><i>"I wanted to ask you, if in your opinion, it would be useful for beginners.."</i></p> <p>Yes it would be useful if you turn it around, you make more than...here it's, ok you have two size eh, but it's more than the tool and the tutorial is secondary... I would reverse and make it really the tutorial's structure, the method would be structured, and if you want you can create an artefact from here, you read the about observation? Create an observation now. And it could be useful of course to learn, it's also very useful that somebody is..the tutorial in this form you know that you splitting by phase and then in each phase you have some activities, I think is good because it gives a good structure, a good mental model, so you have the structure, yes, I think is good."</p> <p>34:25 – 35:45</p>	<p><i>"Sincerely would you use this tool to document your thing and also tutorial or document or...?"</i></p> <p>No, I wouldn't, I have mine, we have our own folder's structure and system that we use, I mean, to do stuff. So I wouldn't need the digital help to centralize it, I wouldn't, and I would rather prefer if this was a creation tool that could hold, you know, really... I this is good for structuring, I think is a tool to help people who don't know UCD. For me I would need something I can put the different deliverables more than...you know there's a project in something that manages all my files, where I can {note} different types of contents, I can manage my videos, I can manage my audio recordings and things like that...and then I would use it, with a very smart search that could...ok, I am looking for the question that I ask, I have a transcript of an interview...and quickly find it or I can look in a mind map or in different kind of stuff...and then it would be really useful at this stage but not in this form where is just creating the structure of the activities and not the contents itself."</p> <p>23:45 – 25:18</p>
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User 4	<p>"It's a question of usage, so when you have to scope that you have any knowledge about UCD and you want to have some kicks, and that you say "oh wow"...or checkpoints, then you design it in that way."</p> <p><i>1:22:30 - 1:23:08</i></p> <p><i>"Would you use it?</i></p> <p>Most of the ideas I would take to realize a new one [laughing]but some ideas there're very well and at the beginning I would realize it in another way, so I think it is good that you have taken another approach or other ideas to realize that, so I can't say it is the tool that I use, but it's more than a prototype for me to take out ideas."</p> <p><i>1:26:13 – 1:27:08</i></p>
User 5	<p><i>"Would you use it?</i></p> <p>I think yes. So... I didn't read all things you said, but, for me... why not! There are things like the tutorial who helps me and if there is {instruction, structure} it's easier for me."</p> <p><i>"What would you do if someone says you: 'do an observation' for example?" [...]</i></p> <p>"First I think I would look for some tutorials, in this tutorial what's there about observation, and then I would check the {opinion} how I can create a new observation. But I think I would use it."</p> <p><i>40:06 - 41:09</i></p>

A.7 Attached CD contents - Index

In the attached CD, there are the following elements:

1. Electronic version Master Thesis Report:
“ValentinaColetti-MasterThesisReport.pdf”
2. T-UCD code is divided in three folders: HOMEPAGE, TUCD and UCDTutorial.

In oder to launch T-UCD, it should be open the following file
HOMEPAGE/homepage.html in a Firefox browser with internet connection.