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ANDREI GARCIA

ARTIFACT-FACILITATED COMMUNICATION IN AGILE USER-CENTERED DESIGN

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Artifact-Facilitated Communication in Agile User-Centered Design

ANDREI GARCIA

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Advisor: Dr. Milene Selbach Silveira

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Andrei Garcia

Artifact-Facilitated Communication in Agile User-Centered Design

Dissertação apresentada como requisito parcial para a obtenção do grau de Mestre em Ciência da Computação do Programa de Pós-Graduação em Ciência da Computação, Faculdade de Informática da Pontifícia Universidade Católica do Rio Grande do Sul.

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BANCA EXAMINADORA:

Profa. Dra. Luciana Martinez Zaina (PPGCC/UFSCar)

Profa. Dra. Sabrina dos Santos Marczak (PPGCC/PUCRS)

Profa. Dra. Milene Selbach Silveira (PPGCC/PUCRS – Orientadora)

To my lovely wife and my dear family.

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RESUMO

A integração entre métodos ágeis e design centrado no usuário é uma condição fundamental para aprimorar a qualidade de produtos de software. Entretanto, um dos principais problemas enfrentados para estabelecer essa integração no dia a dia é como facilitar a comunicação entre os diferentes profissionais envolvidos. Portanto, o objetivo dessa pesquisa é explorar e entender os artefatos envolvidos no processo de desenvolvimento que podem facilitar a comunicação entre desenvolvedores e designers no contexto *Agile User-Centered Design* (AUCD). Essa pesquisa qualitativa é composta por três estudos. O primeiro estudo define um mapeamento sistemático visando identificar os artefatos utilizados para facilitar a comunicação na abordagem AUCD. O segundo estudo é também composto por um mapeamento sistemático, o qual apresenta como estudos de etnografia *online* são executados na área de Ciência da Computação. Aplicando o método de netnografia, o terceiro estudo constitui uma etnografia *online*, o qual provê o entendimento de como e onde os artefatos são utilizados para facilitar a comunicação entre *designer* e desenvolvedor. Por meio da combinação dos três estudos, os resultados dessa pesquisa apontam cinco temas: (1) Times eficazes trabalham juntos, (2) *Designer* deve desempenhar três principais papéis, (3) Principais artefatos utilizados para facilitar a comunicação, (4) Comunicação facilitada por artefatos e (5) Colaboração apoiada por artefatos. A interpretação e descrição dos temas demonstram como a utilização dos artefatos facilitam a comunicação do time. Os resultados dessa pesquisa contribuem para as áreas de Engenharia de Software e Interação Humano Computador provendo uma ampla visão sobre os artefatos que facilitam a comunicação na abordagem AUCD, assim como os eventos nos quais eles são utilizados. Além disso, os resultados demonstram como a disciplina de Ciência da Computação vem aplicando os métodos de etnografia *online*. Finalmente, os resultados destacam como a comunicação facilitada por artefatos acontece na indústria através de uma perspectiva de profissionais que participam em comunidades *online*.

Palavras-chave: Métodos Ágeis, Artefatos, Comunicação, Netnografia, Etnografia Online, *User-Centered Design*.

ABSTRACT

The integration of Agile and User-Centered Design methods is a fundamental condition to improve the quality of software products. However, one of the main problems faced to establish this integration on a daily basis is how to facilitate communication among the invariably distinct involved practitioners. Therefore, the purpose of this research is to identify and understand the artifacts involved in the development processes that could facilitate communication between developers and designers in the context of Agile User-Centered Design. This qualitative research is composed of three studies. The first study is a systematic mapping aiming to identify the artifacts used to facilitate communication in an AUCD approach. The second study is also a systematic mapping targeting to present how online ethnography studies have been performed in the Computer Science area. By applying the netnography method, the third study is an online ethnography, which provisions the understanding of how artifacts are used to facilitate communication between designer and developer and when they are used. Through the combination of these three studies, the findings from this research pointed out five themes: (1) Effective teams work together, (2) Designer should play three major roles, (3) Main Artifacts Facilitating Communication, (4) Artifact-Facilitated Communication, and (5) Artifact-Supported Collaboration. The themes interpretation and delineation show the usage of artifacts to facilitates teams' communication. The findings of this research contribute to Software Engineering and Human-Computer Interaction by providing a broad overview of the artifacts used for communication on AUCD, as well as the software development events that they are used. In addition, the findings demonstrate how Computer Science discipline have been applying online ethnography methods. Finally, they highlight how the artifact-facilitated communication occurs in the industry through a perspective from practitioners that participate in online communities.

Key-words: Agile, Artifacts, Communication, Netnography, Online Ethnography, User-Centered Design.

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LIST OF ACRONYMS

AUCD	Agile User-Centered Design
CMC	Computer-Mediated Communication
HCI	Human-Computer Interaction
PO	Product Owner
SE	Software Engineering
SM	Scrum Master
SMS	Systematic Mapping Study
UCD	User-Centered Design
UI	User Interface
US	User Story
UX	User eXperience
XP	eXtreme Programming

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1 INTRODUCTION

Agile development has become mainstream regarding software development processes. Along with it, there is an increasing understanding of the importance of good user experiences. However, despite the fact that both aim to build software products with high quality, Agile methods and User-Centered Design (UCD) approach development from a different perspective [FESR12]. Agile methods focus on addressing activities related to code development [BEAN04] while UCD focuses on addressing activities related to the product's interaction with a user [PRRS15].

The integration of both fields is an essential requirement to increase the quality of software products and it is not a new idea [CHSM06]. The overall picture of Agile User-Centered Design (AUCD) is robust enough for researchers and practitioners [SISM15]. In addition, this integration requires team members' to work together and close in order to promote ongoing and continuous communication [CHSM06]. However, such interaction on a daily basis is still a concern, and one of its main problems is how to facilitate communication between Software Engineering (SE) and Human-Computer Interaction (HCI) practitioners aiming to build a shared understanding about the project context.

This shared understanding among SE and HCI individuals is critical to the success of several agile projects, but little has been known about how communication works [BRLB11]. In addition, the reliance on communication within agile teams is a fundamental characteristic [SHRP09]. In AUCD, designers and developers must be prepared to communicate and collaborate. Moreover, designers must be willing to share artifacts and disseminate the design vision with developers [SSMH12]. Related to sharing and understanding of the design vision on AUCD approach, a number of techniques are used, such as design studio, developers participating in user interface specifications, and shared artifacts between developers and designers [SAPC14]. Thus, communication issues might be addressed by the use of artifacts as a communication facilitator. It is important to define the term "facilitate" in this research as "make something possible" and "promote" as defined by Oxford Dictionary [OXFO10].

One of the five principles explored by Brhel et al. [BMMW15] supports the idea of artifact-mediated communication on Agile User-Centered Design approach. The authors define an artifact as an "…aspect of the material world that has been modified

over the history of its incorporation into goal-directed human action." This principle consists of the use of tangible and up-to-date artifacts – accessible to all involved stakeholders – to document and communicate product and design concepts.

In this context, Artifact-Mediated Communication principle can be the lens to establish a shared understanding between SE and HCI experts, especially concerning developers and designers. Therefore, **which are the artifacts that could facilitate the communication between developer and designer in an Agile User-Centered Design approach?** In order to answer this question, this research is composed of three main studies, being them two systematic mappings and one online ethnography.

Through the accomplishment of these studies, one of the contributions of this research is the delineation of how artifact-facilitated communication happens in the industry through a perspective from practitioners that participate in online communities. Furthermore, it provides a broad overview of the artifacts used for communication on AUCD, as well as the software development events which they are used. Finally, it shows how Computer Science disciplines have been applying online ethnography methods. The detailed research methodology of all studies, as well as the research goal, are presented next.

1.2 Research Goal

The main goal related to this research is **to identify and understand the artifacts used to facilitate communication between designers and developers in an Agile User-Centered Design approach**.

In order to achieve the main goal, the following objectives were defined:

- **To identify** - in literature - the state of art of artifacts used to facilitate communication in Agile User-Centered Design approach.
- **To understand** – in literature – how online ethnography studies have been performed in Computer Science.
- **To identify and understand** - with practitioners - how artifacts are used to facilitate communication and when they are used.

1.3 Research Methodology

The purpose of this qualitative research is to identify and understand the artifacts used to facilitate the communication between designers and developers in an Agile User-Centered Design approach, especially in events (as known as agile ceremonies) where the communication is important for both roles. Hence, in order to identify these artifacts in the literature, the first study of this research was a systematic mapping [GASS16]. The outcomes of this study provided a list of artifacts, events, and roles involved in Agile User-Centered Design.

The second study was another systematic mapping, but this mapping aimed to present how online ethnography studies have been performed in the Computer Science area. This study was essential to understand the available methods and define the method for the next study. Finally, the third study involves an online ethnography based on netnography method which yielded the understanding of how artifacts are used to facilitate communication between designer and developer and when they are used. Table 1 summarizes the goal of each research study.

Table 1 - Objectives mapped to each research study

	Study	**Objective**
1	Systematic Mapping: Artifacts for AUCD	To identify - in literature - the state of art of artifacts used to facilitate communication in Agile User-Centered Design approach
2	Systematic Mapping: Online Ethnography	To understand – in literature – how online ethnography studies have been performed in Computer Science.
3	Online Ethnography	To identify and understand - with practitioners - how artifacts are used to facilitate communication and when they are used.

1.4 Dissertation Structure

This document is structured in seven Chapters. Chapter 2 presents the theoretical background related to agile, user-centered design, their integration, and artifacts used through this approach. Chapter 3 demonstrates the systematic mapping study performed to identify the state of art of artifacts used to facilitate communication in AUCD. Chapter 4 presents the systematic mapping study implemented in order to understand how online ethnography studies have been performed in Computer Science. Chapter 5 brings up the online ethnography performed to identify and understand how artifacts are used to facilitate communication and when they are used. Chapter 6 presents the discussion related to research findings. Finally, Chapter 7 presents the conclusion and potential future work.

2 THEORETICAL BACKGROUND

This chapter outlines the theoretical background of Agile, User-Centered Design, Agile User-Centered Design and the artifacts used in AUCD.

2.1 Agile

Larman [LARM04] argues that it is not possible to define Agile methods as specific practices vary. However, these methods apply time-boxed iterative and evolutionary development, as well as adaptive planning, promoting evolutionary delivery, and including other values and practices that encourage agility, rapid and flexible response to change. In addition, they promote practices and principles that reflect an agile sensibility of simplicity, lightness, communication, self-directed teams and programming over documenting, for instance.

In 2001, in Salt Lake City, a group interested in iterative and agile methods met to find common ground. The Agile Manifesto [SCBE01A] resulted from this meeting states that:

> *Individuals and interactions over processes and tools.*
> *Working software over comprehensive documentation.*
> *Customer collaboration over contract negotiation.*
> *Responding to change over following a plan.*

The generated Agile principles have guided the Agile development. These principles have also guided a number of Agile methods, e.g. Scrum [SCBE01B], eXtreme Programming (XP) [BEAN04] and Crystal [COCK04], just to name a few. The twelve defined principles according to Agile Manifesto [SCBE01A] are described next:

1. *Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.*
2. *Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.*

3. *Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.*
4. *Business people and developers must work together daily throughout the project.*
5. *Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.*
6. *The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.*
7. *Working software is the primary measure of progress.*
8. *Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.*
9. *Continuous attention to technical excellence and good design enhances agility.*
10. *Simplicity--the art of maximizing the amount of work not done--is essential.*
11. *The best architectures, requirements, and designs emerge from self-organizing teams.*
12. *At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.*

These principles guide the techniques and rules in different agile methods. Among the existing Agile methods, Scrum or Scrum/XP hybrid approach dominates the Agile software industry with 70% of respondents of the 10th Annual State of Agile Survey [VERS16]. The latest agile survey, 11th Annual State of Agile Survey [VERS17] revealed that these methods continue to be the most common agile methodologies used by 68% of the respondents' organizations.

Scrum can be described as a rough outline of a process, based on iterative development that is composed of three roles, five events and three documents [THHA10]. The three roles are Product Owner (PO), Development Team, and Scrum Master (SM), these three roles define the Scrum Team structure. The PO provides the requirements by representing the stakeholder such as customers, marketing, etc. The

team is the development team, which is responsible for developing and testing the deliverables. Finally, the Scrum Master is responsible for ensuring Scrum and adjusting it according to the project and organization.

The five events are the sprint, the sprint planning, the daily scrum, the sprint review, and the sprint retrospective. In Scrum, the development is done in small iterations called sprints and each sprint has a duration of two to four weeks. Once defined the sprint time-box it should be used for all sprints. The sprint planning is the event where the scrum team plans the work to be done during the specific iteration. The daily scrum is a 15 minutes event for the team to synchronize the activities during the day. The sprint review is held at the end of the sprint to verify the product increment and what was done. Finally, the sprint retrospective occurs at the end of the sprint and it is an opportunity for the team to inspect and create a plan for improvements for future sprints [SCSU17].

The three documents are the product backlog, sprint backlog, and sprint results. The product backlog is a list of all gathered and prioritized requirements related to the project. The product backlog is used to describe the upcoming work on the product and it is polished in order to add details to the items. This detailing is called refinement, which is the act of add details, estimates, and order to items in the product backlog. The sprint backlog is a set of product backlog items committed for the sprint. And the sprint results are the potentially shippable product increment developed during the sprint [SCSU17]. Figure 1, shows the Scrum flow containing the roles, events, and documents.

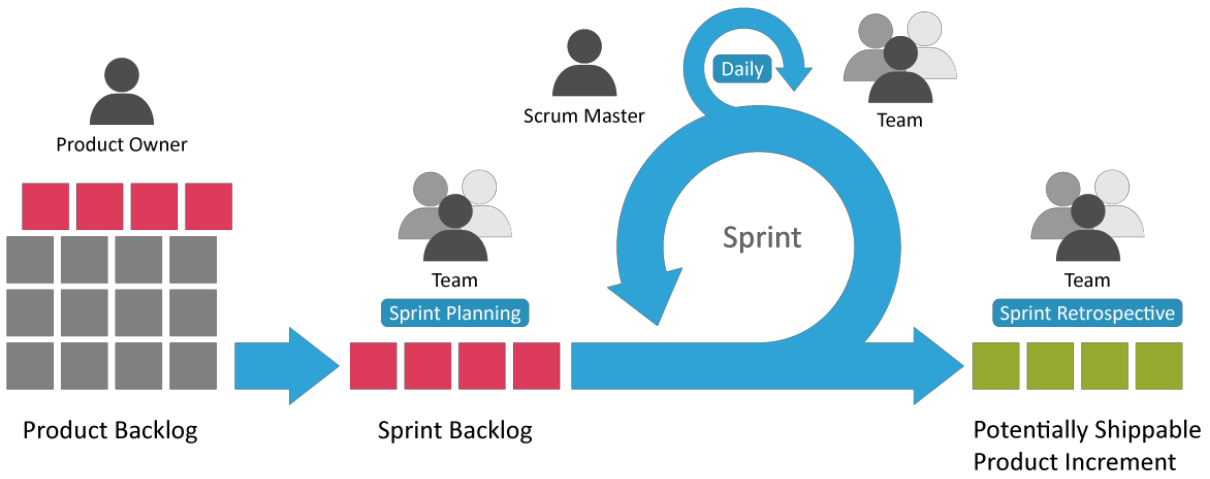


Figure 1 - Scrum Flow, based on Scrum Guide [SCSU17]

2.2 User-Centered Design

Usability is the aspect of HCI devoted to ensuring that human-computer interaction is, among other things, effective, efficient, and satisfying for the user. Thus, usability includes characteristics such as ease of use, productivity, efficiency, effectiveness, learnability, retainability, and user satisfaction [ISO07].

User-Centered Design is an iterative design process which focuses on the users. The international standard ISO 9241-210: Human-centred design for interactive systems [ISO10] is the basis of UCD and defines a general process for including human-centered (user-centered) activities throughout a development life-cycle, but does not specify exact methods.

In this process, once the need to use a human-centered design approach has been identified, four activities form the main cycle of work:

1. Specifying the context of use: Identifying the people who will use the product, what they will use it for, and under what conditions they will use it.
2. Specifying requirements: Identifying any business requirements or user goals that must be met for the product to be successful.
3. Creating design solutions: This part of the process may be done in stages, building from a rough concept to a complete design.
4. Evaluating designs: The most important part of this process is that evaluation -- ideally through usability testing with actual users -- is as integral as quality testing is to good software development.

The process ends – and the product can be released – once the requirements are met.

2.3 Agile User-Centered Design

Agile UCD (AUCD) evolved from different motivations. On one hand, software engineers aim to satisfy customers through timely releases and responsiveness to change requests without compromising software quality. On the other hand, UCD aims at ensuring appropriate user experience of the implemented software, a characteristic that has not been sufficiently considered in traditional, plan-driven approaches or in agile approaches. User-Centered Design addresses this issue but does not consider Agile principles [BMMW15].

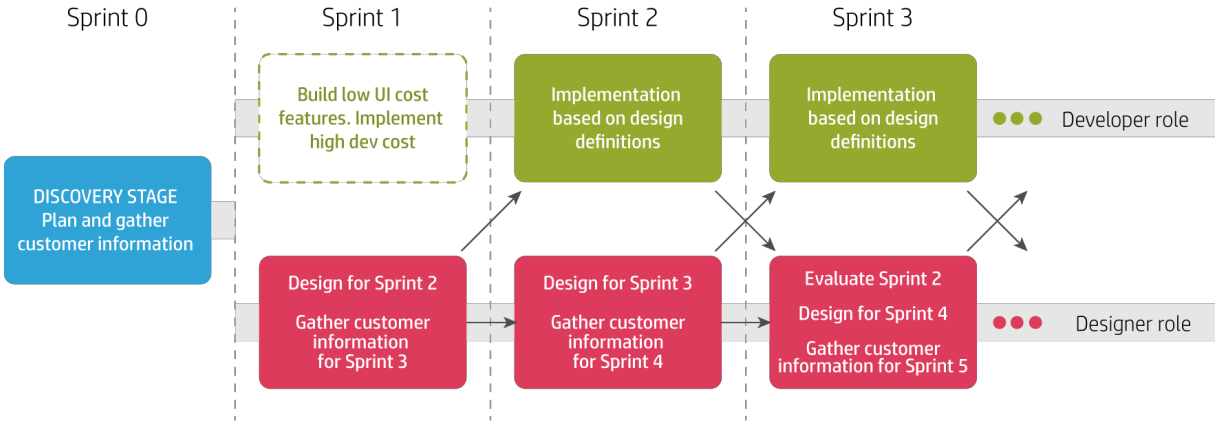


Figure 2 - Parallel tracks for development and design, based on Sy [SY07]

First attempts to integrate Agile and UCD approaches were made about a decade ago. For instance, Sy [SY07], Ferreira et al. [FESR10], Fox et al. [FOSM08], and Silva et al. [SMMS11] came up with very similar proposals about the integration between these two approaches. Their proposal is based in two parallel tracks, iterating the design and development separately but simultaneously, as presented in Figure 2. This model presents the concept of discovery stage, or sprint 0, which involves usability investigations, user interviews, creation of personas, and definition of the main product goals [SY07].

Salah, Paige, and Cairns [SAPC14] performed a systematic review to identify restriction factors regarding Agile and UCD integration and explored practices to deal with them. One of their findings in this review was about the dynamics between developers and designers which talks about the ongoing and continuous communication between the teams. Regarding sharing and understanding design tasks, a number of practices are used, such as design studio, developers participating in UI specifications and shared artifacts within the team.

Brhel et al identified five principles for the integration of Agile and UCD in their study [BMMW15]. These five principles are described below:

- ***Principle 1*** – *Separate product discovery and product creation* – AUCD should be based on separated product discovery and product creation phases.
- ***Principle 2*** – *Iterative and incremental design and development* – AUCD approaches should support software design and development in incremental and short iterations.

- ***Principle 3*** – *Parallel interwoven creation tracks* – In AUCD approaches, design and development should run in parallel interwoven iterations.
- ***Principle 4*** – *Continuous stakeholder involvement* – Stakeholders should be actively involved in AUCD approaches early on and during the entire development process.
- ***Principle 5*** – *Artifact-mediated communication* – In AUCD approaches, artifacts should be used to communicate and document product and design concepts and should be accessible to all involved stakeholders.

Regarding the last principle – *Artifact-mediated communication* – artifacts can be used for communication, elaboration, validation, and documentation of requirements in the agile environment [SCTE17].

2.4 Artifacts used on AUCD

Many artifacts appear as facilitators in communication between Agile and UCD. In the mapping study performed by Garcia, Silva, and Silveira [GASS16], 20 different artifact groups play this important role (the results of this study are presented in Chapter 3). Prototypes and user stories show up as the most used artifacts. Besides that, personas, sketches, scenarios, and wireframes also appear as important means for organizing communication and collaboration among team members. Therefore, a brief description of these artifacts is presented below:

- **Prototype** – In the software development area, a prototype is a preliminary model of a system. It can be anything from a paper-based storyboard through to a complex software piece [PRRS15]. Prototypes allow stakeholders interaction with an envisioned product and explore imagined uses. In addition, they are a communication artifact among team members, support designers in choosing between alternatives, and are an effective means to test an idea with end-users [PRRS15].
- **User Story** – A User Story (US) describes a valuable functionality focused on the user [COHN04]. A US consists of a short description of functionality and user interaction, the business value, testes that convey, and document details to determine when a story is complete [THHA10].

- **Persona** – A persona can be defined as a hypothetical archetype that represents a specific person in a specific work role, with specific user characteristics [HAPY12]. This artifact makes clear what functionality or features must be included or omitted in a system for example. It also helps designers to debate about end features [BRBA08].
- **Sketch** – As mentioned by Hartson and Pyla [HAPY12], sketching is the quick creation of freehand drawing to express preliminary ideas, always focusing on ideas instead of details. As stated by the authors, sketch supports communication within ideation and also serve as an important design document, helping other team members and designers to understand the design. Usually, a sketch is the main foundation for a wireframe or a prototype.
- **Scenario** – A scenario is a natural narrative description that describes a story of user's accomplishing an action or activities [PRRS15]. Scenarios describe the user behaviors and experiences and help designers to understand user motivations while interacting with an object in a specific environment.
- **Wireframes** – A wireframe is considered a form of prototype and comprises lines and outlines – hence the name *wire frame* – of mostly boxes to represent evolving interactions designs [HAPY12]. Wireframes are used to illustrate high-level concepts and behaviors.

3 SYSTEMATIC MAPPING: ARTIFACTS ON AUCD

A systematic mapping is a method designed to provide an overview of a research field by verifying the existent research data and by providing the amount and classification of such research data [KICH07]. The first study of the main research was performed following the guidelines for conducting systematic mapping studies described by Petersen [PFMM08]. The authors explain that the mapping process consists of three phases, namely planning, conducting, and reporting. Results were published in [GASS16], and are presented in details in this chapter.

3.1 Planning

To start, the SMS was first planned in detail to define the search question and establish the research protocol. The protocol was defined bearing in mind the steps of search strategy, selection criteria, and data extraction strategy. As argued by Kitchenham [KICH07], a protocol is necessary to reduce probabilities of researcher bias. The protocol, papers selection, and data extraction phases were performed jointly with Dr. Tiago Silva da Silva.

3.1.1 Research Questions

The main goal of this mapping study was to identify the artifacts that may facilitate communication in an Agile User-Centered Design approach. Therefore, three primary research questions were defined:

- RQ1: Which are the artifacts that facilitate communication between Agile Methods and User-Centered Design areas?
- RQ2: Which event of the process are these artifacts being used?
- RQ3: Are these artifacts physical or electronic?

3.1.2 Search Strategy

There are some relevant systematic reviews about Agile Methods and UCD integration [BMMW15], [SMMS11], [SAPC14]. Since Brhel et al study [BMMW15] captured the state of Agile and UCD integration, it was decided to replicate part of their

search strategy. However, this study focuses on mapping the artifacts that might mediate the communication within this context.

The main relevant databases that include HCI domain were used to search for primary studies: ACM Digital Library[1], EBSCO Host[2], Elsevier ScienceDirect[3], IEEE Xplore[4], ProQuest[5], and Springer Link[6]. In order to automate the search in the selected databases, a search string was composed using keywords from both User- Centered Design and Agile Methods. Table 2 shows the search string.

Table 2 - Search string applied for systematic mapping: artifacts on AUCD

Search String
(ergonomics OR "human-computer interaction" OR "computer-human interaction" OR "interaction design" OR usability OR "user experience" OR "user-centered design" OR "ui design" OR "interface design") AND (agile OR scrum OR "extreme programming" OR lean OR "crystal clear" OR "feature driven development" OR "dynamic software development")

The timeframe defined for this systematic mapping included studies published from 2002 to 2016. This starting date was selected because Agile Manifesto arose in 2001 and the publication of papers related to this field has started in 2002.

3.1.3 Selection Criteria

Each publication retrieved from the automated search was evaluated in order to select whether or not it should be included by considering titles and abstracts. In a first filter, papers based only on titles and abstracts were excluded. In the second filtering process, we read the full text to decide which paper to keep. The following inclusion criteria was applied in the first filter: (a) Studies should be published in the Computer Science area and (b) Studies should present the subject on Agile Methods and UCD integration.

Publications that met at least one of the following exclusion criteria were removed: (a) Books, (b) Duplicated papers, (c) Studies written in any language other

[1] http://portal.acm.org
[2] https://www.ebscohost.com/
[3] http://www.sciencedirect.com
[4] http://www.ieeexplore.ieee.org/Xplore
[5] http://www.proquest.com/
[6] http://link.springer.com/

than English, (d) Studies presenting summaries of tutorials, panels, poster sessions or workshops, and (e) Conference covers and table of content.

During the full text reading stage, it was performed a detailed analysis of the paper content. The goal of this stage was to select the studies according the following inclusion criteria: (a) Studies should present artifacts used in Agile User-Centered Design, (b) Studies should present artifacts that facilitate team communication (e.g. communication between developer and designer).

3.1.4 Data Extraction Strategy

The data extraction strategy was based on providing a set of possible answers for the research questions. Since RQ1 and RQ2 could retrieve a great number of answers, it was defined some initial possible answers. This set of possible answers was extended throughout screening. Table 3 display the initial possible answers for each research question.

Table 3 - Data extraction strategy for first study

Research Question	**Possible Answers**
RQ1: Which are the artifacts that facilitate communication between Agile Methods and User-Centered Design areas?	Sketch Persona Mockup Scenario Guideline Prototype User Story Storyboard
RQ2: Which event of the process are these artifacts being used?	Discovery Iterative Cycle Planning
RQ3: Are these artifacts physical or electronic?	Physical Electronic

3.2 Conduction

It was searched for papers in the selected databases during April 2016. The first results were set of 1403 studies. After the results' compilation, it was applied the exclusion criteria, resulting in 1200 publications. Afterwards, 146 papers were selected in accordance with the inclusion criteria from the first stage, where only the title and abstract were considered. Finally, in the full text reading stage, 56 publications were selected (Appendix A). The selection process is shown in Figure 3.

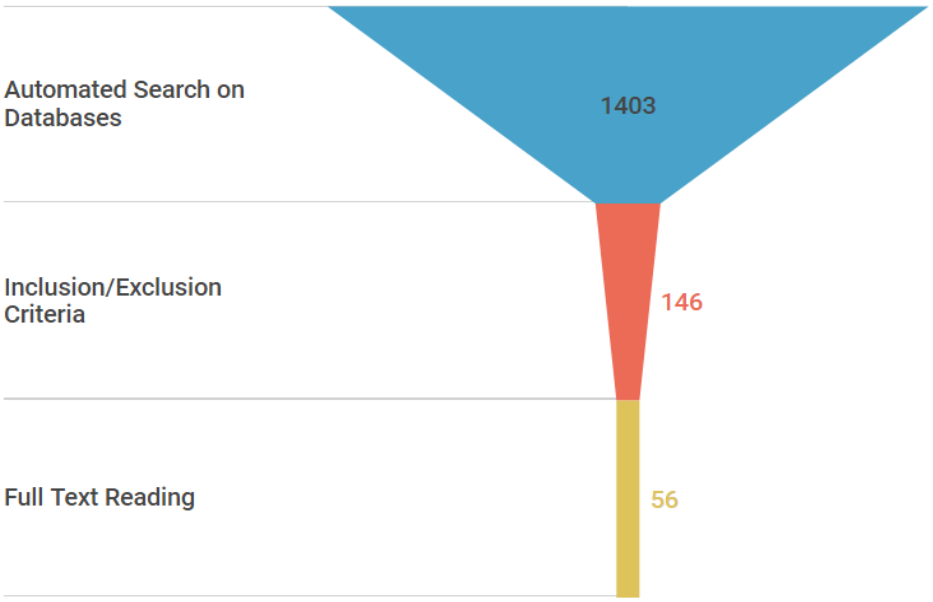


Figure 3 - Selection process for first study

3.3 Results

The goal of the systematic mapping study was to identify the artifacts that may facilitate communication in an Agile User-Centered Design approach. The following sections present the results for each research question.

3.3.1 Artifacts on Agile User-Centered Design

The results for RQ1 - *Which are the artifacts that facilitate communication between Agile Methods and User-Centered Design fields?* – revealed that there are at least 20 artifacts used to promote communication in Agile User-Centered Design. During data extraction, it becomes clear that the initial set of possible answers was not

covering all the artifacts. Over the full text reading, many artifacts were identified and were included in possible answers to increment the data extraction definition. Additionally, the authors use different nomenclature for artifacts that are used for the same purpose. For example, the term guideline [OVLA15][WALE15] was also used as style guide [KUMI13] and design specification [BLPÅ15]. To handle these different names, the artifacts were grouped according to their objectives. The most common name and most cited terminology was used to group them. Appendix B presents all the extracted artifacts, groups and extracted numbers for all selected papers. Figure 4 shows the list of all extracted artifacts.

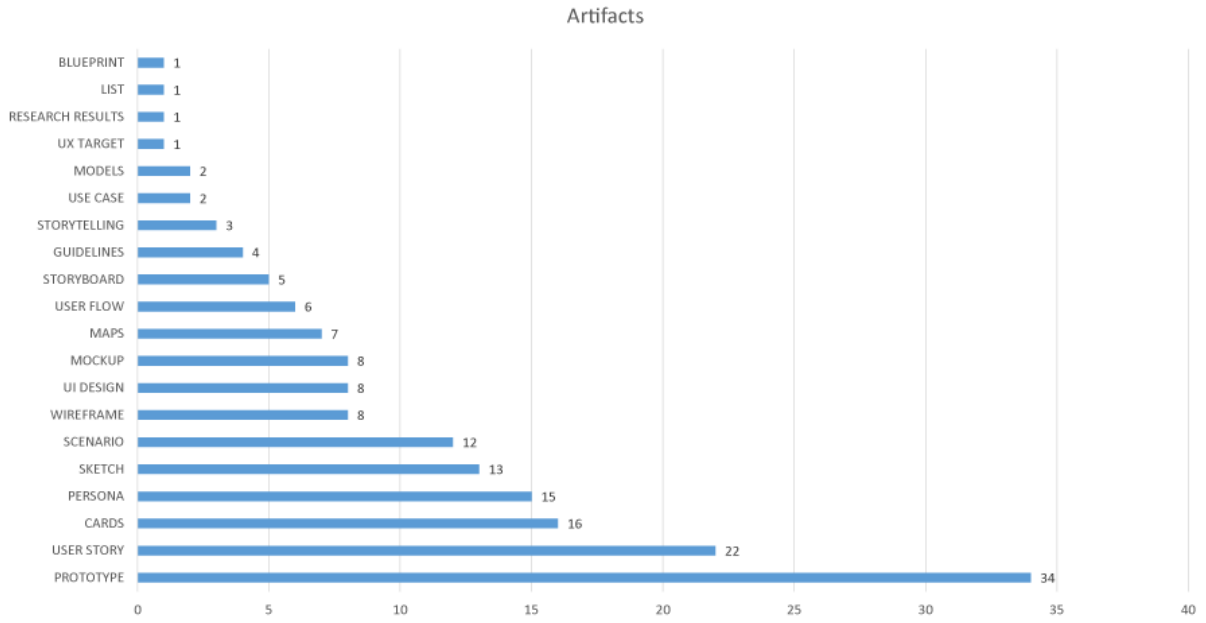


Figure 4 - Artifacts used to facilitate communication

Some studies selected in this mapping highlight the importance of artifacts as an essential channel of communication between different areas [TAI05]. Beyer, Holtzblatt, and Baker [BEHB04] state that using conceptual diagrams and mockups, team communication can be facilitated. In their study, task models were used to show the scope of issues from all customers to the entire team. Afterward, product marketing, development leads and human factors participated in determining which issues would be addressed by the project. User stories were described according to sequence models, defined as tasks. These user stories were used during the planning meeting to define what would integrate an iteration. During planning, high-level mockups were used to facilitate team communication.

In her study, Tay [TAI05] describes that a UI prototype created by software developers was effective in encouraging group communication. In that case, the UI prototype evolved from storyboards. Testers used storyboards as a base to test the workflow. Meszaros and Aston [ISVH12] took advantage from paper prototypes to run usability tests and, afterward, used these prototypes as a UI storyboard, where they taped up all story cards. This storyboard became an important means of communication during the planning meeting.

In his project, Patton [PATT05] described that they used task cards to describe user tasks during the span plan, referring to a task modeling and planning technique. These user tasks were used as a base to build low fidelity paper prototypes. Whit the prototypes supporting the most important tasks they could write the user stories. With all these artifacts, especially the prototypes, developers could estimate and build software more accurately.

According to results, prototypes are the most used artifact to facilitate communication on Agile User-Centered Design. In addition to that, brief documentation and face-to-face communication can be used to integrate the team [UNWH08].

3.3.2 Events in which artifacts are used

The results for RQ2 – *Which event of the process are these artifacts being used?* – revealed at least 5 events involving artifacts as a means of communication between team members. The initial set of possible answers for events included discovery, iterative cycle, and planning meeting. However, throughout data extraction, two more events were included, namely review meeting and general meetings. Resulted events were grouped according to their purposes and are displayed in Appendix C.

The main goal of a planning event is to define what would integrate an iteration. This event appears in 17 studies. For the planning period, UI design and user stories are delivered to the development team and they can use them to estimate how much effort they need for the next iteration [BEHB04]. Cards are the most used artifact on planning event, as seen in Figure 5. During a planning event, cards are used to estimate work and, through this process, the designer explains to the engineering manager and developers to have a more accurate estimation and to figure out what is going to be done in the iteration [FENB07].

The iterative cycle is a process based on iterative and incremental cycles of software production [PWBK13], which includes both development and design tasks. During this iterative event, many artifacts are used to mediate communication, mainly between developers and designers. The most common artifact on this event is the prototype, followed by user story and cards. 31 studies reported the use of some artifact during this event. Sy [SY07] explains that in this event the UI design is presented face-by-face to the developers who will implement it. A typical workflow is demonstrated on the last available prototype.

Five studies [SING08][KDLC12][BRLB12][JUHM14][BRLB11] show the use of artifacts in meetings with no specific subject. They were called general meetings since it was not possible to identify the exact meetings' topic. Basically, prototypes, personas, and sketches are used during these meetings to facilitate communication. Interactive prototypes and whiteboard sketches are examples of interface proxies between designers and developers [BRLB11].

ARTIFACTS \ EVENTS	Discovery	Planning	Iterative Cycle	Review Meeting	General Meetings
BLUEPRINT	0	1	0	0	0
CARDS	4	5	7	1	0
GUIDELINES	0	0	0	0	0
LIST	0	0	0	0	0
MAPS	0	0	3	1	0
MOCKUP	0	0	4	1	0
MODELS	0	0	0	2	0
PERSONA	0	2	3	0	1
PROTOTYPE	0	3	15	0	3
RESEARCH RESULTS	0	0	1	0	0
SCENARIO	1	1	3	0	0
SKETCH	1	0	0	0	1
STORYBOARD	1	1	0	0	0
STORYTELLING	0	0	3	0	0
UI DESIGN	2	1	5	0	0
USE CASE	0	0	0	0	0
USER FLOW	1	0	1	0	0
USER STORY	0	4	9	0	0
UX TARGET	0	1	0	0	0
WIREFRAME	0	1	3	0	0

Figure 5 – Heatmap Artifacts x Events

3.3.3 Artifacts format

Regarding studies that describe artifacts' format, the results for RQ3 - *Are these artifacts physical or electronic?* – demonstrate that 48% of artifacts are available in physical formats such as sketches and paper prototypes. On the other hand, 52% of the artifacts are available in electronic format.

Paper and whiteboards are used as tools to create physical artifacts. Most common cases of paper artifacts are cards, sketches and paper prototypes [PATT05][MEAS06][BRLB08]. In addition, these categories of artifacts are commonly used throughout planning and discovery events. Paper prototypes are posted as a user interface storyboard in planning meetings to facilitate team communication [MEAS06]. Paper mockups are also used to collect and present ideas between developers and designers [SLMS08].

On the topic of electronic artifacts, they are available using technologies such as Central Design Record (CDR) [LEMS09][LEJM11][LEMT07], PowerPoint [TAI05][ISVH12], Balsamiq [BABI14], Shockwave [HASA03], and HTML [ABIK14][AMSA15][WALE15]. It is important to emphasize that electronic artifacts are mostly used during the iterative cycle. This event requires artifacts that have more details. At this point, they often serve as a basis for development and test.

Summarizing, this study focused on the artifacts used to facilitate communication in Agile UCD approach. Through a mapping study about the integration of both areas, we deepened the understanding not only about the artifacts used for communication in this approach but also the software development events that they are used. Thus, in order to extend the understanding of how artifacts are used to facilitate communication between designer and developer, an online ethnography study was performed. However, before running the online ethnography study, a systematic mapping about online ethnography studies was completed in order to have an overview of applied online ethnography methods in Computer Science. Thus, the next Chapter presents a systematic mapping study of how online ethnography studies have been performed in Computer Science.

4 SYSTEMATIC MAPPING: ONLINE ETHNOGRAPHY

This second systematic mapping study was also carried out by following the established guidelines for conducting systematic mapping studies suggested by Petersen et al. [PEVK15], which organizes the review in three phases: planning, conducting, and reporting. The results of this SMS is published in [GAMS18] and reported in details next.

4.1 Planning

Before conducting the systematic mapping, we forethought the research questions and established the research protocol. As in the previous study, the protocol was delineated considering the steps of search strategy, selection criteria, and data extraction strategy. The protocol, papers selection, and data extraction steps were performed jointly with Bruna Pereira de Mattos.

4.1.1 Research Questions

Online ethnography adopts principles of ethnographic research molded in offline environments and applies them to online environments with necessary adjustments [RPHD12]. Kozinets [KOZI15], argue that online ethnography is a generic term for performing any ethnographic research by using some sort of digital or online environment. Methods such as netnography [KOZI10] and virtual ethnography [HINE00] are widely adopted for qualitative research. However, it is not clear how the Computer Science domain is using online ethnography for empirical studies. Therefore, the main goal of this mapping was to present how online ethnographic studies have been performed in Computer Science. To accomplish this goal, the following three research questions were defined:

- RQ1 - Which areas of Computer Science have been using online ethnography research method?
- RQ2 - Where are online ethnography studies published?
- RQ3 - How are online ethnography studies performed?

By answering these research questions, this study provides an overview of how online ethnographic studies have been performed in Computer Science and it is possible to comprehend where these studies are headed.

4.1.2 Search Strategy

Search strategy comprises the identification of search terms for querying applicable scientific databases. Seven relevant Computer Science databases were selected for the search: ACM Digital Library, EBSCO Host, Elsevier ScienceDirect, IEEE Xplore, ProQuest, Springer Link, and Web of Science. The search string was composed based on well-known online ethnographic research methods such as netnography [KOZI10], virtual ethnography [HINE00], webnography [HOGO12], and cyber-ethnography [WARD99]. Therefore, in order to automate the search in the selected databases, the search string was defined as presented in Table 4.

Table 4 - Search string applied for systematic mapping: online ethnography

Search String
"*online ethnography" OR netnography OR "virtual ethnography" OR webnography OR "cyber-ethnography*".

In addition, Springer and Web of Science databases provide a mechanism to filter by the discipline of Computer Science, which was helpful and returned more accurate results. For all other selected bases, the filter per discipline was performed manually since they do not provide an interface to refine the search considering the discipline. Furthermore, the names of the Computer Science disciplines were not added as part of the search criteria in order to comprehend all possible Computer Science areas and avoid inaccurate results.

4.1.3 Selection Criteria

Each publication retrieved from the automated search was evaluated in order to select whether or not it should be included by considering the selection criteria. The selection criteria were composed by inclusion and exclusion criteria. In a first filter, papers were included/excluded based only on titles and abstracts. In a second filter, it

was ensured a full-text reading. Thus, the following inclusion criteria were applied in the first filter: (a) Studies should be published in the Computer Science area, and (b) Studies should present reference of use of online ethnography methods.

Publications that met at least one of the following exclusion criteria were removed: (a) Books, (b) Duplicated papers, (c) Studies written in any other language other than English, (d) Studies presenting summaries of tutorials, panels, poster sessions or workshops, and (e) Conference covers and table of content. Papers content were analyzed following the inclusion criteria: (a) Studies should present references of online ethnography methods application, being that a unique method or part of a mixed method and (b) Studies should describe the methodology application. Studies that have no reference to online ethnography methodology were excluded.

4.1.4 Data Extraction Strategy

The data extraction strategy was based on defining a dataset that should be collected in order to answer the research questions. RQ1 could be answered by defining the Computer Science area or sub-discipline which the study belongs to. RQ2 and RQ3 dataset are composed of a conjunction of data as shown in Table 5.

Table 5 - Data extraction strategy for second study

Research Question	**Data Set**	**Example / Details**
RQ1: Which areas of Computer Science have been using online ethnography research method?	Computer Science areas	User Interfaces and Human Computer Interaction; Software Engineering; Database Management; ...
RQ2: Where are online ethnography studies published?	Title Content Type Content Type name Year Author(s)	Study's title Journal or Conference Journal's or Conference's name Study's year Study's author(s)
RQ3: How are online ethnography studies performed?	Research methodology Mixed Methods (if any) Application domain Number of communities Community size Timeframe Collected data Researcher involvement	Netnography, Virtual Ethnography... Netnography + Survey + Interview... Human Behavior, UX, Robotics, etc. Number of included online comm. Number of community members Study's timeframe Text, Video, Image, etc. Active or Passive

4.2 Conduction

The search in the selected databases occurred during April 2017. The first search resulted in a set of 853 studies. After the results' compilation, the exclusion criteria were applied, resulting in 762 publications. Afterward, a total of 62 were selected in accordance with the inclusion criteria from the first stage, where only the title and abstract were considered. Finally, in the full-text reading stage, 36 publications were selected (Appendix D). The selection process is shown in Figure 6.

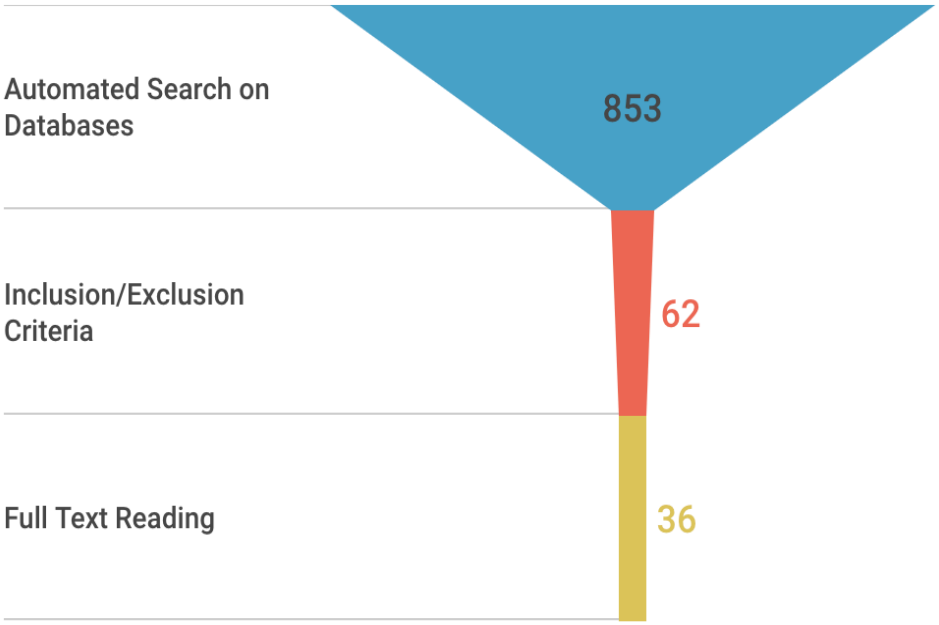


Figure 6 - Selection process for second study

4.3 Results

The goal of this systematic mapping study was to present how online ethnographic studies have been performed in Computer Science. The following sections present the results for each research question.

4.3.1 Computer Science Areas Applying Online Ethnography Methods

The results for question RQ1 – Which areas of Computer Science have been using online ethnography research method? – revealed that 83% of result set studies applying an online ethnographic method are classified under *User Interfaces and*

Human Computer Interaction area. The remaining studies are categorized under *Software Engineering*, *Database Management*, and *Artificial Intelligence and Robotics* areas, as shown in Figure 7.

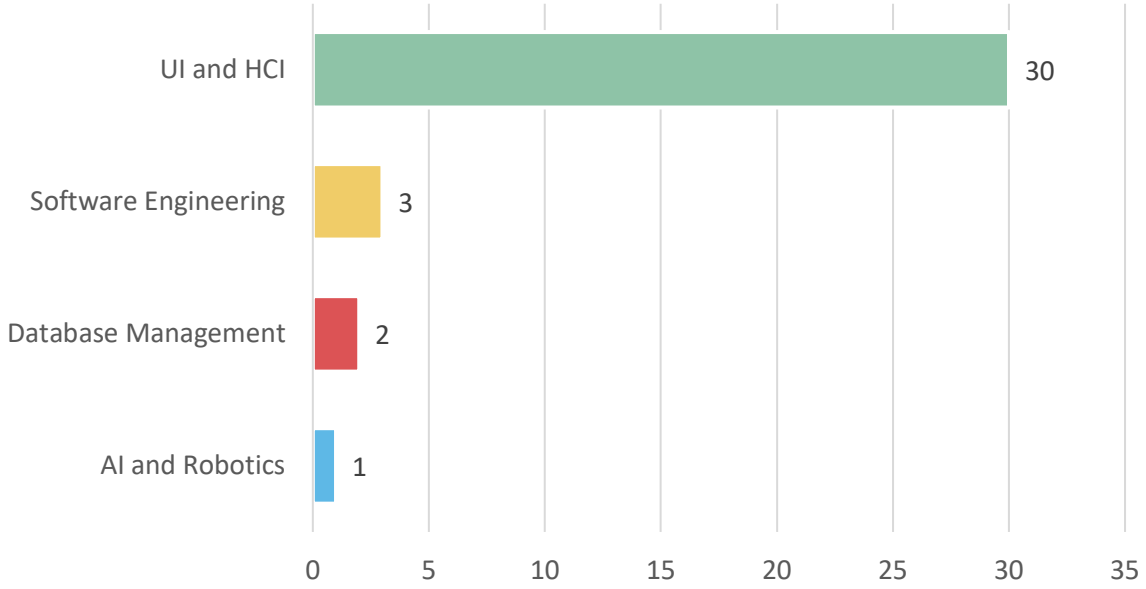


Figure 7 - Computer Science areas applying online ethnography methods

4.3.2 Published Online Ethnography Studies

Results for question RQ2 – Where are online ethnography studies published? – revealed that approximately 56% of result set studies are published as articles in journals and approximately 44% are conference proceedings. The complete list of journals and conference names is displayed in Table 6.

Table 6 - Journal and Conference names where studies are published

Type	Name
Journal	Bulletin of Science, Technology & Society Calico Journal Computers in Human Behavior Ethics and Information Technology Identity in the Information Society Information and Organization Information and Software Technology Information Systems Journal Information Systems Research Information Technology & People International Journal of Electronic Commerce Studies International Journal of Technology Management Journal of Computer-Mediated Communication Journal of Documentation Journal of Information Technology Journal of the Association of Information Systems Online Information Review Procedia Computer Science Procedia Technology
Conference	Computer Science and Electronic Engineering Conference Extended Abstracts on Human Factors in Computing Systems Hawaii International Conference on System Science International Conference in HCI and UX International Conference on Advanced Learning Technologies International Conference on Advances in Social Networks Analysis and Mining International Conference on Computing, Communication and Security International Conference on Well-Being in the Information Society International Multi-Conference on Society, Cybernetics, and Informatics International Professional Communication Conference International Scientific Conference eLearning and software for Education International Symposium on Open Collaboration International Symposium on Robot and Human Interactive Communication Panhellenic Conference on Informatics

4.3.3 How Online Ethnography Studies are Performed

Considering the applied methodology, the results for RQ3 – How are online ethnography studies performed? – exposed that the majority of the studies on Computer Science (approx. 86%) followed virtual ethnography and netnography methods. Only one study adopted cyber-ethnography method and four studies used the term online ethnography with no distinction for a specific method. Figure 8 shows the adopted methods on the selected set of studies.

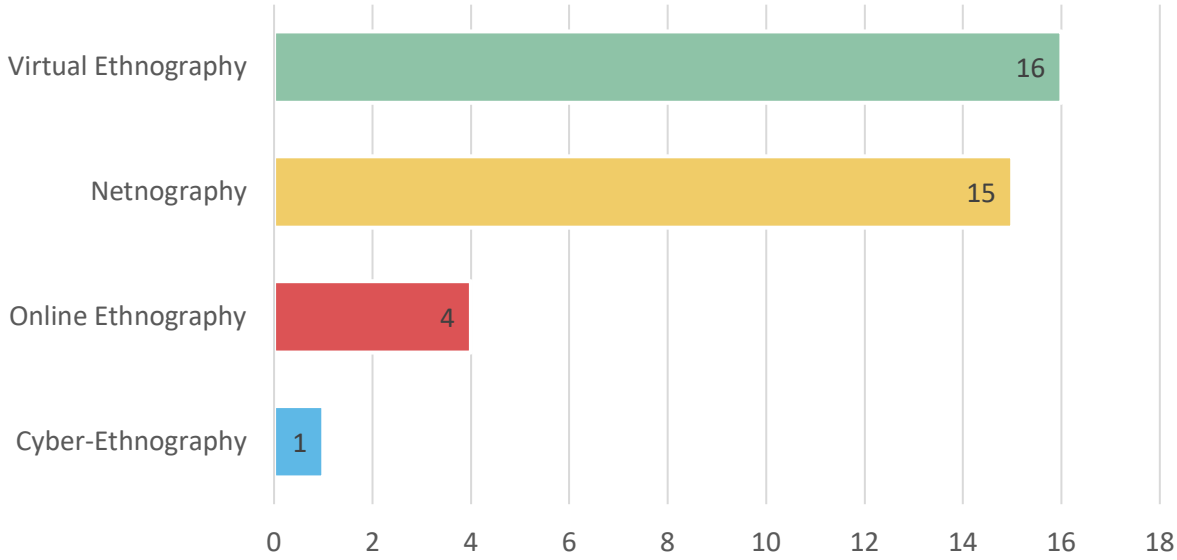


Figure 8 - Adopted methods in Computer Science Studies

As mentioned, the majority of reviewed studies have adopted virtual ethnography or netnography methods to achieve their goals. For instance, Sigfridsson and Sheehan [SISH11] used virtual ethnography method for studying free and open source software communities, which contributed assessing multiple and interlinked dimensions and interpreting the context of communities' activities. Another example is Synnott, Coulias, and Ioannou study [SYCI17], which applied a virtual ethnography method as part of their multi-method approach to providing a case study analysis of a group of alleged Twitter trolls. In their case, the method provided the research engagement as observational and participatory in a specific online community. Additionally, Teixeira [TEIX14] has applied netnography to delineate how patients use open source disease control software developed by other patients.

Another outcome related to studies' methodology is that 15 studies employed mixed methods, using virtual ethnography or netnography plus interviews, surveys or experiments. Most of these studies applied two methods, except for Rozas' study [ROZA14], which applied virtual ethnography, interviews, and survey, and Bauer, Franke, and Tuertscher's study [BAFT16] which applied netnography, survey, and experiment.

As stated by Bengry-Howell et al. [BWNC11] researchers have used online ethnography methods to study a particular online community, which is aligned with the mapping outcome. The majority of selected papers have used only one community to perform their studies. Only eight studies have adopted two or more communities to perform their studies, and one study has not provided this information. Figure 9 details the number of communities per study. In addition, the number of community's members, for those studies that informed this data, vary from a few members [GRAY12] to more than 1 million registered members [ROZA14]. Therefore, resulted publications focused to study a unique online community, depending on the particular researcher's interest and mainly on the research goal. However, there is no right or wrong regarding the number of communities included in a study, but it is important to bear in mind the criteria to select the appropriated community to perform the research. In general, as stated by Kozinets [KOZI02], online communities should be selected to have a focused topic relevant to the research question, higher number of posts and interactivity, heterogeneity, and rich in data.

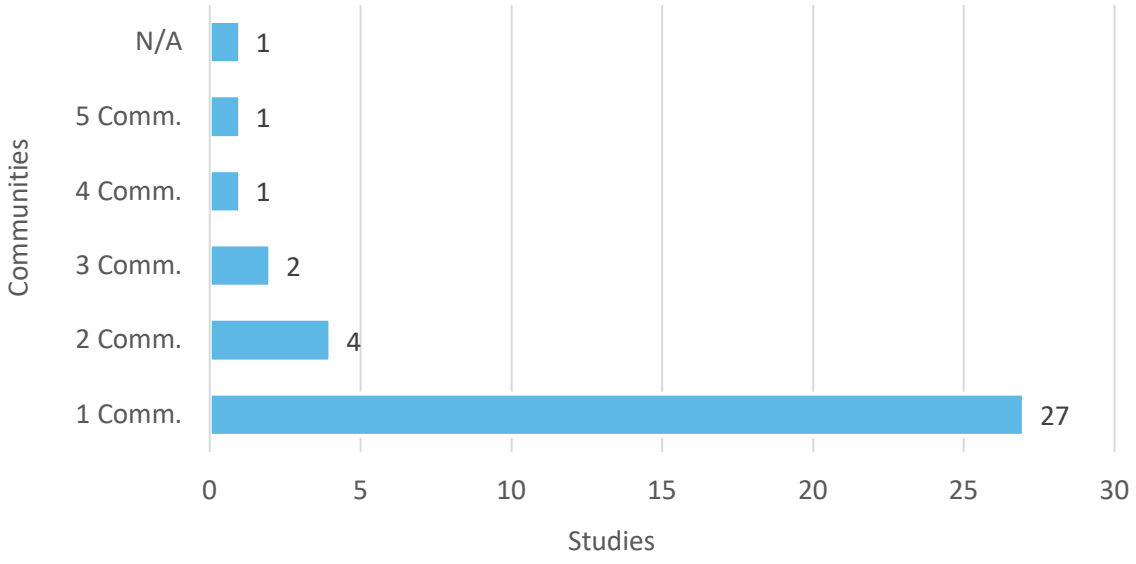


Figure 9 - Number of communities per study resulted from systematic mapping

The period performing an online ethnography study, for those studies that asserted this information, vary from 1 week [EBHD13] to 5 years [ELSC08]. One year or less is the most common period, stated in 17 studies. Two studies conducted a 2 years research, and other two studies conducted a 4 years research. While running an online ethnography research, the collected and analyzed data is mostly text-based. All studies have collected and analyzed text-based data. However, besides text, some studies also collected and analyzed videos [SISH11][KSPM11][EBHD13] and images [MCMN17][GEHO13][BAFT16].

Depending on the participation of the researchers in the community, an online ethnography research can vary from non-participatory (passive) to participatory (active) [COMW17]. The results from our mapping show that 58.7% of the researchers played as passive, while 41.3% participated as active. A passive participation means that the researcher is a member of the community but observes the group without interacting with people. On the other hand, an active participation implies that the researcher is actively engaged and involved in the community's activities [KUVÁ13]. To conclude, active researcher participation aid to obtain rich data but it is not always an easy process.

These results were crucial to providing an overview of the available methods on online ethnographic studies as well as to understand the application of this qualitative research methodology. Thus, these findings were used as a foundation to define and apply the methodology for the next study, an online ethnography in an online community on LinkedIn Groups.

5 ONLINE ETHNOGRAPHY

The most part of ethnographic studies are related to direct observation, however, interviews, questionnaires and studying artifacts used in activities also feature in ethnographic studies [PRRS15]. The basic tenets of ethnography are the recursive and inductive depth observation of a culture or a community as well as open-ended interviews designed to understand the perspectives of community's participant [RPHD12]. In order to help shape researchers' participant depth observation, some ethnographic procedures are used, such as making cultural entrée, gathering and analyzing data, ensuring reliable interpretation, conducting ethical research and providing an opportunity for member feedback. Furthermore, these procedures are completely known in ethnographies conducted in face-to-face situations [KOZI02].

During the last two decades, online environments became rich and vital grounds for ethnographic studies [RPHD12]. In the same period, online communities have become one of the most popular forms of online services [MALI15]. Online communities are essentially forums for meeting and communicating with others [BAFE00], or in a more detailed definition, online communities are web-based online services with features that make it possible the members to communicate with each other [MALI15]. Along with online environments, the growth of online communities brought by Computer-Mediated Communications (CMC) created a solid research field for online ethnography studies [LPSM13].

As previously mentioned, Online ethnography adopts ethnographic research principles and employs them to online environments contemplating necessary adjustments [RPHD12]. One of the online ethnography methods is netnography. Developed by Robert Kozinets, netnography is a qualitative research method which adapts ethnography research processes to study cultures and communities that are emerging through CMC [KOZI02]. Kozinets [KOZI15] states that online ethnography is a generic term for performing any ethnographic research by using a digital or online environment, thus it is important to define netnography as a method by referring to a "specific set of related data collection, analysis, ethical and representational research practices" [KOZI15].

Another online ethnographic method is virtual ethnography [HINE00]. Virtual ethnography is a form of ethnography for studying online communities based on textual data [SISH11]. However, it appears to allow for a composition of online and offline

ethnographic approaches to have an understanding of the online phenomena [KULA15]. Meanwhile, netnography addresses online interactions and differ from other online ethnography methods by offering a more systematic, defined approach to addressing ethical, procedural and methodological issues specific for online researches [COMW17].

Thereby, this study adopted netnography method to identify and understand, with practitioners that participate in discussions in online communities, the artifacts used to facilitate communication between developers and designers, and in which events the communication happens. The netnography method performed in this study followed the steps of planning and entrée, community observation and data collection, data analysis, and reporting as per Kozinets guidance [KOZI15] on conducting netnography. Next sections detail how the netnography was performed and its results.

5.1 Planning and Entrée

This step involves the formulation of the research questions, screening, and identification of appropriate online communities. Furthermore, it is important to learn about the communities and define the criteria to select the community that will be studied.

5.1.1 Definition of Research Questions

The goal of this netnographic study is to understand how artifacts are used to facilitate communication between designer and developer on AUCD approach according to practitioners, which participate in discussions on online communities. Therefore, three related Research Questions were defined:

- RQ1: Which artifacts are used to facilitate communication between designer and developer?
- RQ2: How these artifacts are used to facilitate communication?
- RQ3: When these artifacts are used?

5.1.2 Identification of online communities

After the research question was defined, it was time for the screening and identification of online communities. In order to discover appropriate online communities, it was taken into account the research goal, which led to search for communities containing the terms "*Agile*", "*User-Centered Design*" or "*Agile User-Centered Design*". Ideally, the community should focus on AUCD, but since this is an approach that can be taken by Agile and UCD, all the three terms were included. Moreover, it is important to mention that in the industry the term User-Centered Design is widely known as User Experience Design, so this wording was also used to search for communities of interest.

This search was performed using as base the Facebook[7] and LinkedIn[8] groups as well as the Slack[9] communities. These revealed 36 communities that seemed relevant to the study (Appendix E). Most of the communities belong to LinkedIn and most of them are related to UCD as shown in Table 7. Communities containing the research topic but related to job offers, focused in a specific region or country and created for a particular company were not included.

Table 7 - Number of communities per platform and topic

Platform	**Topic**			**Total**
	UCD	**Agile**	**AUCD**	
LinkedIn	10	7	3	20
Slack	5	3	1	9
Facebook	5	2	0	7

5.1.3 Criteria definition to select the community

After the identification of these 36 communities it was time to start learning about them, hence, since most of these communities are closed, the researcher sent the invitation to join them. From 36 communities, 27 have accepted the request to join,

[7] https://www.facebook.com/groups
[8] https://www.linkedin.com/groups/
[9] https://slack.com/

however, he never heard back from the other 9 communities at the time this step was performed. Appendix E shows the list of all communities specifying the ones that were joined. Once the researcher identified and joined the communities, it was time to define the criteria to select a winning community for the study. The selection criteria were composed of seven factors including relevance, activity, interactivity, substantiality, heterogeneity, richness, and experientiality [KOZI15].

The relevance is the first and most important factor. For a community to be considered relevant it should have relation to the research focus and questions. The community needs to be active containing recent and regular communications. Interactivity factor is related to the flow of communication between members. Substantial factor regards to the mass of communicators and energetic feel. The heterogeneity factor concerns about either a variety of difference or a consistency of similar type of participants. The community should be rich in data offering more detailed or descriptive data. Finally, there is the experiential factor that talks about the experience that the community offers to the members.

Related to activity, interactivity and substantiality factors, no scale was found in the literature in order to set the criteria definition, thus a three-point scale was created based on the identified communities, as displayed in Table 8. To define if a community was active, the number of messages per day was analyzed. Concerning the interactivity, the number of interactions was evaluated, in other words, the number of comments per post. Regarding substantiality, it was considered the number of members per community. These data were collected over a period of 30 days.

Table 8 - Community selection criteria for activity, interactivity and substantiality factors

Scale	**Activity**	**Interactivity**	**Substantiality**
	Messages/Day	**Comments/Post**	**Number of Members**
High	>=20	>=10	> 50000
Medium	>=10 AND <20	>=2 AND <10	>=5000 AND <50000
Low	<10	<2	<5000

5.1.4 Community Selection

Based on selection criteria, and considering the relevance as the most important factor, three potential communities were highlighted, two from LinkedIn, “Scrum Practitioners” and “UX Professionals”, and one from Slack, “Hands on Agile”. Most of the pre-selected communities from Facebook were considered not relevant to this research due to the fact that on Facebook the members of these communities use to share posts with ads, events or conferences related to the area. Thus, these communities were considered not relevant neither rich in data.

The selected community was “Scrum Practitioners”. The decision to cherry-pick this community was based first on the relevance factor, once the community’s topic was aligned with the research focus. Secondly, this community had the most activity containing the average of 2 posts (main threads) and 33 messages per day, the most interactive with the average of 18 comments per post, and therefore contained the most data. The community analytics[10] is shown in Table 9.

Table 9 - Community Analytics

Community	Activity	Interactivity	Substantiality
Scrum Practitioners	33 messages/day	18 comments/post	98431 members

5.2 Community Observation and Data Collection

The second step of the netnographic research involves the community observation and data collection [KOZI15]. Once the online community is chosen, the researcher is ready to begin collecting the data. However, it is imperative to ensure ethical procedures for any online ethnographic study.

5.2.1 Ethical procedures

Ethical concerns about netnography, or any online research, are mainly related to what can be considered as public or private as well as what constitutes informed

[10] This analytics data was extract from a period of 30 days where the activity and interactivity are an average of this period. The number of members was extracted in June 22, 2017.

consent in cyberspace [KOZI06]. As debated by Paris et al [PCNB13] several studies have discussed these issues in many aspects. However, there is no clear standards and guidelines for online research [PCNB13].

Prior to the observation and data collection, ensuring an ethical research must be an important part of the netnographic research planning. Therefore, in order to address the ethical issues this study used the following procedures defined by Kozinets [KOZI15]: identify the researcher profile and informing members about the research; ask for proper permissions; and gain consent when needed.

Kozinets argues that if the netnographic study uses Facebook, Instagram, LinkedIn, YouTube, Pinterest or another common social media platform, and if the netnographic fieldwork will involve researcher communications with other people, then it is highly recommended that the researcher use his personal or user profile. Thereafter, the interactions while conducting the research appear in his profile or status update. Thus, the LinkedIn's researcher profile containing the role as Researcher and the specific affiliation was used to openly, and accurately identify himself to the group and administrators (Figure 10).

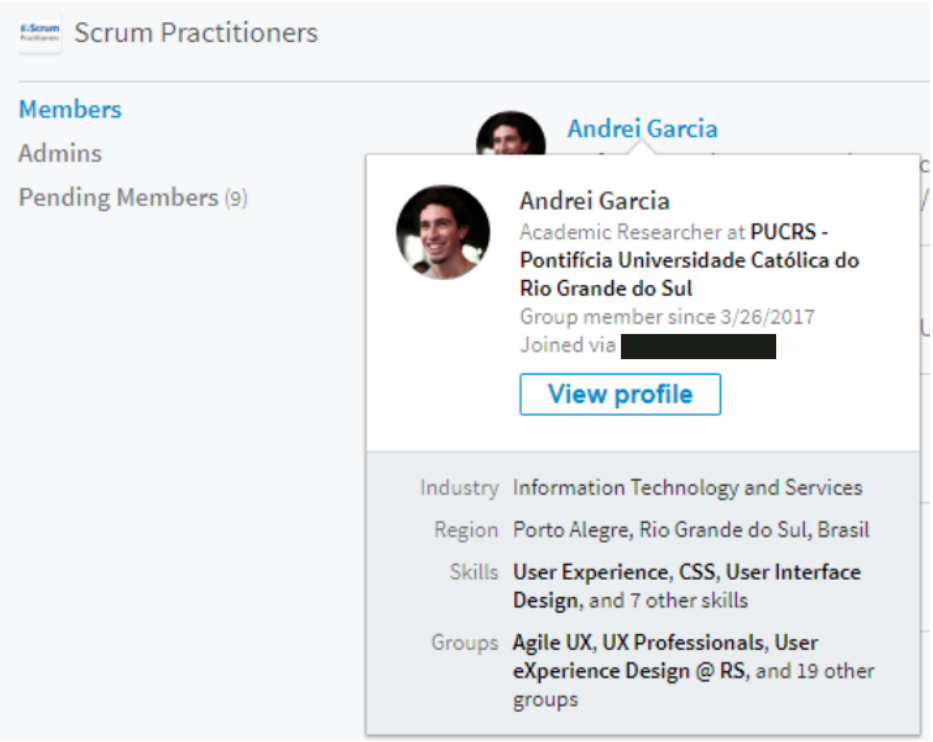


Figure 10 - Researcher profile

Scrum Practitioners is a closed LinkedIn group with well-defined rules and two administrators. A group administrator is a legitimate gatekeeper who the researcher should approach prior to contacting other group members or collecting any data [KOZI15]. In LinkedIn Groups, gatekeepers assume the roles of Owner, Manager or Moderator. In addition, LinkedIn Groups Terms of Service [LINK17] states that:

> "As the owner, manager or moderator of a LinkedIn Group, you acknowledge and agree that you may be deemed a 'Data Controller,' as the term is defined in the EU Data Protection Directive 95/46/EC and its supporting legislation. If you are deemed a Data Controller, you are subject to the roles and responsibilities of a Data Controller, which include, for example, ensuring that the data you collect about your Group Members is processed fairly and not used in ways that are beyond the scope for which the data was collected."

Because of LinkedIn Groups terms, and considering the administrator as a gatekeeper, the researcher properly asked the group's manager for permissions aimed at data analysis and interaction with the group (Appendix F). In addition, group members were informed about the research with an accurate description of the research focus and interest. No direct quotations were used in the report or publications to ensure the user's anonymity, once direct quotes are increasingly easy to identify through search engines. In addition, all data were treated using pseudonyms for the members.

5.2.2 Data collection strategy

Netnographic data can assume three forms [KOZI15]: archival data, which is already recorded and stored; communicatively co-created or elicited data; and participative-authored field note data. In addition, data collection has two elements, which are the data the researcher straight copies from online communities' platforms and the data the researcher writes in from their observations of the community.

Loanzon et al [LPSM13] described that data collection in netnography is normally textual. As per observation, Scrum Practitioners group is mainly focused on textual communication and their interactions happen through a post, that is usually a question from some agile professional, and the comments on this post from other members trying to collaborate with an answer. Figure 11 shows the post structure from LinkedIn Groups containing these elements. The number of likes and the number of comments can measure the popularity and the community acceptance of a post.

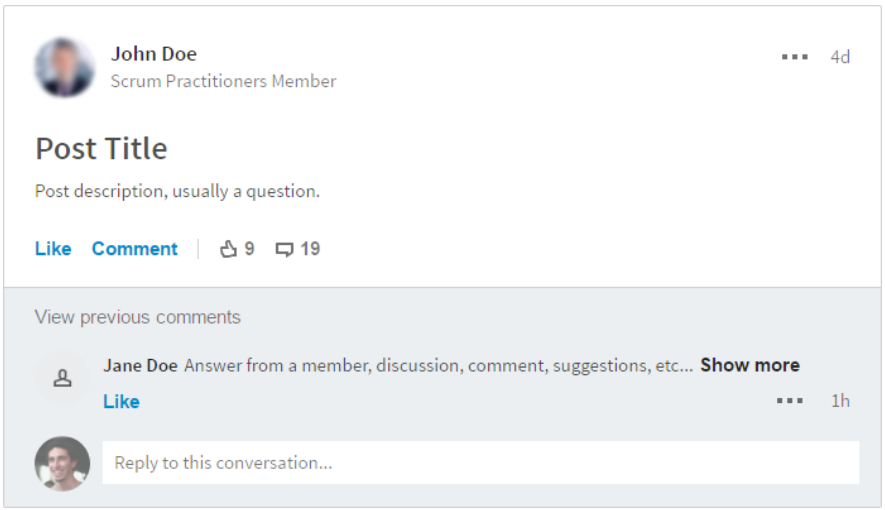


Figure 11 - Post structure on LinkedIn Groups

Based on LinkedIn Groups post structure, also in Scrum Practitioners members' interactions, this study has collected textual data from posts and comments focused on the research questions. Thereby, the collected data derivate from historical posts (archival data), researcher interactions (elicited data), and researcher sketches as field notes (participative-authored data).

Archival data were collected bearing in mind the research questions, thus only posts related to the study topic were downloaded. LinkedIn groups keep all historical posts available, but only posts from March 2015 to December 2017 were gathered in order to have the most recent discussions. Furthermore, LinkedIn groups provides a search engine inside the community, which supported the archival data exploration. The collection data period was from August 2017 to January 2018.

Prior to start interacting with the community it is important to spend some time observing the members and understanding the community [KOZI15]. Thus, in order to create a question that would be understood and accepted by the community, several historical posts were evaluated. This analysis was valuable to demonstrate a pattern on how the most popular questions were formulated. Basically, member's posts were structured with three main parts regarding the *context*, poster's *personal knowledge or opinion*, and the *question* itself. Often a fourth element classified as an *emotional appeal* was added to the post. Thereupon, the post formulated by the researcher, that was part of the elicited data, encompass an emotional appeal and presentation, the context and the question, as presented in Figure 12. This question was posted on October 19th, 2017.

Figure 12 - Researcher's post as part of elicited data

5.2.5 Posters categorization

To close the data collection delineation, there is the members classification. *Posters* are the community members who interact within the group. Kozinets [KOZI02] categorizes them into four categories: *Tourists*, *Minglers*, *Devotees*, and *Insiders*. To match the reality of this study, the description of each category is adapted to be aligned with the study's subject, thus instead of use "consumption activity" wording to define the member engagement, as originally stated by Kozinets, it was adapted to "group topic". Hence, all four categories are detailed bellow.

Tourists, who lack strong social ties, maintain a superficial interest in the group topic. They have a shallow participation in the community and potentially their participation in the group will not last very long. Tourists are in the community to get information [LPSM13]. *Minglers*, are members who have strong social ties but least interest in the group topic. They have highly visibility but limited influence. *Devotees*, members who maintain a strong interest in group topic but have few attachments to the online group. Usually they are mostly unknown in the community, but they may be respected within a small circle. They do not participate actively in all posts, but only in some specific threads that they are interested. *Insiders* are the leaders of the

community, they are both passionate about group's topic and sensitive to social welfare of the community. In other words, they have strong social ties and high group's topic interest. They are well respected by other community members and have a frequent and highly visible participation in almost all posts. Typically, they also have a large number of deep network connections.

Therefore, the members were classified according to these four categories for all collected comments. In addition, information related to the members' industry, job position, region, and skills were collected.

5.3 Data Analysis and Interpretation

Data collection and data analysis is a simultaneous process in qualitative researches [CRES14]. Thus, this netnographic research step occurs concomitantly with community observation and data collection [KOZI02]. This step involves organizing, reading, coding, categorizing and interpreting the data.

5.3.1 Data analysis

During data analysis, the data was organized categorically, reviewed and continually coded [CRES14]. The data analysis followed the approach described by Creswell as presented in Figure 13. It is an interactive approach and the various stages are interrelated and not always visited in the displayed order.

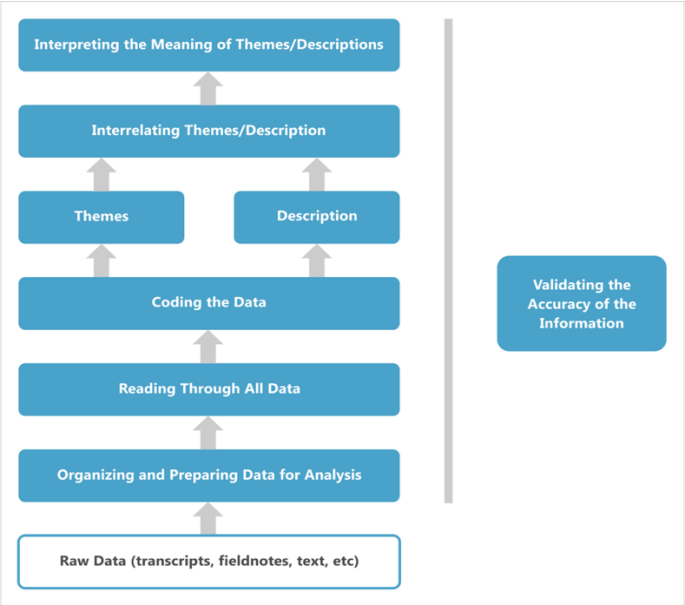


Figure 13 - Data Analysis in Qualitative Research, based on Creswell [CRES14]

The first stage commences with data organization and preparation for the analysis. This involves typing up field notes, sorting and arranging the data depending on the source of information. The second stage regards about to read and look to all data, in order to have a general sense of information and reflect on its overall meaning on the information collected from participants, use predetermined codes, or use a combination of emerging and predetermined codes.

Stage 4 concerns to generate a description of the setting or people, also create categories or themes for analysis. Description includes a detailed representation of information about people, places or events. It is possible to create codes for description. Themes or categories can also use the approach of coding and they are described as the major finds in a qualitative study. Themes should demonstrate diverse perspectives from individuals and be supported by specific pieces of evidence.

In stage 5, the description and themes should be interrelated, and they must represent in the qualitative study. Stage 6 is the final step in data analysis, which involves an interpretation of the findings or results. It can be based on the researcher's personal interpretation or it can be also a meaning derived from a comparison from the literature or theories. Hence, this study took advantage of these six stages approach to analyze the data. In addition, the data analysis was executed by the use of the qualitative data analysis software QSR International's NVivo 11 [NVIV17].

5.3.2 Data Organization

Whereas the software NVivo was used to analyze all collected data, it is important to describe how it was organized. First of all, collected posts were imported to the tool as internal sources and organized as archival data or elicited data as previously mentioned. Each post was defined as a case and each member's comment was considered as an inner case, which was helpful for the coding process. Codes are treated as nodes on NVivo, consequently all codes were organized and created under nodes structure. Finally, all inner cases, containing the poster information, were classified according to posters categorization definitions. Figure 14 shows the NVivo structure.

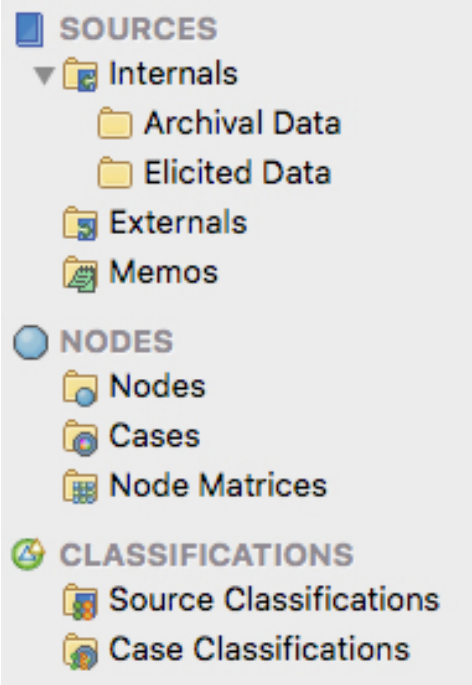


Figure 14 - NVivo structure

5.3.3 Data Coding

As part of the data analysis, data coding is the process of organizing the data by grouping related data and labeling these categories with a term [CRES14]. As mentioned above, data coding can be developed based on three strategies [CRES14]: (1) Create codes during the data analysis based on the emerging information collected from participants, no predetermined code is used; (2) Use predetermined codes based on the theory being examined. In this case, it is possible to create a qualitative codebook, which contains a list of predetermined codes and their formal definitions; and (3) Use a combination of predetermined and emerging codes. In this case, the codebook evolves during the study based on data analysis and occurrence of new codes.

Since the preliminary systematic mapping study about artifacts on AUCD has been performed, it was possible to create a qualitative codebook with predetermined codes from literature (Appendix G). Thus, the data coding strategy for this study followed the third option, which has used a preliminary codebook based on theory, which has evolved to a complete codebook during data analysis (Appendix H). Furthermore, data coding was performed on text-based data, since the collected data was textual.

5.4 Results

The final set of collected data comprises 6 main posts, with a total of 134 comments, including archival and elicited data. In total 63 distinguished members, from 18 different countries, participated in the posts discussions (Figure 15).

Country	No Members
United States	22
United Kingdom	10
Australia	7
India	4
Canada	3
Brazil	2
Germany	2
Latvia	2
Netherlands	2
China	1
Denmark	1
France	1
Ireland	1
Malaysia	1
New Zealand	1
Saudi Arabia	1
Singapore	1
Switzerland	1

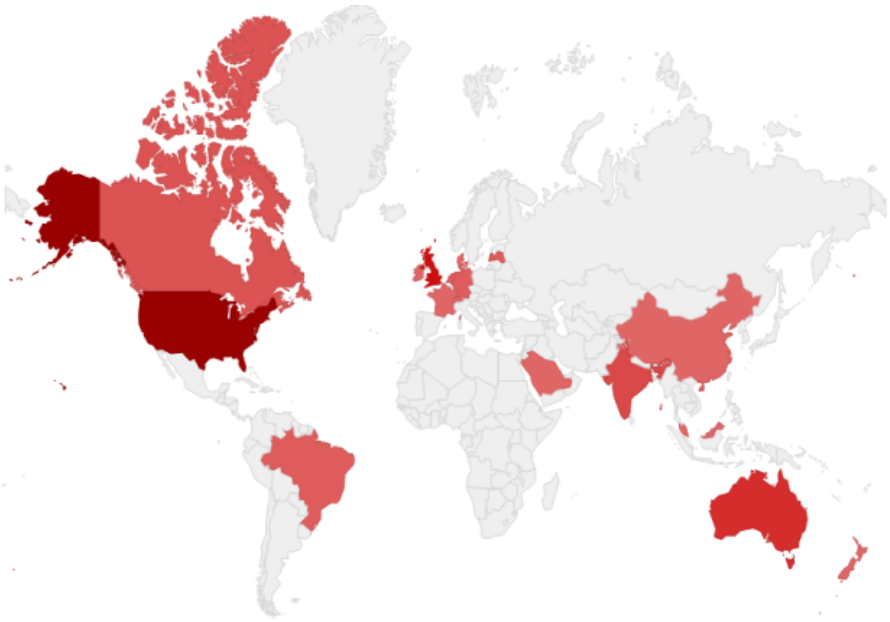


Figure 15 - Members' geolocation

The majority of the members who interacted in the collected posts were categorized as *Devotees* and *Insiders* due to the level of engagement in Scrum Practitioners LinkedIn group. From the 63 members, 49 were categorized as *Devotees*, 11 *Insiders*, and 3 *Tourists* (Figure 16). Summing up, 95,3% of the members who participated in the collected posts were categorized as *Insiders* and *Devotees*. According to Kozinets [KOZI02], preliminary research reveals that enthusiastic, devoted, energetically involved, and experienced user segments are represented by *Insiders* and *Devotees* in online communities.

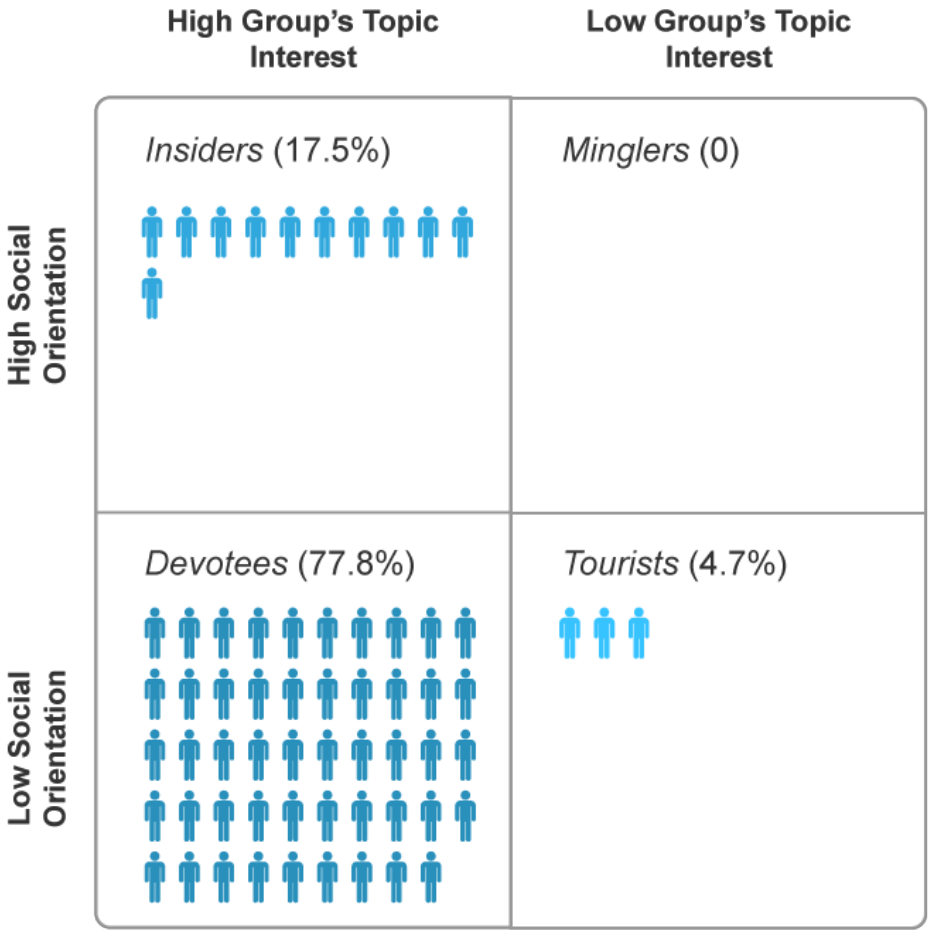


Figure 16 - Posters categorization

LinkedIn provides industry information for all profiles; thus, this data was also collected as mentioned in the methodology Chapter. Most of the members belong to *Information Technology and Services*, as well as *Computer Software* Industries, covering together 73% of all members who commented in gathered posts. In addition, the job position information from members profiles was collected. Since job position is an opened field on LinkedIn the extracted data was preserved as defined by the member. Although the job positions varied, especially because it is an opened field on LinkedIn, *Scrum Master* and *Agile Coach* job positions were the majority with 25% jointly. Appendix I shows a tree-map containing the industry and job position from all participants. Furthermore, the three first listed skills from each professional were collected, which shows that their skills are aligned with their job position. Appendix J, displays all information collected from members who participated in collected posts, the first column uses a pseudonym as mentioned on Ethical Procedures. These pseudonyms will be used along the Results and Discussion Chapters when referring to a member.

As mentioned previously, the final set of analyzed data includes 6 main posts. From these 6 posts, 5 are historical and 1 is elicited data. The oldest collected post is from March 2015 and the newest collected post is from December 2017. During the data collection and community observation it was clear that the community members preferred to comment and participate in threads than *like* a post, that explains why the number of likes are smaller than the number of comments. In addition, it was normal to have distinguished members *liking* and commenting a post, most of the times who liked the post did not comment in the specific post and vice versa. Table 10 demonstrates the information about each source.

Table 10 - Sources information

Source	Data Type	№ Comments	№ Likes	Post Date	Last Comment	Collected Date
Post 1	Archival	6	3	03/12/2015	03/16/2015	08/03/2017
Post 2	Archival	27	10	03/15/2017	03/24/2017	08/05/2017
Post 3	Archival	13	1	08/23/2017	09/24/2017	10/15/2017
Post 4	Elicited	30	14	10/19/2017	11/04/2017	11/09/2017
Post 5	Archival	29	13	12/14/2017	12/17/2017	12/17/2017
Post 6	Archival	29	16	12/18/2017	01/02/2018	01/02/2017

All these sources were coded using 31 codes. By the end of the coding stage the preliminary qualitative codebook was expanded generating the final codebook (Appendix H). Table 11, shows the list of codes, and the number of sources and references. The codes EVENT and ARTIFACT have child nodes that were used to break down the analysis per event and artifact. The description of each code is also available in Appendix H.

Table 11 - List of codes containing number of sources and references

Code	Sources	References
EVENT	5	38
ITERATIVE_CYCLE	3	12
DISCOVERY	3	9
PLANNING	2	6
REFINEMENT	3	6
REVIEW	1	2
UX_MEETING	1	1
ARTIFACT	5	36
WIREFRAME	3	9
USER_STORY	4	9
PROTOTYPE	5	6
MOCKUP	3	3
SKETCH	3	3
STYLE_GUIDE	1	2
PERSONA	1	1
SAME_TEAM	6	36
UPFRONT	5	27
CONFLICT	6	22
T_SHAPED	3	12
CROSS_FUNCTIONAL	4	11
COLLABORATION	2	10
COMMUNICATION	4	8
DIFFERENT_TEAM	3	8
EXTERNAL_LINK	2	6
VALUE	3	6
VERTICAL_SLICE	3	5
DISTRIBUTED	1	4
TEAM_COMPOSITION	3	3
TOOL	1	3
DESIGNER_ROLE	1	3
NO_TITLE	1	2

After the coding and analysis of each comment, it was possible to create five main themes supported by the codes. The relation among themes and codes is represented in Figure 17, which shows the composition of each theme according to the related codes.

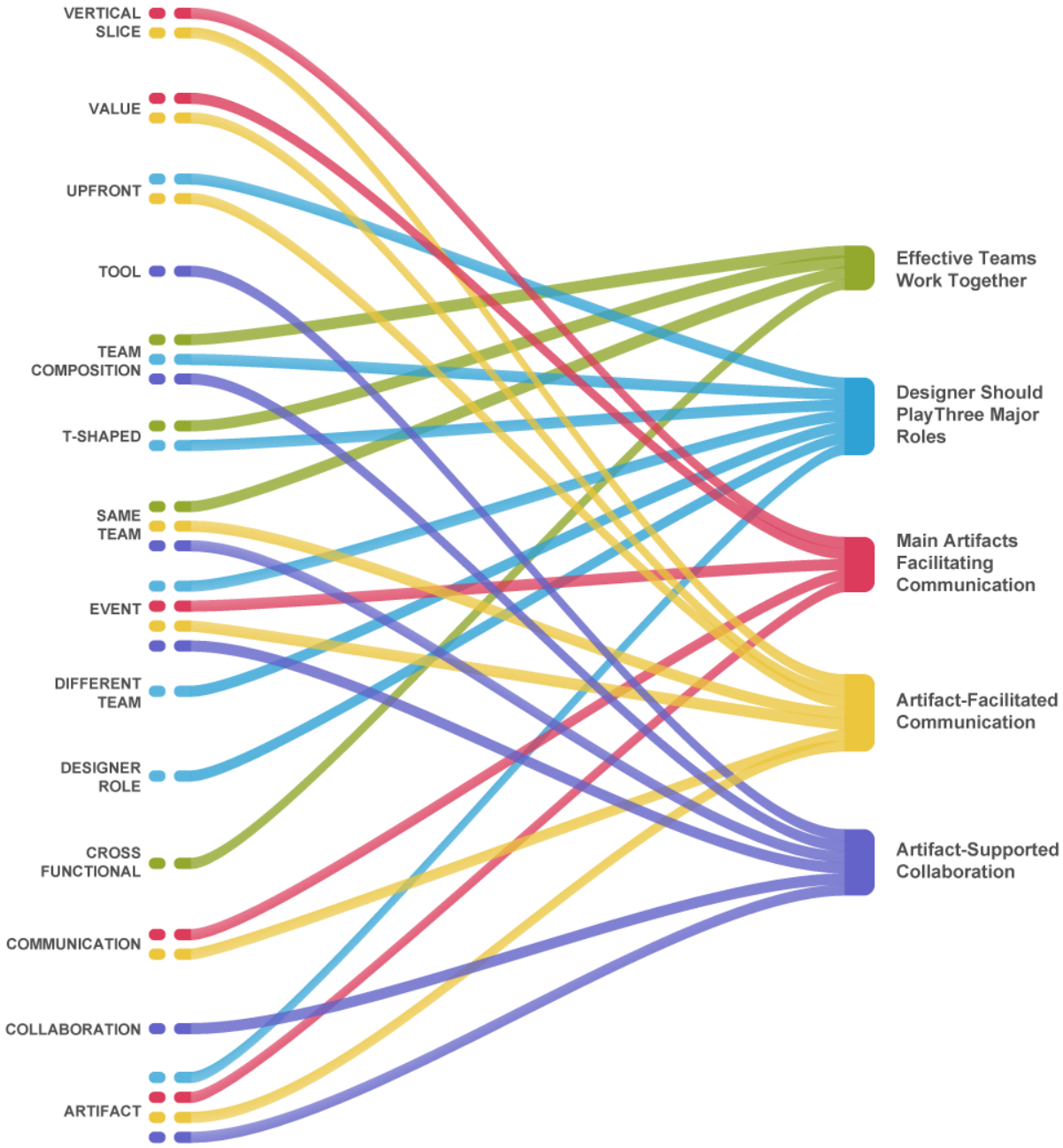


Figure 17 - Codes and Themes interrelation

The five themes are described below containing a short explanation (the interpretation of these themes and descriptions are discussed on next Chapter):

- **Theme 1 – Effective teams work together**: Agile teams should work as a whole involving all professionals with distinguished skills, including designers and developers, to be effective.

- **Theme 2 – Designer should play three major roles**: Designer's responsibilities goes beyond the iterative cycle, expanding to discovery (upfront design) and validation (after iteration work).
- **Theme 3 – Main Artifacts Facilitating Communication:** The results from systematic mapping associated with online ethnography study reveals six most used artifacts that facilitate communication.
- **Theme 4 – Artifact-Facilitated Communication:** Artifacts plays an important role as communication facilitators throughout AUCD events. All six most used artifacts emerge from discovery, planning, iterative cycle, until review and refinement events.
- **Theme 5 – Artifact-Supported Collaboration:** Artifacts not only facilitates communication but also support team's collaboration. Design thinking and Lean UX approaches corroborate to the use of artifacts as collaborative means.

6 DISCUSSION

This Chapter presents the discussion related to the main findings from the online ethnography study, containing the themes delineation and interpretation, as well as the interrelation with the results from the systematic mapping study.

6.1 Effective teams work together

Before start talking about artifacts and how they can facilitate communication between designer and developer, it is essential to discuss team structure. In all collected posts there were discussions regarding where the designer should work, if as part of the Scrum Team or as part of a “Design Team”. This discussion was generated due to the fact that Scrum Guide [SCSU17] states that the Scrum Team consists of a Product Owner, the Development Team, and the Scrum Master, and has no citation to design discipline or designer role. However, Scrum Guide also explains that Development Teams are cross-functional, containing all necessary specialized skills to create a product increment. Thus, the community understanding is that the team must be cross-functional and the designer should be part of the team. Furthermore, considering the approach of AUCD, which has design discipline involved, the team must have a person with great skills in design as part of the team. Donnie has commented about having the designer as part of the team, stating that the designer sits with the team when he/she is not interacting with the end-users. (*Donnie, posted on Scrum Practitioners, March 24, 2017*). Donnie’s comment was also supported by other members. Several citations of the word “together” referring to the team, were encountered in the analyzed data, as displayed in the word tree (Figure 18). Moreover, other synonyms were used to state that the designer should be part of the team, such as “along”, “alongside”, “part of”, “sitting with”, “whole”, “integrate”, “embedded”, “jointly”, and “work with”. An overview of these synonyms is displayed through the word cloud generated from this theme and related codes (Figure 19).

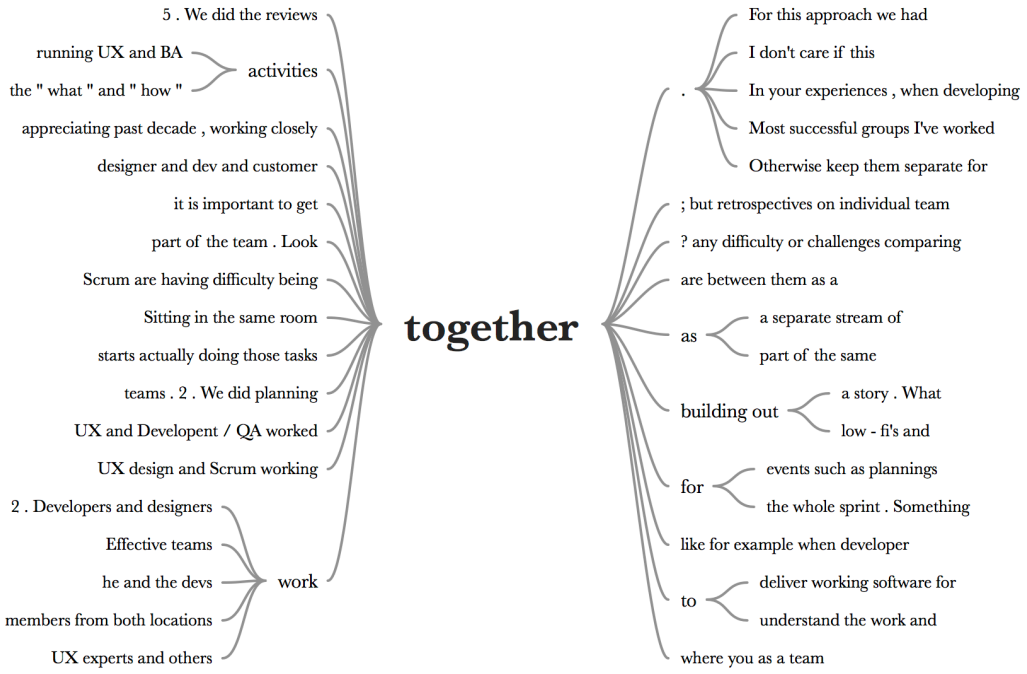


Figure 18 - Word tree generated from word “together”

Figure 19 - Word cloud from Effective Teams Work Together theme

Another code that supports this theme is “T-Shape”. There were some comments about T-Shape skills when the community was discussing Dev Team members. As displayed in Figure 20, there are two variations of this word, with and without a hyphen, but they both have the same meaning. T-Shape skills is defined as a person who has deep knowledge in a main topic and also broad knowledge in other related subjects. According to the community, this broad knowledge helps team members work together by having sufficiently overlap between each member’s skills.

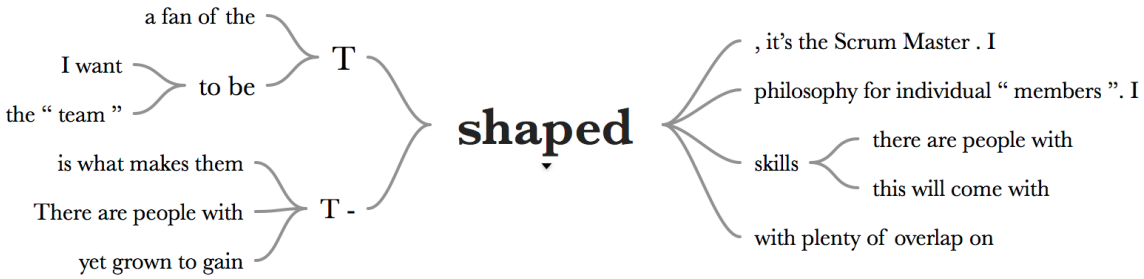


Figure 20 - Word tree generated from code “T-Shaped”

6.2 Designer plays three major roles

Even though knowing that designer and developer should work together as part of the same team, the designer responsibilities go beyond the iterative cycle. The community states that designers are engaged in three main events: discovery, iterative cycle, and validation.

During the discovery stage, designers are working close to the Product Owner to identify and understand the right product features, defining some initial interactions and wireframes, and refining the acceptance criteria for high priority user stories. Thus in this stage, the designer is playing the role of a *User Experience Researcher*, with great user research skills as stated by Liikkanen et al. [LKSH14], focusing on identifying the right problems to solve and doing *little design upfront* for the initial user interactions. While *little design upfront* is totally supported by the community, *big design upfront* is completely rejected since it goes against agile principles. Figure 21 shows a word tree with the related member’s ideas around upfront work.

Additionally, this finding is aligned with principle 1 from Brhel et al. [BMMW15], which says that product discovery and product creation should be separated on AUCD. Furthermore, this finding also supports that extensive upfront design is against agile

principles, but little analysis or design upfront is needed for the successful UCD efforts on AUCD environment.

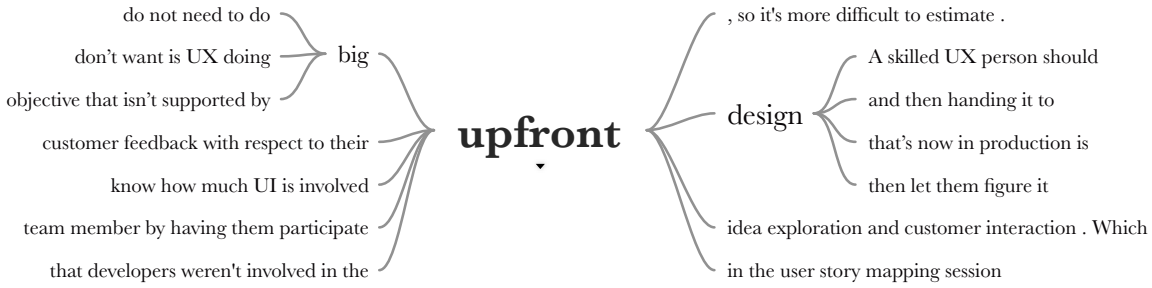


Figure 21 - Word tree generated from code "upfront"

Besides the discovery stage, the designer should be part of the Development Team working close to developers, as already discussed on the previous theme. As stated by Ferreira, Noble, and Biddle [FENB07], the User Interface designers should work in collaboration with developers during the iterative cycle discussing the UI implementation on a daily basis. The designer must be part of the "daily development team" and provide guidance regarding the user interface interactions and specifications to developers and other designers (*Ambrose, posted on Scrum Practitioners, December 16, 2017*). Thus, during the iterative cycle the designer plays the role of *User Interface Designer*, focusing on user interface interactions and collaborating with other team members [TAI05].

After each iterative cycle there is a potentially shippable product increment, as showed in Figure 1, when the designer can validate the product. As presented by Sy [SY07], designers perform usability tests for the implemented working product version from each iteration. After the sprint the UX designer can test the initial feature with end users, gather feedback, and finally work with PO to prioritize these items on the existing backlog (*Adam, posted on Scrum Practitioners, December 17, 2017*). Thereby, after each iteration the designer plays the role of *User Experience Designer*, by running usability tests with end users and validating the implemented working product version, also supported by [LKSH14][SY07].

6.3 Main Artifacts Facilitating Communication

Whereas the team should be considered as a unit, and designers and developers should work together, their interactions occur on a daily basis. Agile events

cooperate for this interaction, where both roles need to communicate, sometimes by using artifacts. The outcomes of this research show that many artifacts facilitate communication. The findings from online ethnography study reveal that 7 distinguished artifacts were mentioned by Scrum Practitioners community members as facilitators in communication between designer and developer. In addition, the results from the systematic mapping study demonstrate that 20 artifacts accomplish this purpose. Figure 22 display the outcome from both studies and the intersection between them.

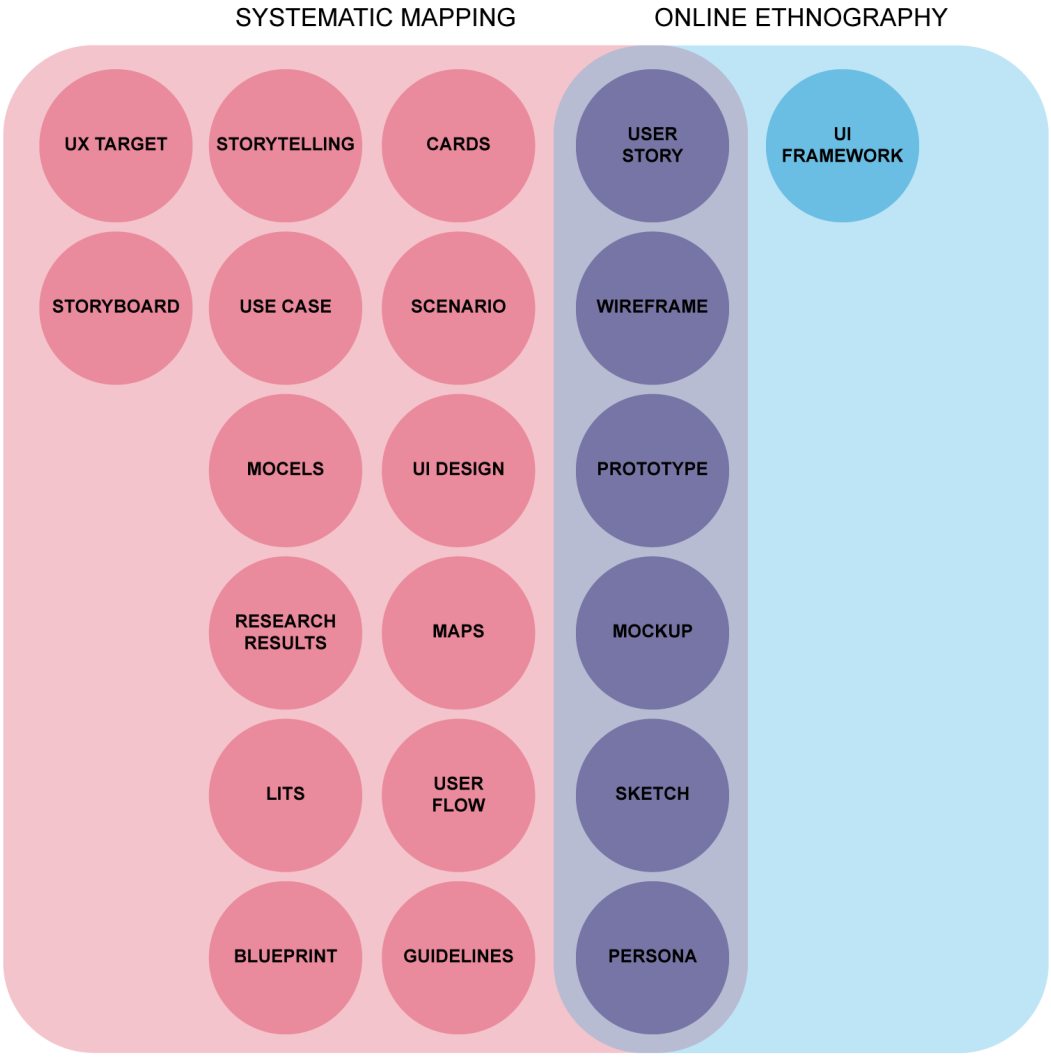


Figure 22 – Systematic Mapping ∩ Online Ethnography (Artifacts)

In contrast with the systematic mapping, the online ethnography findings show that user story and wireframe artifacts are more used by practitioners (these values are presented in Table 11). Users story helps to clarify what should be implemented. A well-written user story facilitates the communication when the designer describes

the interactions in the acceptance criteria, and the developers can estimate the effort necessary to implement the story (*Trenton, posted on Scrum Practitioners, March 15, 2017*). This usage was also observed in the systematic mapping results as mentioned by Beyer, Holtzblatt, and Baker [BEHB04], user stories are shared with the development team and they can use them to estimate how much effort they require for the next iteration.

User stories also facilitate discussions to define if a determined feature will deliver or not value for the product. This discussion also involves the breakdown of large user stories into thin vertical slices, which involves all architectural layers from user interface to the backend code. Figure 23 shows two word trees generated from the code user story and stemmed words.

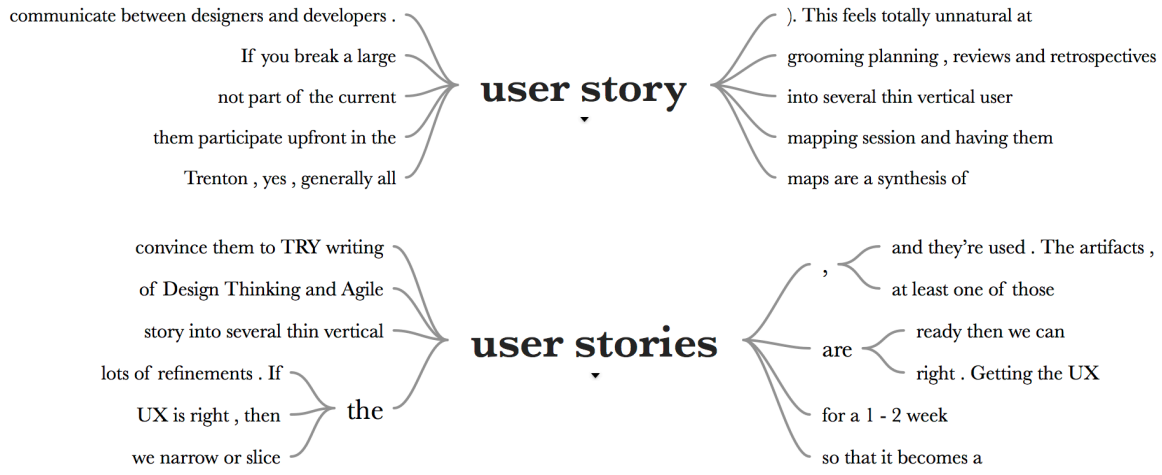


Figure 23 - Word trees generated from code "user story"

Wireframes support the description of a user story. They are used to support the acceptance criteria and communicate illustratively how a user interface should be structured. Since they illustrate high-level concepts and behaviors [HAPY12], wireframes complement user stories description and are necessary to define that a story is ready for development (*Ambrose, posted on Scrum Practitioners, December 17, 2017*). Figure 24 displays the word tree generated from code wireframe.

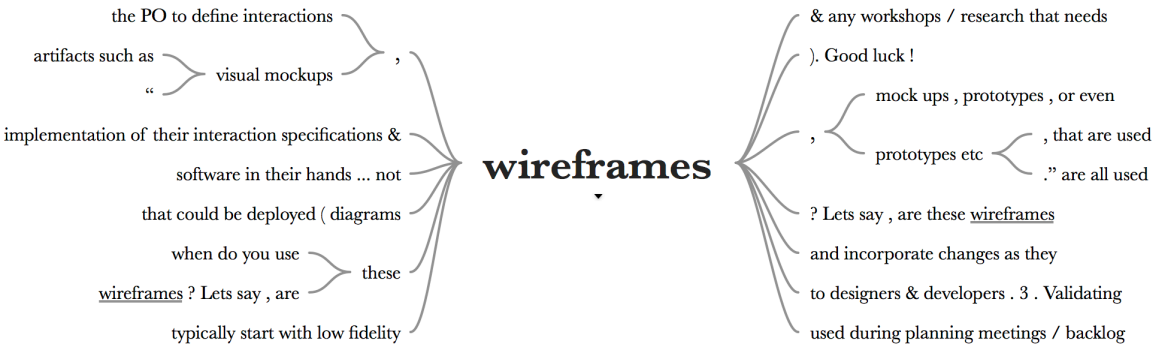


Figure 24 - Word tree generated from code "wireframe"

Apart from user stories and wireframes, it is important to highlight that UI framework artifact, extracted from online ethnography analysis, was not part of the systematic mapping results. The intersection between the two studies pointed out the most common artifacts. Next theme further describes how these artifacts are used to facilitate communication.

6.4 Artifact-Facilitated Communication

As mentioned in Background Chapter, Agile Manifesto asserts in the first sentence: “*Individuals and interactions over processes and tools”* [SCBE01A]. Thus, interactions among professionals in AUCD approach are important to conduct the product to the right course and deliver value. A common form of interaction is communication. Designers and developers communicate in different agile events using different artifacts as facilitators. The communication occurs throughout the entire AUCD flow, starting from discovery session, passing to all sprint events, until the sprint review and refinement.

In the online ethnography study, prototypes were mentioned to be used during discovery sessions. One member commented that during discovery the team, including developers, testers and designers, meet to create low fidelity prototypes in order to verify the User Interface and interactions feasibility in terms of technical support (*Mathew, posted on Scrum Practitioners, December 20, 2017*). Thus, they use low fidelity prototypes to communicate how the User Interface should be created considering user experience and technical perspectives.

Wireframes and personas were also mentioned as communication facilitators through discovery sessions. Personas are used to delineate the user profile and create a shared understanding between designer and developer regarding the product focus.

On the other hand, designers use wireframes to validate an idea with users and then employ these same wireframes to validate whether the development team can build it considering how much effort it takes in terms of feasibility and finances. Thus, developers can understand what the requirements are, estimated how much effort it will take, and define how they will build them (*Herman, posted on Scrum Practitioners, December 19, 2017*). Furthermore, these resultant artifacts from discovery sessions are used as foundation to write user stories and/or refine the acceptance criteria of existing user stories that will feed the product backlog, ensuring the highest priority backlog items are ready to be designed and built (*Ambrose, posted on Scrum Practitioners, December 17, 2017*). Therefore, wireframes are used as a mean of communication to explain what the user needs are resulted from discovery sessions, as well as to validate and estimate how the requirements should be built. Both wireframe and prototype artifacts were not cited as part of discovery sessions as a result of systematic mapping study, instead, they appear during iterative cycles and planning events as presented on systematic mapping study results.

Likewise, prototypes as well as user stories, are relevant during planning events, where they are used to define what will integrate an iteration. During the estimation process, designers use these artifacts to provide more details to developers for a more accurate estimation [FENB07]. In general, at this event, artifacts use to be more flexible and lightweight to facilitate face-to-face communication. Therefore, in the planning, the artifacts are intended for clarifying and sharing the work for the iterative cycle that is starting.

During the iterative cycle, the preliminary prototypes created throughout discovery sessions are used as a reference for designers to generate mockups. All along the iterative cycle, mockups are used to communicate how the user interface should look like, supported by the prototype and user story, which together define the user interface behavior (*Frederick, posted on Scrum Practitioners, March 18, 2017*). Thus, mockups are important to communicate the user interface details such as colors, typography, and spacing, while prototypes and user stories provide the user interaction definitions.

Personas were also mentioned as a communication facilitator during the iterative cycle. This artifact helps both designer and developer to focus and discuss the core product functionalities. Personas are used as means to confirm that the team

is going to the right direction to implement the user stories, thus delivering value to the product (*Sophia, posted on Scrum Practitioners, December 15, 2017*).

The findings from online ethnography, regarding prototypes, personas, mockups, and user stories being used during the iterative cycle are aligned with the results from systematic mapping study. As showed in Figure 5, all these artifacts are used during the iterative cycle, when they can provide details for the development team and they are used as a vehicle to trigger discussions. For instance, Lievesley and Yee [LIYE06] described in their case study that prototypes were posted in the developers' team workspace as a regular point of reference. Hence, during the iterative cycle these artifacts are used as a reference to keep the team aware they are going to the right direction, as well as a reference to achieve the end of the iteration with all user stories completed in accordance with the acceptance criteria.

By the end of each iteration, there is the sprint review event. During this meeting, while the developers demonstrate the work that has been done, designers can show what is the result of design parallel track. Wireframes, mockups, and prototypes are shown as result of designer's work in the sprint review, even knowing that these artifacts cannot be deployed as part of the product increment (*Frederick, posted on Scrum Practitioners, March 18, 2017*). Thus, during sprint review designers can communicate what are the resultant artifacts and use them to give an overview of what will possible included in next sprint.

Finally, prior to the succeeding sprint planning it is time for product backlog refinement – also known as backlog grooming by practitioners. For the time of refinement sketches are used to quickly describe the backlog item. They are used to add brief details to a user story, and the designer can easily communicate to the developers what is expected from the user story even before to have a wireframe or a prototype. (*Tylar, posted on Scrum Practitioners, October 20, 2017*). Therefore, sketches facilitate quick communication during refinement and help other team members to have a shared understanding.

Figure 25 shows the generated word cloud from the current discussed theme. The events are highlighted in blue, while artifacts are emphasized in pink.

Figure 25 - Word Cloud from Artifact-Facilitated Communication

6.5 Artifact-Supported Collaboration

The collaboration between designers and developers should be supported by facilitating communication of design vision [SAPC14]. As mentioned by the authors, sharing an understanding of the design vision can be achieved via design thinking [BROW09], engaging the whole team in design practices and UI specifications, and sharing design artifacts.

Artifacts support an environment of participation and collaboration. Design thinking discipline creates an atmosphere of collaboration where the entire team, including designers and developers, can create low fidelity prototypes together in order to match users' needs and technical feasibility (*Benjamin, posted on Scrum Practitioners, December 18, 2017*). Consequently, the collaborative environment is extremely tied to the first theme which supports that effective teams work together. Figure 26, shows some excerpts considering the code *collaboration*, which corroborate the idea of close collaboration.

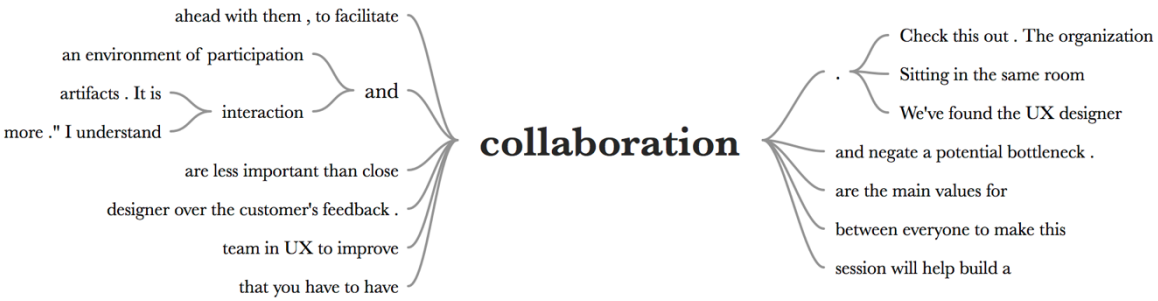


Figure 26 - Word tree generated from code "Collaboration"

Moreover, InVision [INVI00] and Confluence [ATLA18] were mentioned as collaborative tools. InVision provides a collaborative view where developers and designers can interact over shared mockups and prototypes, posting comments and defining the user interface (*Marianna, posted on Scrum Practitioners, October 22, 2017*). Confluence provides a template where wireframes can be attached and it also contains a section to add comments and discussions about the artifact (*Marlina, posted on Scrum Practitioners, October 21, 2017*).

Another collaborative approach mentioned by the community was Lean UX. Lean UX stands on 3 foundations: design thinking, agile software development, and Lean startup method [GOTH15]. Figure 27 shows the word tree generated from “lean” word always related to UX, ensuring the practitioners were talking about Lean UX approach. Since this approach stands on these 3 foundations, it also considers the team working as a single unit, creating a collaborative environment. The author states that the artifacts such as stick notes, sketches, wireframes, and paper prototypes, created during kickoff and ideation sessions, – also named discovery stage – are meaningful to the team since they created these artifacts together. Thus, Lean UX also defend the idea of using artifacts to support collaboration and creates a shared understanding necessary to create the team synergy.

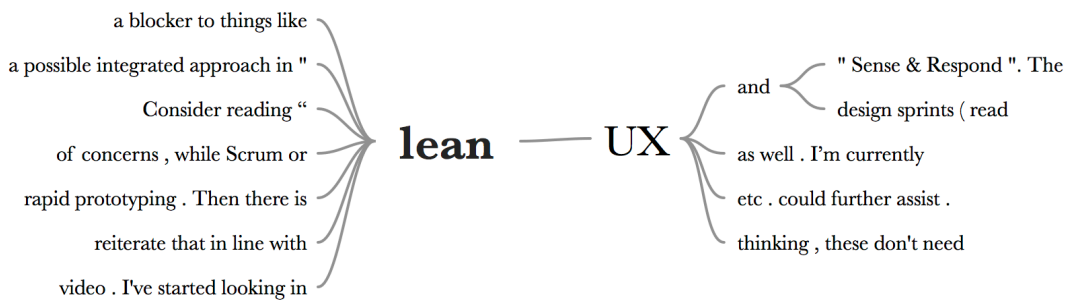


Figure 27 - Word tree generated from word "Lean"

7 CONCLUSION

Both Agile and UCD intend to build quality software from different perspectives. Agile User-Centered Design approach attempt to close the gaps between these two areas, bringing to the software development process the most effective techniques, methods, and artifacts of each of them. However, not only do different perspectives affect this integration but also communication between different professional profiles – designers and developers – have a high impact on it.

The research herein presented focused on the artifacts used to facilitate the communication between designers and developers in an Agile User-Centered Design approach. Through a combination of three studies, including a systematic mapping regarding artifacts used on AUCD, a systematic mapping related to online ethnography methods in Computer Science area, and an online ethnography study performed in an online community, it was possible to identify and understand the artifacts that facilitate communication, when they are used, and how they can facilitate communication.

The findings from this research pointed out five themes resulted from online ethnography study and interrelated with the systematic mapping: (1) Effective teams work together; (2) Designer should play three major roles; (3) Main Artifacts Facilitating Communication; (4) Artifact-Facilitated Communication; and (5) Artifact-Supported Collaboration. The themes interpretation and delineation show the usage of artifacts to facilitates teams' communication.

The findings of this research contribute to further studies regarding Agile User-Centered Design approach, integrating both Software Engineering and Human-Computer Interaction areas. The first systematic mapping provided a deeper understanding not only about the artifacts used for communication but also the software development events that they are used. The second systematic mapping demonstrated how Computer Science disciplines have been applying online ethnography methods. Finally, the online ethnographic study highlighted how artifact-facilitated communication happens in the industry through a perspective from practitioners that participate in online communities.

Overall, contextual factors such as skill sets, experiences, and personalities of people involved impact on the artifact-facilitated communication. Moreover, the choice of artifacts may vary over time, both as context change and as the team members learn what is effective for them. In addition, team configuration and distributed teams

influence on how the team's interactions and collaboration occur, likewise including artifact-facilitated communication.

Future study might extend the work presented in this research. It became clear during the online ethnography analysis that the distributed teams are really impacted by communication factors, and artifacts that are used face-to-face cannot be applied to this team configuration. A member from the analyzed community even commented that distributed teams should be avoided whenever possible, due the complexity to manage communication between people (*Vicent, posted on Scrum Practitioners, March 1, 2015*). Other members also commented that even the teams are distributed, it is important to get together for events such as planning and retrospectives, to work in the same space for some time, and to build a rapport among the team members.

Another point mentioned by several members is that planning meetings should involve the entire team, if possible in the same physical place, if it is not possible video conferences can be used to have all team members understanding the work and sharing it. Thus, considering the distributed teams scenario, how the distributed teams are impacted by artifact-facilitated communication? Which are the applied artifacts when teams are distributed geographically?

Furthermore, it is possible to research on the impact of different artifacts' combination and interrelation, for instance the sequence they are created and how they support the creation of new artifacts. Another perspective that can be studied is the communication not only between developers and designers, but also extended to reach the strategic levels of decision-making.

REFERENCES

[ABIK14] K. A. Abdelouhab, D. Idoughi, and C. Kolski, “Agile & user centric SOA based service design framework applied in disaster management,” in *1st International Conference on Information and Communication Technologies for Disaster Management, ICT-DM*, 2014, pp. 1–8.

[AMSA15] S. Anwar, Y. H. Motla, Y. Siddiq, S. Asghar, M. S. Hassan, and Z. I. Khan, “User-centered design practices in scrum development process: A distinctive advantage?,” in *17th IEEE International Multi Topic Conference: Collaborative and Sustainable Development of Technologies, IEEE INMIC*, 2015, pp. 161–166.

[ATLA18] Atlassian, “Confluence,” 2018. [Online]. Available: https://www.atlassian.com/software/confluence. [Accessed: 10-Jun-2017].

[BABI14] S. M. Butt, O. Azura, M. M. B, N. T. Inam, and M. Butt, “Incorporation of Usability Evaluation Methods in Agile Software Model,” in *International Multi Topic Conference, INMIC*, 2014, pp. 193–199.

[BAFE00] M. Bakardjieva and A. Feenberg, “Involving the Virtual Subjects,” *Ethics and Information Technology*, vol. 2, pp. 233–240, 2000.

[BAFT16] J. Bauer, N. Franke, and P. Tuertscher, “Intellectual property norms in online communities: How user-organized intellectual property regulation supports innovation,” *Information Systems Research*, vol. 27, pp. 724–750, 2016.

[BEAN04] K. Beck and C. Andres, *Extreme Programming Explained: Embrace Change*, 2nd ed. Boston: Addison-Wesley, 2004.

[BEHB04] H. Beyer, K. Holtzblatt, and L. Baker, “An Agile Customer-Centered Method : Rapid Contextual Design,” in *Extreme Programming and Agile Methods, XP/Agile Universe*, 2004, pp. 50–59.

[BLPÅ15] J. K. Blomkvist, J. Persson, and J. Åberg, “Communication through Boundary Objects in Distributed Agile Teams,” in *33rd Annual ACM Conference on Human Factors in Computing Systems, CHI ’15*, 2015, pp. 1875–1884.

[BMMW15] M. Brhel, H. Meth, A. Maedche, and K. Werder, “Exploring principles of user-centered agile software development: A literature review,” *Information & Software Technology*, vol. 61, pp. 163–181, 2015.

[BRBA08] D. Broschinsky and L. Baker, “Using persona with XP at LANDesk software, an avocent company,” in *Agile 2008 Conference*, 2008, pp. 543–548.

[BRLB08] J. Brown, G. Lindgaard, and R. Biddle, “Stories, sketches, and lists: Developers and interaction designers interacting through artefacts,” in *Agile 2008 Conference*, 2008, pp. 39–50.

[BRLB11] J. M. Brown, G. Lindgaard, and R. Biddle, “Collaborative events and shared artefacts: Agile interaction designers and developers working toward common aims,” in *Agile 2011 Conference*, 2011, pp. 87–96.

[BRLB12] J. M. Brown, G. Lindgaard, and R. Biddle, “Joint implicit alignment work of interaction designers and software developers,” in *7th Nordic Conference on Human-Computer Interaction Making Sense Through Design, NordiCHI ’12*, 2012, pp. 693–702.

[BROW09] T. Brown, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*. New York: HarperBusiness, 2009.

[BWNC11] A. Bengry-Howell, R. Wiles, M. Nind, and G. Crow, “A Review of the Academic Impact of Three Methodological Innovations: Netnography, Child-Led Research and Creative Research Methods,” *ESRC National Centre for Research Methods, NCRM Working Paper*. pp. 1–37, 2011.

[CHSM06] S. Chamberlain, H. Sharp, and N. Maiden, “Towards a Framework for Integrating Agile Development and User-Centred Design,” in *Extreme Programming and Agile Processes in Software Engineering, XP*, 2006, pp. 143–153.

[COCK04] A. Cockburn, *Crystal Clear a Human-powered Methodology for Small Teams*, 1st ed. Boston: Addison-Wesley, 2004.

[COHN04] M. Cohn, *User Stories Applied: For Agile Software Development*. Boston: Addison-Wesley, 2004.

[COMW17] L. Costello, M. Mcdermott, and R. Wallace, “Netnography : Range of Practices , Misperceptions , and Missed Opportunities,” *International Journal of Qualitative Methods*, vol. 16, pp. 1–12, 2017.

[CRES14] J. W. Creswell, *Research Design. Qualitative, Quantitative and Mixed methods approaches*, 4th ed. London: SAGE Publications, 2014.

[EBHD13] S. Emad, A. Broillet, W. Halvorson, and N. Dunwell, “The competency building process of human computer interaction in game-based teaching: Adding the flexibility of an asynchronous format,” in *IEEE International Professional Communication Conference, IPCC*, 2013, pp. 1–8.

[ELSC08] M. S. Elliott and W. Scacchi, “Mobilization of software developers: the free software movement,” *Information Technology & People*, vol. 21, pp. 4–33, 2008.

[FENB07] J. Ferreira, J. Noble, and R. Biddle, “Agile development iterations and UI design,” in *Agile 2007 Conference*, 2007, pp. 50–58.

[FESR10] J. Ferreira, H. Sharp, and H. Robinson, “Values and Assumptions Shaping Agile Development and User Experience Design in Practice,” in *Agile Processes in Software Engineering and Extreme Programming, XP*, 2010, pp. 178–183.

[FESR12] J. Ferreira, H. Sharp, and H. Robinson, “Agile development and user experience design integration as an ongoing achievement in practice,” in *Agile 2012 Conference*, 2012, pp. 11–20.

[FOSM08] D. Fox, J. Sillito, and F. Maurer, “Agile Methods and User-Centered Design: How These Two Methodologies are Being Successfully Integrated in Industry,” in *Agile 2008 Conference*, 2008, pp. 63–72.

[GAMS18] A. Garcia, B. P. De Mattos, and M. S. Silveira, “Online Ethnography Studies in Computer Science: A Systematic Mapping,” in *Social Computing and Social Media. User Experience and Behavior, SCSM 2018*, 2018, pp. 32–45.

[GASS16] A. Garcia, T. S. Da Silva, and M. Silveira, “Artifacts for Agile User-Centered Design : A Systematic Mapping,” in *Annual Hawaii International Conference on System Sciences, HICSS*, 2016, pp. 1–10.

[GEHO13] M. Germonprez and D. S. Hovorka, “Member engagement within digitally enabled social network communities: New methodological considerations,” *Information Systems Journal*, vol. 23, pp. 525–549, 2013.

[GOTH15] J. Gothelf, *Lean UX, Applying Lean Principles to Improve User Experience*, 1st ed. Sebastopol: O’Reilly Media Inc., 2015.

[GRAY12] K. L. Gray, “Diffusion of Innovation Theory and Xbox Live: Examining Minority Gamers’ Responses and Rate of Adoption to Changes in Xbox Live,” *Bulletin of Science, Technology & Society*, vol. 32, pp. 463–470, 2012.

[HAPY12] R. Hartson and P. Pyla, *The UX Book*, 1st ed. Waltham: Morgan Kaufmann, 2012.

[HASA03] J. Hakim, T. Spitzer, and J. Armitage, “Sprint: Agile specifications in Shockwave and Flash,” in *2003 Conference on Designing for User Experiences, DUX ’03*, 2003, pp. 1–14.

[HINE00] C. Hine, *Virtual Ethnography*, 1st ed. London: SAGE Publications, 2000.

[HOGO12] E. Horster and C. Gottschalk, “Computer-assisted Webnography: a new approach to online reputation management in tourism,” *Journal of Vacation Marketing*, vol. 18, pp. 229–238, 2012.

[INVI00] InVision, “InVision.” [Online]. Available: https://www.invisionapp.com/. [Accessed: 10-May-2017].

[ISO07] ISO, “ISO 9241-400:2007, Ergonomics of human-system interaction - Part 400: Principles and requirements for physical input devices,” 2007. [Online]. Available: https://www.iso.org/obp/ui/#iso:std:38896:en. [Accessed: 31-Dec-2016].

[ISO10] ISO, “ISO 9241-210:2010, Ergonomics of human-system interaction - Part 210: Human-centred design for interactive systems,” 2010. [Online]. Available: https://www.iso.org/obp/ui/#iso:std:iso:9241:-210:ed-1:v1:en. [Accessed: 31-Dec-2016].

[ISVH12] M. Isomursu, A. Sirotkin, P. Voltti, and M. Halonen, “User experience design goes agile in lean transformation - A case study,” in *Agile 2012 Conference*, 2012, pp. 1–10.

[JUHM14] G. Jurca, T. D. Hellmann, and F. Maurer, “Integrating agile and user-centered design: A systematic mapping and review of evaluation and validation studies of agile-UX,” in *Agile 2014 Conference*, 2014, pp. 24–32.

[KDLC12] K. Koerner, D. Dailey, M. Lipp, H. Connor, and R. Sharma, “Data visualization for psychotherapy progress tracking,” in *30th ACM international conference on Design of communication, SIGDOC ’12*, 2012, pp. 213–218.

[KICH07] B. Kitchenham and S. Charters, “Guidelines for performing Systematic Literature reviews in Software Engineering Version 2.3,” *EBSE Technical Report*. p. 57, 2007.

[KOZI02] R. V. Kozinets, “The Field Behind the Screen: Using Netnography for Marketing Research in Online Communities,” *Journal of Marketing Research*, vol. 39, pp. 61–72, 2002.

[KOZI06] R. V. Kozinets, “Netnography 2.0,” in *Handbook of qualitative research methods in marketing*, Cheltenham, UK: Edward Elgar Publishing, 2006, pp. 129–142.

[KOZI10] R. V. Kozinets, *Netnography: Doing Ethnographic Research Online*, 1st ed. London: SAGE Publications, 2010.

[KOZI15] R. V. Kozinets, *Netnography: Redefined*, 2nd ed. London: SAGE Publications, 2015.

[KSPM11] I. Kongmee, R. Strachan, A. Pickard, and C. Montgomery, “Moving between virtual and real worlds: Second language learning through massively multiplayer online role playing games (MMORPGs),” in *3rd Computer Science and Electronic Engineering Conference, CEEC’11*, 2011, pp. 13–18.

[KULA15] D. Kulavuz-Onal, “Using Netnography to Explore the Culture of Online Language Teaching Communities,” *CALICO Journal*, vol. 32, pp. 426–448, 2015.

[KUMI13] K. Kuusinen and T. Mikkonen, “Designing User Experience for Mobile Apps: Long-Term Product Owner Perspective,” in *20th Asia-Pacific Software Engineering Conference, APSEC*, 2013, pp. 535–540.

[KUVÁ13] D. Kulavuz-Onal and C. Vásquez, “Reconceptualising fieldwork in a netnography of an online community of English language teachers,” *Ethnography and Education*, vol. 8, pp. 224–238, 2013.

[LARM04] C. Larman, *Agile and Iterative Development: A Manager’s Guide*, 1st ed. Boston: Addison-Wesley, 2004.

[LEJM11] J. C. Lee, T. K. Judge, and D. S. McCrickard, “Evaluating eXtreme scenario-based design in a distributed agile team,” in *CHI ’11 Extended Abstracts on Human Factors in Computing Systems, CHI EA ’11*, 2011, pp. 863–877.

[LEMS09] J. C. Lee, D. S. McCrickard, and K. T. Stevens, “Examining the foundations of agile usability with extreme scenario-based design,” in *Agile 2009 Conference*, 2009, pp. 3–10.

[LEMT07] J. C. Lee, D. S. Mccrickard, and V. Tech, “Towards Extreme(ly) Usable Software : Exploring Tensions Between Usability and Agile Software Development,” in *Agile 2007 Conference*, 2007, pp. 59–71.

[LINK17] LinkedIn, “LinkedIn Groups Terms of Service,” 2017. [Online]. Available: https://www.linkedin.com/legal/more-groups-terms. [Accessed: 25-Jun-2017].

[LIYE06] M. A. Lievesley and J. S. R. Yee, “The role of the interaction designer in an agile software development process,” in *CHI ’06 Extended Abstracts on Human Factors in Computing Systems, CHI EA ’06*, 2006, pp. 1025–1030.

[LKSH14] L. A. Liikkanen, H. Kilpiö, L. Svan, and M. Hiltunen, “Lean UX: the next generation of user-centered agile development?,” in *8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational, NordiCHI ’14*, 2014, pp. 1095–1100.

[LPSM13] E. Loanzon, J. P. Provenzola, B. Siriwannangkul, and M. Al Mallak, “Netnography: Evolution, trends, and implications as a fuzzy front end tool,” in *Technology Management in the IT-Driven Services, PICMET*, 2013, pp. 1572–1593.

[MALI15] S. Malinen, “Understanding user participation in online communities: A systematic literature review of empirical studies,” *Computers in Human Behavior*, vol. 46, pp. 228–238, 2015.

[MCMN17] B. McKenna, M. D. Myers, and M. Newman, “Social media in qualitative research: Challenges and recommendations,” *Information and Organization*, vol. 27, pp. 87–99, 2017.

[MEAS06] G. Meszaro and J. Aston, “Adding usability testing to an agile project,” in *Agile 2006 Conference*, 2006, pp. 289–294.

[NVIV17] NVivo, “NVivo qualitative data analysis Software; QSR International Pty Ltd.” 2017.

[OVLA15] T. Ovad and L. B. Larsen, “The Prevalence of UX Design in Agile Development Processes in Industry,” in *Agile 2015 Conference*, 2015, pp. 40–49.

[OXFO10] *Oxford American Dictionary & Thesaurus*, Third Edit. New York: Oxford University Press, 2010.

[PATT05] J. Patton, “Finding the Forest in the Trees,” in *20th annual ACM SIGPLAN conference on Object-oriented programming, systems, languages, and applications, OOPSLA ’05*, 2005, pp. 266–274.

[PCNB13] C. Paris, N. Colineau, S. Nepal, S. K. Bista, and G. Beschorner, “Ethical considerations in an online community: The balancing act,” *Ethics and Information Technology*, vol. 15, pp. 301–316, 2013.

[PEVK15] K. Petersen, S. Vakkalanka, and L. Kuzniarz, “Guidelines for conducting systematic mapping studies in software engineering: An update,” *Information and Software Technology*, vol. 64, pp. 1–18, 2015.

[PFMM08] K. Petersen, R. Feldt, S. Mujtaba, and M. Mattsson, “Systematic mapping studies in software engineering,” in *International conference on Evaluation and Assessment in Software Engineering, EASE ’08*, 2008, pp. 68–77.

[PRRS15] J. Preece, Y. Rogers, and H. Sharp, *Interaction Design: Beyond Human-Computer Interaction*, 4th ed. West Sussex: Wiley, 2015.

[PWBK13] S. Prior, A. Waller, R. Black, and T. Kroll, “Use of an agile bridge in the development of assistive technology,” in *SIGCHI Conference on Human Factors in Computing System, CHI ’13*, 2013, pp. 1579–1588.

[ROZA14] D. Rozas, “Drupal as a Commons-Based Peer Production community,” in *The International Symposium on Open Collaboration*, 2014, p. 36.

[RPHD12] D. Rotman, J. Preece, Y. He, and A. Druin, “Extreme ethnography: challenges for research in large scale online environments,” in *iConference*, 2012, pp. 207–214.

[SAPC14] D. Salah, R. F. Paige, and P. Cairns, “A Systematic Literature Review for Agile Development Processes and User Centred Design Integration,” in *International Conference on Evaluation and Assessment in Software Engineering, EASE ’14*, 2014, pp. 1–10.

[SCBE01A] K. Schwaber and M. Beedle, “Principles behind the agile manifesto,” 2001. [Online]. Available: https://agilemanifesto.org/principles.html. [Accessed: 08-Nov-2015].

[SCBE01B] K. Schwaber and M. Beedle, *Agile Software Development with Scrum*, 1st ed. Upper Saddle River: Prentice Hall, 2001.

[SCSU17] K. Schwaber and J. Sutherland, “The Scrum Guide,” *Scrum.Org and ScrumInc*. p. 17, 2017.

[SCTE17] E. Schön, J. Thomaschewski, and M. J. Escalona, “Agile Requirements Engineering: A Systematic Literature Review,” *Computer Standards & Interfaces*, vol. 49, pp. 79–91, 2017.

[SHRP09] H. Sharp, H. Robinson, and M. Petre, “The role of physical artefacts in agile software development: Two complementary perspectives,” *Interacting with Computers*, vol. 21, pp. 108–116, 2009.

[SING08] M. Singh, “U-SCRUM: An agile methodology for promoting usability,” in *Agile 2008 Conference*, 2008, pp. 555–560.

[SISH11] A. Sigfridsson and A. Sheehan, “On qualitative methodologies and dispersed communities: Reflections on the process of investigating an open source community,” *Information and Software Technology*, vol. 53, pp. 981–993, 2011.

[SISM15] T. S. Da Silva, M. S. Silveira, and F. Maurer, “Usability evaluation practices within agile development,” in *Annual Hawaii International Conference on System Sciences, HICSS*, 2015, pp. 5133–5142.

[SLMS08] Z. H. Sain et al., “User interface design for a mobile multimedia application: An iterative approach,” in *1st International Conference on Advances in Computer-Human Interaction, ACHI*, 2008, pp. 189–194.

[SMMS11] T. Silva, A. Martin, F. Maurer, and M. Silveira, “User-Centered Design and Agile Methods: A Systematic Review,” in *Agile 2011 Conference*, 2011, pp. 77–86.

[SSMH12] T. S. Da Silva, M. S. Silveira, F. Maurer, and T. Hellmann, “User experience design and agile development: From theory to practice,” *Journal of Software Engineering and Applications*, vol. 05, pp. 743–751, 2012.

[SY07] D. Sy, “Adapting Usability Investigations for Agile User-Centered Design,” *Journal of Usability Studies*, vol. 2, pp. 112–132, 2007.

[SYCI17] J. Synnott, A. Coulias, and M. Ioannou, “Online trolling: The case of Madeleine McCann,” *Computers in Human Behavior*, vol. 71, pp. 70–78, 2017.

[TAI05] G. Tai, “A communication architecture from rapid prototyping,” in *Workshop on Human and social factors of software engineering, HSSE ’05*, 2005, vol. 30, pp. 1–3.

[TEIX14] J. Teixeira, “Patients Using Open-Source Disease Control Software Developed by Other Patients,” in *Communications in Computer and Information Science, CCIS*, 2014, pp. 203–210.

[THHA10] S. Thomas and U. Hansmann, *Agile Software Development: Best Practices for Large Software Development Projects*, 1st ed. London: Springer, 2010.

[UNWH08] J. Ungar and J. White, “Agile User Centered Design: Enter the Design Studio – A Case Study,” in *CHI ’08 Extended Abstracts on Human Factors in Computing Systems, CHI EA ’08*, 2008, pp. 2167–2178.

[VERS16] VersionOne, “10th Annual State of Agile Report,” 2016. [Online]. Available: http://stateofagile.versionone.com/. [Accessed: 10-Jun-2016].

[VERS17] VersionOne, “11th Annual State of Agile Report,” 2017. [Online]. Available: https://goo.gl/RMoK9C. [Accessed: 21-Jun-2017].

[WALE15] A. Y. Wale-Kolade, “Integrating usability work into a large inter-organisational agile development project: Tactics developed by usability designers,” *Journal of Systems & Software*, vol. 100, pp. 54–66, Feb. 2015.

[WARD99] K. J. Ward, “Cyber-ethnography and the emergence of the virtually new community,” *Journal of Information Technology*, vol. 14, pp. 95–105, 1999.

APPENDIX A – SELECTED PAPERS ON SYSTEMATIC MAPPING STUDY 1

Title	Reference
Usage-centered engineering for Web applications	[1]
Hitting the target: adding interaction design to agile software development.	[2]
Sprint: Agile Specifications in Shockwave and Flash	[3]
An Agile Customer-Centered Method: Rapid Contextual Design	[4]
A Communication Architecture from Rapid Prototyping	[5]
Finding the Forest in the Trees	[6]
The Role of the Interaction Designer in an Agile Software Development Process	[7]
Adding usability testing to an agile project	[8]
Something to believe in	[9]
Adapting Usability Investigations for Agile User-centered Design	[10]
Agile Development Iterations and UI Design	[11]
The UCD Perspective: Before and After Agile	[12]
Towards Extreme(ly) Usable Software: Exploring Tensions Between Usability and Agile Software Development	[13]
Agile User Centered Design: Enter the Design Studio - a Case Study	[14]
Probing an Agile Usability Process	[15]
Agile Methods and User-Centered Design: How These Two Methodologies are Being Successfully Integrated in Industry	[16]
Stories, Sketches, and Lists: Developers and Interaction Designers Interacting Through Artefacts	[17]
The Design Studio: Interface Design for Agile Teams	[18]
Two Case Studies of User Experience Design and Agile Development	[19]
U-SCRUM: An Agile Methodology for Promoting Usability	[20]
User Interface Design for a Mobile Multimedia Application: An Iterative Approach	[21]
Using Persona with XP at LANDesk Software, an Avocent Company	[22]
When User Experience Met Agile: A Case Study	[23]
Adopting an Agile Culture	[24]
Examining the Foundations of Agile Usability with eXtreme Scenario-Based Design	[25]
The Importance of Identity and Vision to User Experience Designers on Agile Projects	[26]
Evaluating eXtreme Scenario-based Design in a Distributed Agile Team	[27]
Collaborative Events and Shared Artefacts: Agile Interaction Designers and Developers Working Toward Common Aims	[28]
User-Centered Design and Agile Methods: A Systematic Review	[29]
Combining InterMod Agile Methodology with Usability Engineering in a Mobile Application Development	[30]
Data Visualization for Psychotherapy Progress Tracking	[31]
Joint Implicit Alignment Work of Interaction Designers and Software Developers	[32]
User Experience Design Goes Agile in Lean Transformation -- A Case Study	[33]
User Experience Design and Agile Development: From Theory to Practice	[34]

RITE+Krug: A Combination of Usability Test Methods for Agile Design	[35]
Use of an Agile Bridge in the Development of Assistive Technology	[36]
A guide to agile development of interactive software with a "User Objectives"-driven methodology	[37]
Designing User Experience for Mobile Apps: Long-Term Product Owner Perspective	[38]
Ten Lessons Learned from Integrating Interaction Design and Agile Development	[39]
Agile & user centric SOA based service design framework applied in disaster management	[40]
Engineering M-Learning Using Agile User-Centered Design	[41]
Integrating Agile and User-Centered Design: A Systematic Mapping and Review of Evaluation and Validation Studies of Agile-UX	[42]
User-centered design practices in scrum development process: A distinctive advantage?	[43]
User-centered-design in agile RE through an On-site User Experience Consultant	[44]
The usefulness of usability and user experience evaluation methods on an e-Learning platform development from a developer's perspective: A case study	[45]
An Agile Information-Architecture-Driven Approach for the Development of User-Centered Interactive Software	[46]
Communication Through Boundary Objects in Distributed Agile Teams	[47]
Patterns for Integrating Agile Development Processes and User Centred Design	[48]
Teaching Software Developers to Perform UX Tasks	[49]
Exploring principles of user-centered agile software development: A literature review	[50]
Integrating usability work into a large inter-organisational agile development project: Tactics developed by usability designers	[51]
Usability Evaluation Practices within Agile Development	[52]
The Prevalence of UX Design in Agile Development Processes in Industry	[53]
Incorporation of Usability Evaluation Methods in Agile Software Model	[54]
Empowering User Interfaces for Industrie 4.0	[55]
A Systematic Mapping on Agile UCD Across the Major Agile and HCI Conferences	[56]

REFERENCES

[1] L. L. Constantine and L. A. D. Lockwood, “Usage-centered engineering for web applications,” *IEEE Software*, vol. 19, no. 2, pp. 42–50, 2002.

[2] J. Patton, “Hitting the Target: Adding Interaction Design to Agile Software Development,” in *OOPSLA ’02 OOPSLA 2002 Practitioners Reports*, 2002.

[3] J. Hakim, T. Spitzer, and J. Armitage, “Sprint: Agile specifications in Shockwave and Flash,” *Proceedings of the 2003 conference on …*, pp. 1–14, 2003.

[4] H. Beyer, K. Holtzblatt, and L. Baker, “An Agile Customer-Centered Method : Rapid Contextual Design,” *Extreme Programming and Agile Methods-XP/Agile Universe 2004*, no. Cd, pp. 50–59, 2004.

[5] G. Tai, “A communication architecture from rapid prototyping,” *ACM SIGSOFT Software Engineering Notes*, vol. 30, no. 4, p. 1, 2005.

[6] J. Patton, “Finding the trees in the forest,” *Nature Methods*, vol. 7, no. 11, pp. 869–869, 2005.

[7] M. A. Lievesley and J. S. R. Yee, “The role of the interaction designer in an agile software development process,” in *Human factors in computing systems*, 2006, p. 1025.

[8] G. Meszaro and J. Aston, “Adding usability testing to an agile project,” *Proceedings - AGILE Conference, 2006*, vol. 2006, pp. 289–294, 2006.

[9] J. Honious and J. Clark, “Something to Believe In,” *Agile 2006 (Agile’06)*, pp. 203–212, 2006.

[10] D. Sy, “Adapting Usability Investigations for Agile User-Centered Design,” *Journal of Usability Studies*, vol. 2, no. 3, pp. 112–132, 2007.

[11] J. Ferreira, J. Noble, and R. Biddle, “Agile development iterations and UI design,” in *Agile Conference*, 2007, pp. 50–58.

[12] H. Williams, A. Ferguson, V. G. A. A. I. A. T. Rally Software, A. W. Software, I. L. N. S. Prentice Hall, N. O. V. O. E. S. P. O. Microsoft, S. A. S. A. L. C. C. P. Green Pepper Software, and P. T. T. S. S. Solut Iq, “The UCD perspective: Before and after agile,” *AGILE 2007 Conference*, pp. 285–290, 2007.

[13] J. C. Lee, D. S. Mccrickard, and V. Tech, “Towards Extreme (ly) Usable Software : Exploring Tensions Between Usability and Agile Software Development,” *Agile Conference (AGILE), 2007*, 2007.

[14] J. Ungar and J. White, “Agile User Centered Design: Enter the Design Studio – A Case Study,” *Proceeding of the twenty-sixth annual CHI conference extended abstracts on Human factors in computing systems - CHI ’08*, p. 2167, 2008.

[15] P. Wolkerstorfer, M. Tscheligi, R. Sefelin, H. Milchrahm, Z. Hussain, M. Lechner, and S. Shahzad, “Probing an agile usability process,” *Proceedings of ACM CHI 2008 Conference on Human Factors in Computing Systems*, vol. 2, pp. 2151–2158, 2008.

[16] D. Fox, J. Sillito, and F. Maurer, “Agile Methods and User-Centered Design: How These Two Methodologies are Being Successfully Integrated in Industry,” in *Agile Conference*, 2008, pp. 63–72.

[17] J. Brown, G. Lindgaard, and R. Biddle, “Stories, sketches, and lists: Developers and interaction designers interacting through artefacts,” *Proceedings - Agile 2008 Conference*, pp. 39–50, 2008.

[18] J. Ungar, “The design studio: Interface design for agile teams,” *Proceedings - Agile 2008 Conference*, pp. 519–524, 2008.

[19] M. Najafi and L. Toyoshiba, “Two Case Studies of User Experience Design and Agile Development,” *Agile 2008 Conference*, pp. 531–536, 2008.

[20] M. Singh, “U-SCRUM: An agile methodology for promoting usability,” *Proceedings - Agile 2008 Conference*, pp. 555–560, 2008.

[21] Z. H. Sain, M. Lechner, H. Milchrahm, S. Shahzad, W. Slaný, M. Umgeher, T. Vlk, and P. Wolkerstorfer, “User interface design for a mobile multimedia application: An iterative approach,” *Proceedings of the 1st International Conference on Advances in Computer-Human Interaction, ACHI 2008*, pp. 189–194, 2008.

[22] D. Broschinsky and L. Baker, “Using persona with XP at LANDesk software, an avocent company,” *Proceedings - Agile 2008 Conference*, pp. 543–548, 2008.

[23] M. Budwig, S. Jeong, and K. Kelkar, “When user experience met agile: a case study,” *Proceedings of the 27th international conference extended abstracts on Human factors in computing systems*, pp. 3075–3084, 2009.

[24] L. Cho, “Adopting an agile culture,” *Proceedings - 2009 Agile Conference, AGILE 2009*, pp. 400–403, 2009.

[25] J. C. Lee, D. S. McCrickard, and K. T. Stevens, “Examining the foundations of agile usability with extreme scenario-based design,” *Proceedings - 2009 Agile Conference, AGILE 2009*, pp. 3–10, 2009.

[26] J. Kollmann, H. Sharp, and A. Blandford, “The importance of identity and vision to user experience designers on agile projects,” *Proceedings - 2009 Agile Conference, AGILE 2009*, pp. 11–18, 2009.

[27] J. C. Lee, T. K. Judge, and D. S. McCrickard, “Evaluating eXtreme scenario-based design in a distributed agile team,” *CHI ’11 Extended Abstracts on Human Factors in Computing Systems*, pp. 863–877, 2011.

[28] J. M. Brown, G. Lindgaard, and R. Biddle, “Collaborative events and shared artefacts: Agile interaction designers and developers working toward common aims,” in *Agile Conference*, 2011, pp. 87–96.

[29] T. Silva, A. Martin, F. Maurer, and M. Silveira, “User-Centered Design and Agile Methods: A Systematic Review,” in *Agile Conference*, 2011, pp. 77–86.

[30] B. Losada, M. Urretavizcaya, J.-M. López-Gil, and I. Fernández-Castro, “Combining InterMod agile methodology with usability engineering in a mobile application development,” *Proceedings of the 13th International Conference on Interacción Persona-Ordenador - INTERACCION ’12*, no. August, pp. 1–8, 2012.

[31] K. Koerner, D. Dailey, M. Lipp, H. Connor, and R. Sharma, “Data visualization for psychotherapy progress tracking,” *Proceedings of the 30th ACM international conference on Design of communication - SIGDOC ’12*, p. 213, 2012.

[32] J. M. Brown, G. Lindgaard, and R. Biddle, “Joint implicit alignment work of interaction designers and software developers,” *Proceedings of the 7th Nordic Conference on Human-Computer Interaction Making Sense Through Design - NordiCHI ’12*, p. 693, 2012.

[33] M. Isomursu, A. Sirotkin, P. Voltti, and M. Halonen, “User experience design goes agile in lean transformation - A case study,” *Proceedings - 2012 Agile Conference, Agile 2012*, 2012.

[34] T. Silva and M. Silveira, “User experience design and agile development: From theory to practice,” *Journal of Software …*, vol. 5, no. 10, pp. 743–751, 2012.

[35] J. Mcginn and A. Ramirez Chang, “RITE + Krug : A Combination of Usability Test Methods for Agile Design,” *Journal of Usability Studies*, vol. 8, no. 3, pp. 61–68, 2013.

[36] S. Prior, A. Waller, R. Black, and T. Kroll, “Use of an agile bridge in the development of assistive technology,” *Proceedings of the SIGCHI Conference on Human Factors in Computing System*, pp. 1579–1588, 2013.

[37] B. Losada, M. Urretavizcaya, and I. Fernández-Castro, “A guide to agile development of interactive software with a ‘User Objectives’-driven methodology.,” *Science of Computer Programming*, vol. 78, no. 11, pp. 2268–2281, Nov. 2013.

[38] K. Kuusinen and T. Mikkonen, “Designing User Experience for Mobile Apps: Long-Term Product Owner Perspective,” *2013 20th Asia-Pacific Software Engineering Conference (APSEC)*, vol. 1, pp. 535–540, 2013.

[39] T. S. Da Silva, M. S. Silveira, and F. Maurer, “Ten lessons learned from integrating interaction design and Agile development,” *Proceedings - AGILE 2013*, pp. 42–49, 2013.

[40] K. A. Abdelouhab, D. Idoughi, and C. Kolski, “Agile & user centric SOA based service design framework applied in disaster management,” *2014 1st International Conference on Information and Communication Technologies for Disaster Management, ICT-DM 2014*, 2014.

[41] W. A. Rahim, W. M. Isa, A. M. Lokman, N. F. Taharim, and N. D. Wahid, “Engineering m-learning using agile user-centered design,” *Proceedings - 2014 8th International Conference on Next Generation Mobile Applications, Services and Technologies, NGMAST 2014*, pp. 60–65, 2014.

[42] G. Jurca, T. D. Hellmann, and F. Maurer, “Integrating agile and user-centered design: A systematic mapping and review of evaluation and validation studies of agile-UX,” *Proceedings - 2014 Agile Conference, AGILE 2014*, pp. 24–32, 2014.

[43] S. Anwar, Y. H. Motla, Y. Siddiq, S. Asghar, M. S. Hassan, and Z. I. Khan, “User-centered design practices in scrum development process: A distinctive advantage?,” *17th IEEE International Multi Topic Conference: Collaborative and Sustainable Development of Technologies, IEEE INMIC 2014 - Proceedings*, pp. 161–166, 2015.

[44] E. Kropp and K. Koischwitz, “User-centered-design in agile RE through an On-site User Experience Consultant,” *2014 IEEE 2nd International Workshop on Usability and Accessibility Focused Requirements Engineering, UsARE 2014 - Proceedings*, pp. 9–12, 2014.

[45] A. Gordillo, E. Barra, S. Aguirre, and J. Quemada, “The usefulness of usability and user experience evaluation methods on an e-Learning platform development from a developer’s perspective: A case study,” *2014 IEEE Frontiers in Education Conference (FIE) Proceedings*, vol. 2015–Febru, no. February, pp. 1–8, 2014.

[46] L. A. Rojas and J. A. Macías, “An Agile Information-Architecture-Driven Approach for the Development of User-Centered Interactive Software,” *Proceedings of the XVI International Conference on Human Computer Interaction - Interacción ’15*, pp. 1–8, 2015.

[47] J. K. Blomkvist, J. Persson, and J. Åberg, “Communication through Boundary Objects in Distributed Agile Teams,” *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems - CHI ’15*, pp. 1875–1884, 2015.

[48] D. Salah, R. Paige, and P. Cairns, “Patterns for integrating agile development processes and user centred design,” *… of the 20th European Conference on …*, pp. 1–10, 2015.

[49] T. Øvad, L. B. Larsen, and J. Stage, “Teaching Software Developers to Perform UX Tasks,” pp. 397–406, 2015.

[50] M. Brhel, H. Meth, A. Maedche, and K. Werder, “Exploring principles of user-centered agile software development: A literature review.,” *Information & Software Technology*, vol. 61, pp. 163–181, May 2015.

[51] A. Y. Wale-Kolade, “Integrating usability work into a large inter-organisational agile development project: Tactics developed by usability designers.,” *Journal of Systems & Software*, Feb. 2015.

[52] T. S. Da Silva, M. S. Silveira, and F. Maurer, “Usability evaluation practices within agile development,” in *Annual Hawaii International Conference on System Sciences*, 2015, vol. 2015–March, pp. 5133–5142.

[53] T. Ovad and L. B. Larsen, “The Prevalence of UX Design in Agile Development Processes in Industry,” *2015 Agile Conference*, pp. 40–49, 2015.

[54] S. M. Butt, O. Azura, M. M. B, N. T. Inam, and M. Butt, “Incorporation of Usability Evaluation Methods in Agile Software Model,” in *International Multi Topic Conference*, 2014, no. 8–10, pp. 193–199.

[55] T. Pfeiffer, J. Hellmers, E. M. Sch??n, and J. Thomaschewski, “Empowering User Interfaces for Industrie 4.0,” *Proceedings of the IEEE*, vol. 104, no. 5, pp. 986–996, 2016.

[56] T. S. Da Silva, F. F. Silveira, M. S. Silveira, T. Hellmann, and F. Maurer, “A systematic mapping on agile UCD across the major agile and HCI conferences,” *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, vol. 9159, pp. 86–100, 2015.

APPENDIX B – RESULTED ARTIFACTS ON SYSTEMATIC MAPPING STUDY

Artifact - Group	Artifact - Extracted Name	Results	Total
Blueprint	Blueprint	1	1
Card	Design Card Feature Card Issue Card Task-Case Card User Role Card	4 4 3 3 2	16
Guideline	Guideline Style Guide Design Specification	2 1 1	4
List	List (group of ideas)	1	1
Map	Claim Map Concept Map Content Mapping Effect Map Site Map	3 1 1 1 1	7
Mockup	HTML Mockup Mockup Paper Mockup	1 6 1	8
Model	Content Model Context Model	1 1	2
Persona	Ad-hoc Persona Extreme Persona Persona	1 1 13	15
Prototype	Prototype UI Prototype	28 6	34
Research Results	Research Results	1	1
Scenario	Scenarios	12	12
Sketch	Sketches	13	13
Storyboard	Storyboards	5	5
Storytelling	Oral Storytelling Storytelling	1 2	3

UI Design	UI Design UI Proposal UI Screen Visual Design	5 1 1 1	8
Use Case	Use Case	2	2
User Flow	Flow Model Task Model User Flow User Journey	1 2 1 2	6
User Story	Card (User Story) Stories User Objective User Story	2 8 2 10	22
UX Target	UX Target	1	1
Wireframe	Wireframe	8	8

APPENDIX C – RESULTED EVENTS ON SYSTEMATIC MAPPING STUDY

Event - Group	Event - Extracted Name	Results	Total
Discovery	Build an Affinity	1	7
	Design Studio	1	
	Initial Workshop	2	
	U-CD Session	2	
	UX Design Phase	1	
Planning	Plan Parallel Iteration	1	17
	Planning	13	
	Pre-Planning	1	
	Pre Release Planning	1	
	Span Planning	1	
Iterative Cycle	During Development Cycle	12	31
	Iterative Stage	5	
	Iterative UI Design	1	
	Next Sprint	9	
	One Sprint Ahead	4	
Review Meeting	Review Meeting	1	2
	Product Backlog Management	1	
General Meetings	Meetings	5	5

APPENDIX D – SELECTED PAPERS ON SYSTEMATIC MAPPING STUDY 2

Title	Reference
Accessibility for People with Cerebral Palsy: The use of Blogs as an Agent of Social Inclusion	[1]
An Internet based distribution strategy of luxury products and services grounded on qualitative Web discourse analysis	[2]
Avatars' Appearance and Social Behavior in Online Virtual Worlds	[3]
Characterizing the Dynamics of Open User Experience Design: The Cases of Firefox and OpenOffice.org	[4]
Customer engagement manifestations on Facebook pages of Tesco and Walmart	[5]
Cyber-ethnography and the emergence of the virtually new community.	[6]
Diffusion of Innovation Theory and Xbox Live: Examining Minority Gamers”™ Responses and Rate of Adoption to Changes in Xbox Live.	[7]
Digital Ink Technology for e-Assessment	[8]
Drupal As a Commons-Based Peer Production Community: A Sociological Perspective	[9]
Ethics and Dilemmas of Online Ethnography	[10]
Hei Mookie! Where Do I Start? The Role of Artifacts in an Unmanned MOOC	[11]
How do online social networks support decision making? A pluralistic research agenda	[12]
Intellectual Property Norms in Online Communities: How User-Organized Intellectual Property Regulation Supports Innovation	[13]
Involving the Virtual Subject	[14]
Learning by Blogging: Understanding Salespeople's Learning Experiences on Social Media	[15]
Living the VirtuReal: Negotiating Transgender Identity in Cyberspace	[16]
Member engagement within digitally enabled social network communities: new methodological considerations	[17]
Mick or Keith: blended identity of online rock fans	[18]
Mobilization of software developers: the free software movement	[19]
Moving between virtual and real worlds: Second language learning through Massively Multiplayer Online Role Playing Games (MMORPGs)	[20]
Netnography Approach for UX Research	[21]
On qualitative methodologies and dispersed communities: Reflections on the process of investigating an open source community	[22]
Online community and the personal diary: Writing to connect at Open Diary	[23]
Online trolling: The case of Madeleine McCann	[24]
Patients Using Open-Source Disease Control Software Developed by Other Patients	[25]
Play, belief and stories about robots: A case study of a pleo blogging community	[26]
Sensemaking in Second Life	[27]
Social media in qualitative research: Challenges and recommendations	[28]
Teaching Interpersonal Problem Solving Skills Using Roleplay in a 3D Virtual World for Special Education: A Case Study in Second Life	[29]

The challenge and opportunities of crowdsourcing web communities: an italian case study	[30]
The competency building process of human computer interaction in game-based teaching: Adding the flexibility of an asynchronous format	[31]
The impact of mobile tablet devices on human information behaviour.	[32]
The impact of social software on developing communities of practice to enhance adult learning	[33]
Using Netnography to Explore the Culture of Online Language Teaching Communities	[34]
Value creation and appropriation in social media - the case of fashion bloggers in Sweden	[35]
Why are A-list bloggers continuously popular?	[36]

REFERENCES

[1] A. O. Ferreira, S. B. L. Ferreira, and D. S. Da Silveira, "Accessibility for people with cerebral palsy: The use of blogs as an agent of social inclusion," *Procedia Comput. Sci.*, vol. 14, no. Dsai, pp. 245–253, 2012.

[2] a. Broillet, M. Dubosson, and J.-P. Trabichet, "An Internet based distribution strategy of luxury products and services grounded on qualitative Web discourse analysis," *2008 IEEE Int. Prof. Commun. Conf.*, 2008.

[3] D. Banakou, K. Chorianopoulos, and K. Anagnostou, "Avatars' Appearance and Social Behavior in Online Virtual Worlds," *2009 13th Panhellenic Conf. Informatics*, vol. 5, pp. 207–211, 2009.

[4] P. M. Bach and J. M. Carroll, "Characterizing the Dynamics of Open User Experience Design : The Cases of Firefox and OpenOffice . org," *J. Assoc. Inf. Syst.*, vol. 11, no. 12, pp. 902–925, 2010.

[5] S. Peeroo, B. Jones, and M. Samy, "Customer Engagement Manifestations on Facebook Pages of Tesco and Walmart," 2015.

[6] K. J. Ward, "Cyber-ethnography and the emergence of the virtually new community," *J. Inf. Technol.*, vol. 14, no. 1, pp. 95–105, 1999.

[7] K. L. Gray, "Diffusion of Innovation Theory and Xbox Live: Examining Minority Gamers' Responses and Rate of Adoption to Changes in Xbox Live," *Bull. Sci. Technol. Soc.*, vol. 32, no. 6, pp. 463–470, 2012.

[8] W. Fisher, "Digital Ink Technology for e-Assessment," *Imsci '08 2nd Int. Multi-Conference Soc. Cybern. Informatics, Vol 1, Proc.*, pp. 4–5, 2008.

[9] D. Rozas, "Drupal as a Commons-Based Peer Production community," *Proc. Int. Symp. Open Collab. - OpenSym '14*, pp. 1–2, 2014.

[10] J. Lingel, "Ethics and dilemmas of online ethnography," *Proc. 2012 ACM Annu. Conf. Ext. Abstr. Hum. Factors Comput. Syst. Ext. Abstr. - CHI EA '12*, pp. 41–50, 2012.

[11] M. Ponti, "Hei mookie! Where do i start? The role of artifacts in an unmanned MOOC," *Proc. Annu. Hawaii Int. Conf. Syst. Sci.*, pp. 1625–1634, 2014.

[12] V. Sadovykh and D. Sundaram, "How Do Online Social Networks Support Decision Making? A Pluralistic Research Agenda," *Proc. 2015 Int. Conf. Adv. Soc. Networks Anal. Mining, 2015, Paris, Fr. August 25 - 28, 2015*, pp. 787–794, 2015.

[13] J. Bauer, N. Franke, and P. Tuertscher, “Intellectual property norms in online communities: How user-organized intellectual property regulation supports innovation,” *Inf. Syst. Res.*, vol. 27, no. 4, pp. 724–750, 2016.

[14] M. Bakardjieva and A. Feenberg, “Involving the Virtual Subjects,” *Ethics Inf. Technol.*, vol. 2, pp. 233–240, 2001.

[15] M. Rollins, J. Wei, and D. Nickell, “Learning by blogging: Understanding salespeople’s learning experiences on social media,” *Proc. Annu. Hawaii Int. Conf. Syst. Sci.*, no. 3, pp. 1656–1665, 2014.

[16] A. Marciano, “Living the VirtuReal: Negotiating transgender identity in cyberspace,” *J. Comput. Commun.*, vol. 19, no. 4, pp. 824–838, 2014.

[17] M. Germonprez and D. S. Hovorka, “Member engagement within digitally enabled social network communities: New methodological considerations,” *Inf. Syst. J.*, vol. 23, no. 6, pp. 525–549, 2013.

[18] A. J. Baker, “Mick or Keith: blended identity of online rock fans,” *Identity Inf. Soc.*, vol. 2, no. 1, pp. 7–21, 2009.

[19] M. S. Elliott and W. Scacchi, *Mobilization of software developers: the free software movement*, vol. 21, no. 1. 2008.

[20] I. Kongmee, R. Strachan, A. Pickard, and C. Montgomery, “Moving between virtual and real worlds: Second language learning through massively multiplayer online role playing games (MMORPGs),” *2011 3rd Comput. Sci. Electron. Eng. Conf. CEEC’11*, pp. 13–18, 2011.

[21] I. Hussein, M. Mahmud, and N. L. M. Noor, “Netnography approach for UX research,” *Proc. CHIuXiD 2016, 2nd Int. Hum. Comput. Interact. User Exp. Conf. Indones. Bridg. Gaps HCI UX World*, pp. 120–124, 2016.

[22] A. Sigfridsson and A. Sheehan, “On qualitative methodologies and dispersed communities: Reflections on the process of investigating an open source community,” *Inf. Softw. Technol.*, vol. 53, no. 9, pp. 981–993, 2011.

[23] A. Martinviita, “Online community and the personal diary: Writing to connect at Open Diary,” *Comput. Human Behav.*, vol. 63, pp. 672–682, 2016.

[24] J. Synnott, A. Coulias, and M. Ioannou, “Online trolling: The case of Madeleine McCann,” *Comput. Human Behav.*, vol. 71, pp. 70–78, 2017.

[25] J. Teixeira, “Patients Using Open-Source Disease Control Software Developed by Other Patients,” *Commun. Comput. Inf. Sci.*, vol. 450 CCIS, pp. 203–210, 2014.

[26] M. Jacobsson, “Play, belief and stories about robots: A case study of a pleo blogging community,” *Proc. - IEEE Int. Work. Robot Hum. Interact. Commun.*, no. 215554, pp. 232–237, 2009.

[27] A. Marshall, “Sensemaking in Second Life,” *Procedia Technol.*, vol. 13, pp. 107–111, 2014.

[28] B. McKenna, M. D. Myers, and M. Newman, “Social media in qualitative research: Challenges and recommendations,” *Inf. Organ.*, vol. 27, no. 2, pp. 87–99, 2017.

[29] A. I. Mørch, M. D. Hartley, and V. Caruso, “Mørch, A. I., Hartley, M. D., & Caruso, V. (2015). Teaching Interpersonal Problem Solving Skills using Roleplay in a 3D Virtual World for Special Education : A Case Study in Second Life, 464–468. doi:10.1109/ICALT.2015.139Teaching Interpersonal Problem So,” no. April 2016, pp. 464–468, 2015.

[30] M. C. Di Guardo and M. Castriotta, “The challenge and opportunities of crowdsourcing web communities: An Italian case study,” *Int. J. Electron. Commer. Stud.*, vol. 4, no. 1, pp. 79–92, 2013.

[31] S. Emad, A. Broillet, W. Halvorson, and N. Dunwell, “The competency building process of human computer interaction in game-based teaching: Adding the flexibility of an asynchronous format,” *IEEE Int. Prof. Commun. Conf.*, 2013.

[32] S. Burford and S. Park, “The impact of mobile tablet devices on human information behaviour,” *J. Doc.*, vol. 70, no. 4, pp. 622–639, 2014.

[33] L. Manasia, “The Impact of Social Software on Developing Communities of Practice to Enhance Adult Learning,” in *The International Scientific Conference eLearning and Software for Education*, 2013, vol. 2, pp. 598–603.

[34] D. Kulavuz-Onal, “Using Netnography to Explore the Culture of Online Language Teaching Communities,” *CALICO J.*, vol. 32, no. 3, pp. 426–448, 2015.

[35] C. Pihl and C. Sandström, “Value creation and appropriation in social media - the case of fashion bloggers in Sweden,” *Int. J. Technol. Manag.*, vol. 61, no. 3/4, p. 309, 2013.

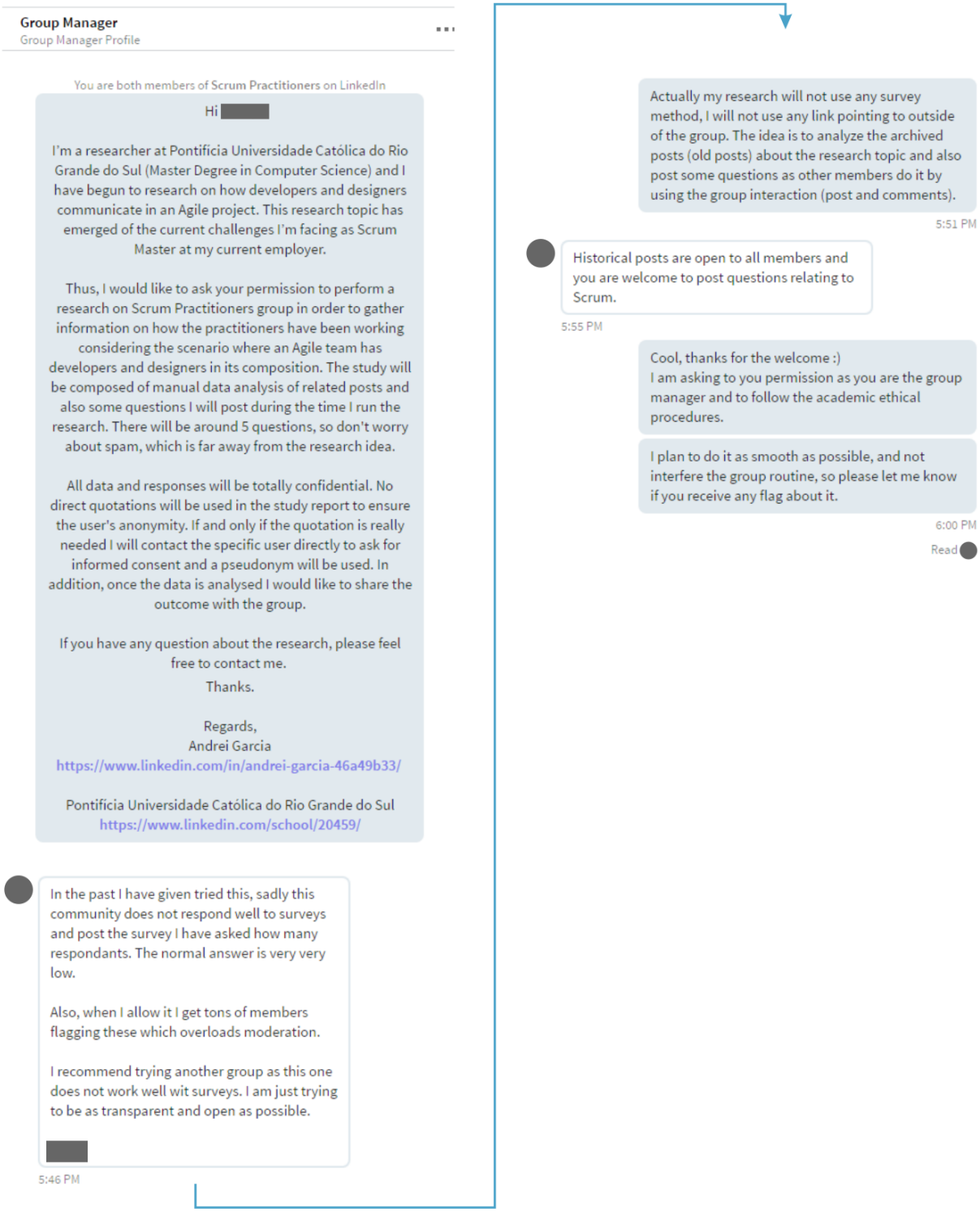
[36] H. Ko, “Why are A-list bloggers continuously popular?,” *Online Inf. Rev.*, vol. 36, no. 3, pp. 401–419, 2012.

Status	Tool	Topic	Community Name	Language	Members	Relevant	Active	Interactive	Substantial	Heterogeneity	Rich in Data	Experiential
Joined	Linkedin	AGILE	Scrum Practitioners	English	98384	High	High	High	High	N/A	High	N/A
Joined	Linkedin	UCD	UX Professionals	English	64899	High	Medium	Low	High	N/A	High	N/A
Joined	Slack	AGILE	Hands on Agile	English	1202	High	High	High	Low	N/A	Medium	N/A
Joined	Linkedin	UCD	User Experience Group	English	38451	High	Low	High	Medium	N/A	High	N/A
Joined	Linkedin	AUCD	Agile UX	English	17811	Hight	Medium	Low	Medium	N/A	Medium	N/A
Joined	Linkedin	UCD	User Experience	English	132842	Low	High	Low	High	N/A	Low	N/A
Joined	Linkedin	AGILE	Agile	English	55938	Low	Low	Low	High	N/A	Low	N/A
Joined	Linkedin	UCD	Design Research	English	57760	Low	Low	Low	High	N/A	Low	N/A
Joined	Facebook	AGILE	Scrum & Agile	English	237	Low	Low	Low	Low	N/A	Low	N/A
Joined	Slack	UCD	UX Design Community	English	1730	Low	Low	Low	Low	N/A	Low	N/A
Joined	Slack	UCD	Open Design	English	176	Low	Low	Low	Low	N/A	Low	N/A
Joined	Facebook	UCD	UX Design	English	4078	Low	Medium	Low	Low	N/A	Low	N/A
Joined	Linkedin	AUCD	Lean UX	English	3923	Low	Medium	Medium	Low	N/A	Low	N/A
Joined	Facebook	UCD	Design (UI/UX)	English	22043	Low	Low	Low	Medium	N/A	Low	N/A
Joined	Facebook	UCD	UI/UX designers	English	32748	Low	Medium	Low	Medium	N/A	Low	N/A
Joined	Linkedin	UCD	UX & IA (User Experience and Information Architecture)	English	7374	Low	Medium	Low	Medium	N/A	Low	N/A
Joined	Slack	UCD	Spec	English	8611	Low	Medium	Low	Medium	N/A	Low	N/A
Joined	Linkedin	AGILE	Scaled Agile Framework® (SAFe®)	English	18856	Low	Low	Medium	Medium	N/A	Low	N/A
Joined	Linkedin	AGILE	Agile and Lean Software Development	English	132412	Medium	Low	High	High	N/A	Low	N/A
Joined	Linkedin	UCD	Interaction Design Association	English	99759	Medium	Medium	Low	High	N/A	Medium	N/A
Joined	Slack	AGILE	#agile	English	380	Medium	High	High	Low	N/A	Low	N/A
Joined	Facebook	AGILE	Modern Agile	English	670	Medium	Medium	Low	Low	N/A	Low	N/A
Joined	Slack	UCD	uxguide	English	942	Medium	Medium	Low	Low	N/A	Low	N/A
Joined	Slack	AGILE	Modern Agile	English	595	Medium	High	Medium	Low	N/A	Medium	N/A
Joined	Slack	AUCD	Agilidade	Portuguese	2683	Medium	High	Medium	Low	N/A	Medium	N/A
Joined	Linkedin	UCD	**Interaction Design Foundation**	English	17505	Medium	Medium	Low	Medium	N/A	Medium to Low	N/A
Joined	Linkedin	UCD	User Experience Professionals Association	English	17047	Medium	Medium	Medium	Medium	N/A	Medium	N/A
Pending	Facebook	UCD	UX - Experience Design	Portuguese	4371	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pending	Facebook	UCD	User experience design	English	1541	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pending	Linkedin	AGILE	Agile Networking Group	English	21753	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pending	Linkedin	AGILE	Agile, Kanban, Scrum, Kaizen, CMMi and Lean	English	4752	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pending	Linkedin	AGILE	Agile Tour	English	763	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pending	Linkedin	AUCD	Agile Experience Design	English	4386	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pending	Linkedin	UCD	Human Centered Design and User Experience	English	242	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pending	Linkedin	UCD	UXtreme	English	61	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pending	Slack	UCD	Design Talks	English	3190	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Active		Interactive		Substantial	
Messages/Day	**Ranking**	**Comments/Post**	**Ranking**	**No Members**	**Ranking**
>= 20	Hight	>= 10	High	> 50.000	High
>=10 AND < 20	Medium	>= 2 AND < 10	Medium	>= 5.000 AND < 50.000	Medium
< 10	Low	< 2	Low	< 5.000	Low

Relevant factor has no scale since it was evaluated considering the research focus and questions
Rich in data and **Experimental** factors were evaluated considering the time spent in those communities and a first search about Agile UCD related posts
Heterogeneity could not measured since LinkedIn has closed his API to extract analytics data.

APPENDIX F – LINKEDIN GROUP MANAGER PERMISSION



Group Manager
Group Manager Profile

You are both members of Scrum Practitioners on LinkedIn

Hi [redacted]

I'm a researcher at Pontificia Universidade Católica do Rio Grande do Sul (Master Degree in Computer Science) and I have begun to research on how developers and designers communicate in an Agile project. This research topic has emerged of the current challenges I'm facing as Scrum Master at my current employer.

Thus, I would like to ask your permission to perform a research on Scrum Practitioners group in order to gather information on how the practitioners have been working considering the scenario where an Agile team has developers and designers in its composition. The study will be composed of manual data analysis of related posts and also some questions I will post during the time I run the research. There will be around 5 questions, so don't worry about spam, which is far away from the research idea.

All data and responses will be totally confidential. No direct quotations will be used in the study report to ensure the user's anonymity. If and only if the quotation is really needed I will contact the specific user directly to ask for informed consent and a pseudonym will be used. In addition, once the data is analysed I would like to share the outcome with the group.

If you have any question about the research, please feel free to contact me.
Thanks.

Regards,
Andrei Garcia
https://www.linkedin.com/in/andrei-garcia-46a49b33/

Pontificia Universidade Católica do Rio Grande do Sul
https://www.linkedin.com/school/20459/

In the past I have given tried this, sadly this community does not respond well to surveys and post the survey I have asked how many respondants. The normal answer is very very low.

Also, when I allow it I get tons of members flagging these which overloads moderation.

I recommend trying another group as this one does not work well wit surveys. I am just trying to be as transparent and open as possible.

[redacted]

5:46 PM

Actually my research will not use any survey method, I will not use any link pointing to outside of the group. The idea is to analyze the archived posts (old posts) about the research topic and also post some questions as other members do it by using the group interaction (post and comments).

5:51 PM

Historical posts are open to all members and you are welcome to post questions relating to Scrum.

5:55 PM

Cool, thanks for the welcome :)
I am asking to you permission as you are the group manager and to follow the academic ethical procedures.

I plan to do it as smooth as possible, and not interfere the group routine, so please let me know if you receive any flag about it.

6:00 PM

Read

APPENDIX G – INICIAL CODEBOOK

Code	Label	Description
ARTIFACT	Artifacts	An artifact is defined as an "…aspect of the material world that has been modified over the history of its incorporation into goal-directed human action.". From Systematic Mapping Study the following artifacts were identified: List, Map, Mockup, Model, Persona, Prototype, Research Results, Scenario, Sketch, Storyboard, Storytelling, UI Design, Use Case, User Flow, User Story, UX Target, Wireframe.
COMMUNICATION	Communication	"means of connection between people or places, in particular." in the context of this research context communication between designer and developer.
DIFFERENT_TEAM	Different Team	Designer and developer working in separated teams.
DISTRIBUTED	Distributed	Designer and developer working distributed, not in the same place.
EVENT	Agile Events	Agile event or ceremonies, such as planning, daily, and retrospective. From Systematic Mapping Study the following events were identified: Discovery, Planning, Iterative Cycle, Review, and General Meetings.
SAME_TEAM	Same Team	Designer and developer working as part of the same agile team.

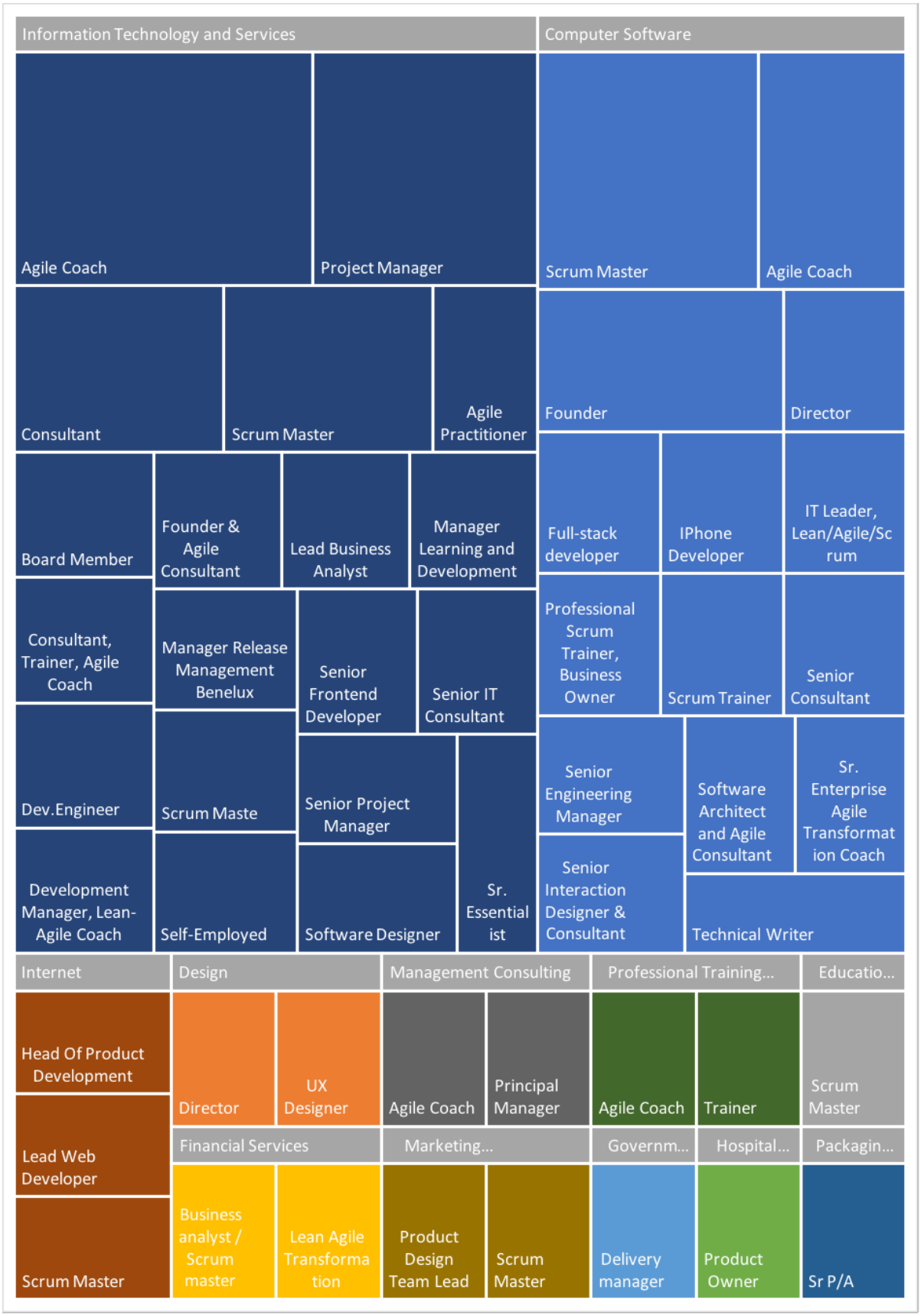
APPENDIX H – FINAL CODEBOOK

Code	Label	Description
ARTIFACT	Artifacts	An artifact is defined as an "…aspect of the material world that has been modified over the history of its incorporation into goal-directed human action.". From Systematic Mapping Study the following artifacts were identified: List, Map, Mockup, Model, Persona, Prototype, Research Results, Scenario, Sketch, Storyboard, Storytelling, UI Design, Use Case, User Flow, User Story, UX Target, Wireframe.
COLLABORATION	Collaboration	Designer and developer working together in order to deliver value.
COMMUNICATION	Communication	"means of connection between people or places, in particular." in the context of this research context communication between designer and developer.
CONFLICT	Conflicts	Possible conflicts between developer and designer.
CROSS_FUNCTIONAL	Cross-functional team	"Cross-functional teams have all competencies needed to accomplish the work without depending on others not part of the team." [SCSU17]
DESIGNER_ROLE	Designer Role	Where the designer works, and designer responsibilities.
DIFFERENT_TEAM	Different Team	Designer and developer working in separated teams.
DISCOVERY	Event – Discovery	Event performed prior start a project, it is also called Sprint 0 sometimes.
DISTRIBUTED	Distributed	Designer and developer working distributed, not in the same place.
EVENT	Agile Events	Agile event or ceremonies, such as planning, daily, and retrospective. From Systematic Mapping Study the following events were identified: Discovery, Planning, Iterative Cycle, Review, and General Meetings.

EXTERNAL_LINK	External Link	Any posted external link, redirecting to outside of the LinkedIn group.
ITERATIVE_CYCLE	Event - Iterative Cycle or Sprints	“A time-box of one month or less during which a ‘Done’, useable, and potentially releasable product Increment is created.” [SCSU17]. Synonyms: “Sprint”, “Iteration”.
MOCKUP	Artifact – Mockups	A mockup is a static high-fidelity visual design. It does not provide any functionality, so here is the difference between a mockup and a prototype.
NO_TITLE	No Titles	“Scrum recognizes no titles for Development Team members, regardless of the work being performed by the person” [SCSU17]
PERSONA	Artifact - Personas	Hypothetical archetype that represents a specific person in a specific work role, with specific user characteristics [HAPY12].
PLANNING	Event – Planning	Sprint Planning is a meeting to answer the following: “What can be delivered in the Increment resulting from the upcoming Sprint?” and “How will the work needed to deliver the Increment be achieved?”
PROTOTYPE	Artifact – Prototypes	Preliminary model of a system. It can be anything from a paper-based storyboard through to a complex software piece [PRRS15].
REFINEMENT	Event – Backlog Refinement	“Product Backlog refinement is the act of adding detail, estimates, and order to items in the Product Backlog”. [SCSU17]
REVIEW	Event – Reviews	“A Sprint Review is held at the end of the Sprint to inspect the Increment and adapt the Product Backlog if needed.” [SCSU17]
SAME_TEAM	Same Team	Designer and developer working as part of the same agile team.
SKECTH	Artifact – Sketches	Sketching is the quick creation of freehand drawing to express preliminary ideas, always focusing on ideas instead of details. Usually a sketch is the main foundation for a wireframe or a prototype [HAPY12].

STYLE_GUIDE	Artifact – Style Guides	Set of standards for design and writing. Contains specifications of how to design a software or more specific an interface.
T_SHAPED	T-Shaped Skills	T-Shape skills is defined as a person who has deep knowledge in a main topic and also broad knowledge in other related subjects. Synonyms: “T Shape”.
TEAM_COMPOSITION	Team Composition	How the team is structure considering people skills and roles.
TOOL	Tools	Tools used to create, collaborate, or share an artifact.
UPFRONT	Upfront Design	Design is done ahead the development starts working in a particular feature. Synonyms: “Little Design Upfront”, “Big Design Upfront”, and “Design Upfront”.
USER_STORY	Artifact – User Stories	Generally used in Agile projects, a User Story describes a valuable functionality focused on the user [COHN04].
UX_MEETING	Event – General Meetings	Any general meeting performed other than the regular agile events, that requires any artifact-based communication.
VALUE	Delivered Value	By the end of each iteration, the working piece of software must deliver some value to the stakeholder.
VERTICAL_SLICE	Vertical Slice	Strategy to create a work item or user story that deliver valuable changes in the system. It includes changes in each architectural layer.
WIREFRAME	Artifact – Wireframes	A wireframe is considered a form of prototype and comprises lines and outlines – hence the name *wire frame* – of mostly boxes to represent evolving interactions designs [HAPY12]

APPENDIX I – TREEMAP MEMBERS, INDUSTRIES, AND JOB POSITION



APPENDIX J – MEMBERS CLASSIFICATION INFORMATION

Pseudonym	Skill A	Skill B	Skill C
Adam	User Experience Design	User Interface Design	Agile Methodologies
Alger	Business Intelligence	Data Warehousing	Program Management
Ambrose	Product Design	User Experience	User Interface Design
Ansel	Coaching	Agile Methodologies	Agile Project Management
Barry	Agile Methodologies	Scrum	Software Development
Benjamin	Business Intelligence	Enterprise Architecture	Agile Methodologies;
Brayden	Agile Methodologies	SDLC	Software Project Management
Brook	Software Development	Software Engineering	Agile Methodologies
Bryson	Scrum	Agile Methodologies	.NET
Celena	Accounting	Tax Software	Tax Accounting
Cletus	Web Development	PHP	Affiliate Marketing
Clifford	Project Management	Agile Methodologies	Software Development
Dewayne	Leadership	Scrum	Training
Dex	Service Now	ITIL	IT Service Management
Diggory	Agile Project Management	Scrum Master	Software Engineering
Donnie	Program Management	Integration	Business Analysis
Douglas	PHP	MySQL	CMS
Elizabeth	Agile	CMMI	Lean SIX SIGMA
Fermin	Requirements Analysis	Testing	SQL
Florene	Business Analysis	Requirements Analysis	Business Requirements
Forrest	PHP	JavaScript	jQuery
Frederick	Interaction Design	User Experience Design	Information Architecture
Fritz	Management	Strategy	Management Consulting
Gavin	Web Development	CSS	CMS
Grier	Scrum	Struts	Java Enterprise Edition
Harold	Certified Scrum Master	Agile Project Management	Project Planning
Harve	Business Analysis	SDLC	Requirements Gathering
Herman	Agile Methodologies	Cross-functional Leadership	Cloud Computing
Isaac	Scrum	Agile Methodologies	Agile Project Management
Jacob	Agile Project Management	Agile Methodologies	Scrum
Jaden	Agile & Waterfall Method.	Product Owner	Business Process
Jarrett	Design Thinking	User-centered Design	Interaction Design
Jeffrey	Scrum	Agile Methodologies	Software Development
Jerald	Software Project Mngt	Software Development	Business Analysis
Jesse	Process Improvements	Project Management	Business Process Improv.
Joe	Scrum	Project Management	Microsoft SQL Server;
Judson	.NET	Software Development	WCF
Kyle	Project Management	Business Analysis	Quality Assurance
Lynda	Leadership	Time Management	Teamwork
Marianna	Software Development	Agile Methodologies	Java
Marlina	Scrum	Agile Project Management	Business Analysis
Marshall	Interaction Design	User Experience	User Interface Design
Mathew	Project Manager	Quality Assurance	Scrum
Matt	Requirements Analysis	Scrum	Functional Specifications
Melvin	Certified Product Owner	Linux	Unix
Parker	Agile Methodologies	Scrum	PHP
Preston	Product Management	Product Development	Scrum
Prosper	Stakeholder Management	Agile Methodologies	Process Improvement
Rex	Project Management	Business Analysis	Business Process
Ronnie	Project Management	Scrum	Agile
Roosevelt	Scrum	Agile Methodologies	Coaching
Rowley	UML	Software Engineering	Software Development
Schuyler	Business Intelligence	ICT	Scrum
Scott	Technical Writing	Software Documentation	Process Improvement

Sharolyn	Change Management	Coaching	Management Consulting
Sophia	Agile Methodologies	Program Management	Integration
Stanley	Agile Methodologies	Scrum	Software Engineering
Steven	Software Project Mngt	Agile Methodologies	Enterprise Software
Trenton	Agile Methodologies	Mobile Devices	Software Development
Tylar	Web Applications	Cloud Computing	Agile Project Management
Vicent	ITIL	Project Portfolio Mngt	IT Management
Victor	Agile Methodologies	Scrum	Team Leadership
Zuriel	C#	Web Services	WCF

Pseudonym	Industry	Region	Member Categoriz.	Job Position
Adam	Information Technology and Services	United States	Insider	Software Designer
Alger	Information Technology and Services	Australia	Insider	Self-Employed
Ambrose	Marketing and Advertising	Australia	Devotee	Product Design Team Lead
Ansel	Financial Services	Singapore	Devotee	Lean Agile Transformation - Executive Coach
Barry	Computer Software	United States	Devotee	Agile Coach
Benjamin	Information Technology and Services	United States	Insider	Agile Coach
Brayden	Information Technology and Services	United States	Devotee	Consultant
Brook	Marketing and Advertising	United Kingdom	Insider	Scrum Master
Bryson	Computer Software	Australia	Insider	Professional Scrum Trainer, Business Owner
Celena	Computer Software	United States	Devotee	Agile Coach
Cletus	Internet	United Kingdom	Devotee	Lead Web Developer
Clifford	Computer Software	United States	Devotee	IT Leader, Lean/Agile/Scrum
Dewayne	Computer Software	Canada	Devotee	Scrum Trainer
Dex	Professional Training & Coaching	United Kingdom	Insider	Trainer
Diggory	Information Technology and Services	United Kingdom	Devotee	Founder & Agile Consultant
Donnie	Management Consulting	United States	Devotee	Principal Manager
Douglas	Internet	Switzerland	Insider	Scrum Master
Elizabeth	Information Technology and Services	Brazil	Tourist	Agile Coach
Fermin	Information Technology and Services	United Kingdom	Devotee	Senior IT Consultant
Florene	Information Technology and Services	United Kingdom	Devotee	Lead Business Analyst
Forrest	Information Technology and Services	Malaysia	Devotee	Senior Frontend Developer
Frederick	Computer Software	Germany	Devotee	Senior Interaction Designer & Consultant
Fritz	Information Technology and Services	India	Tourist	Manager Learning and Development
Gavin	Information Technology and Services	Australia	Devotee	Project Manager
Grier	Information Technology and Services	India	Devotee	Project Manager
Harold	Management Consulting	Brazil	Devotee	Agile Coach
Harve	Information Technology and Services	United States	Devotee	Consultant
Herman	Computer Software	United States	Insider	Scrum Master

Isaac	Information Technology and Services	Latvia	Devotee	Agile Coach
Jacob	Information Technology and Services	Canada	Devotee	Development Manager, Lean-Agile Coach
Jaden	Hospital & Health Care	United States	Devotee	Product owner (SAFe)/Sr business analyst
Jarrett	Design	United States	Devotee	Director
Jeffrey	Computer Software	Denmark	Devotee	Software Architect and Agile Consultant
Jerald	Packaging and Containers	United States	Devotee	Sr P/A
Jesse	Information Technology and Services	United Kingdom	Devotee	Board Member
Joe	Information Technology and Services	Ireland	Insider	Scrum Master
Judson	Computer Software	United States	Devotee	Senior Consultant
Kyle	Information Technology and Services	United States	Devotee	Sr. Essentialist
Lynda	Computer Software	Canada	Devotee	Scrum Master
Marianna	Computer Software	United States	Devotee	Scrum Master
Marlina	Information Technology and Services	United States	Devotee	Senior Project Manager
Marshall	Design	Australia	Tourist	UX Designer
Mathew	Computer Software	United States	Devotee	Sr. Enterprise Agile Transformation Coach
Matt	Financial Services	United States	Devotee	Business analyst / Scrum master
Melvin	Computer Software	United States	Devotee	Senior Engineering Manager
Parker	Information Technology and Services	India	Devotee	Scrum Master
Preston	Education Management	China	Devotee	Scrum Master
Prosper	Information Technology and Services	United Kingdom	Devotee	Scrum Master
Rex	Information Technology and Services	New Zealand	Devotee	Project Manager
Ronnie	Government Administration	United Kingdom	Devotee	Delivery manager
Roosevelt	Information Technology and Services	Netherlands	Devotee	Dev. Engineer
Rowley	Computer Software	France	Devotee	Founder
Schuyler	Information Technology and Services	Netherlands	Devotee	Manager Release Management Benelux
Scott	Computer Software	United States	Devotee	Technical Writer
Sharolyn	Information Technology and Services	Germany	Devotee	Agile Coach
Sophia	Professional Training & Coaching	United States	Devotee	Agile Coach
Stanley	Computer Software	United States	Insider	IPhone Developer
Steven	Computer Software	India	Devotee	Founder
Trenton	Computer Software	United Kingdom	Devotee	Director
Tylar	Internet	Saudi Arabia	Devotee	Head Of Product Development
Vicent	Information Technology and Services	Latvia	Devotee	Consultant, Trainer, Agile Coach
Victor	Information Technology and Services	Australia	Devotee	Agile Practitioner
Zuriel	Computer Software	Australia	Insider	Full-stack developer

Pontifícia Universidade Católica do Rio Grande do Sul
Pró-Reitoria de Graduação
Av. Ipiranga, 6681 - Prédio 1 - 3º. andar
Porto Alegre - RS - Brasil
Fone: (51) 3320-3500 - Fax: (51) 3339-1564
E-mail: prograd@pucrs.br
Site: www.pucrs.br