Exploration of User-Centered Agile Development Practices

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Abstract

During the past decade, there has been a growing interest in how to integrate user-centered approaches in agile processes. This study researches the topic of Norwegian user-centered agile development through an exploratory interview study. Insight is given into how agile developers understand user-centered design, regard proposed integration models and perceive multidisciplinary cooperation and integration. The impression is that fundamental principles of agile and user-centered methodologies are not necessarily merged in integrated approaches. Findings suggest proposed parallel integration models are generally well received among developers, however the success of merged models seems to rest heavily on comfortable project constraints. An interesting insight from the study is how proposed parallel models may be disadvantageous to interdisciplinary collaboration in multidisciplinary teams.

Keywords: user-centered design, agile development, interdisciplinary, parallel integration

1 Introduction

IT-solutions are vital parts of modern Nordic business models, and software may be mission-critical as well as crucial for competitiveness. In order to get a competitive edge in a constantly changing market, responding quickly and exploiting new opportunities are essential, but as are creating great user experiences. Ensuring user experience design in agile development has heightened the need for a merger between agile and user centered methodology. Thus, there has been an increasing interest in how to integrate user-centered design (UCD) approaches into agile development processes (VersionOne, 2015), and several possible theoretical process models have been suggested (Miller, 2005; Sy, 2007; Beyer, 2010; Silva da Silva, Martin, Maurer & Silviera, 2011; Thorkildsen, 2014). As of today, several Norwegian development companies are attempting to develop their own integrated approaches merging the two methodologies. According to literature, they face several challenges. Literature report on a culture gap between designers and developers, with diverging principles and core values, which may cause collaboration and communication challenges (Beyer, Holtzblatt & Baker, 2004; Beyer, 2010; Salah, Paige & Cairns 2014b). For example, user-centered methodology focuses on early planning and user research to

understand users needs and specify contexts of use, while agile methodology is focused on rapid production of functional software for costumer review. Research also indicate agile user-centered methodology does not fully integrate the principles and methodological breath of user-centered design (Begnum & Thorkildsen, 2015), and Raison & Schmidt (2013) claim the status of user-centered design is a key factor to the success of a methodological merger. As there is little knowledge on how suggested integrated approaches work in practice, this study seeks to explore the practices and views of agile developers in Norway. Focus is on the developers' understandings and perceptions of UCD, experiences with integrated user centered agile (UCA) processes and insights related to multidisciplinary team cooperation.

2 Background

User-Centered Design (UCD) is a methodological approach where the user is the focal point throughout the design and development process (Rubin & Chisnell, 2008). The main goal is to create solutions with high usability, fitting user needs and contexts of use. Basing design on user needs is essential to UCD, thus key aspects of the methodology are user involvement, user testing prototypes (including mockups, sketches, real or simulated use) and re-design (Gould & Lewis, 1985; Rogers, Sharp & Preece, 2011). The ISO 9241-210:2010 standard on Human-centred design (ISO, 2015) is often used as a best-practice approach for user-centered design processes; starting with initial planning then iterating the phases 1) understand and specify context of use, 2) specify user requirements, 3) produce design solutions to meet user needs and 4) evaluate designs - until a solution that meets user requirements is designed. ISO (2015) specify the following core principles: basing design upon an explicit understanding of users, tasks and environments, involving users throughout design and development, design driven and refined by user-centered evaluation, iterative process, design addressing the whole user experience and including multidisciplinary skills and perspectives on the design team. Gould and Lewis (1985) emphasize early and continual focus on users, empirical measurement of usage and iterative design as basic UCD principles. The exact levels of user contact and user involvement in UCD approaches are not specified, nor are there strong recommendations tied to methodology for user research, specification and testing (Begnum & Thorkildsen, 2015). Thus, some UCD processes emphasize indirect, low contact methods, while others utilize participatory design techniques and have high contact strategies.

UCD as a methodology does not belong to one particular academic field. The assumption is typical user-centered designers on Norwegian agile projects belong to professions such as Interaction design (IxD), User Interface (UI) design, Information design, Visual design and Web design. These professions overlap, and all are viewed as belonging within the area of User eXperience (UX) design (Saffer, 2010:20). Since UX also covers physical design, the term IxD may be chosen to specify focus on software products (Cooper, Reimann & Cronin, 2007). This article uses the term "UX/IxD" for any (user-centered) designers on agile teams.

Like UCD, agile methodology is based on iterative software development processes and relies on multidisciplinary teams. The Agile Manifesto (2001) presents 12 principles of agile software, valuing Individuals and interactions over processes and tools, Working software over comprehensive documentation, Customer collaboration over contract negotiation, and Responding to change over following a plan. Agile development typically run short iterations focused on producing working code, recommending early and frequent deployment (incremental delivery) (Petersen & Wohlin, 2010). The iterative approach facilitates a high tolerance for changes from one iteration to the next, involving the costumer in development

and testing in order to continuously detect errors, changing needs or priorities (Constantine, 2001). Agile methodology thus represents a fundamental shift from traditional linear and plan-driven software development with emphasis on delivery in phases.

A number of different agile practices exist, such as eXtreme programming (XP), Scrum and Kanban. While XP is emphasizing specific techniques for agile development, Scrum suggests a process framework for agile management (Sommerville, 2011). The agile Scrum team is to be self-driven, with the project manager (Scrum master) acting as a facilitator. In Scrum, iterations are labeled "Sprints". The team commits to implement tasks (Sprint backlog) from a to-do list prioritized by the costumer (Product backlog) within an estimated time frame. Main activities in Sprint planning and Sprint review is updating back-logs and estimates. Daily stand-up meetings ensure close team collaboration. Kanban approaches focus less on management and more on flow, visualizing the workflow and limiting the number of unfinished work in progress – encouraging collaboration to resolve congestions.

Though UCD and agile methodologies have similarities, they also have diverging principles and processes that complicate a merger (Beyer, 2010; Beyer et.al. 2004, Salah et.al. 2014b). A contrast between user centered and agile methodologies is the focus on requirement specification. While user-centered processes place emphasis on understanding and specifying requirements (which could be viewed as big design up front – BDUF), agile approaches is based on detecting costumer requirements as you go, little design up front (LDUF) and just-in-time (JIT) production. The agile approach may lead to limited focus on overall design, be based on weak or faulty assumptions about users and context of use, or create solutions fitting the business needs of the costumer rather than users needs (Constantine, 2001). There are indications of differences in methods utilization in agile versus non-agile user-centered development processes (Begnum & Thorkildsen, 2015), and this indicates there could be differences in user-centered culture, perceptions and understanding between design professions and agile developers. Raison & Schmidt (2013) highlight successful integration could depend on organizations valuing user-centered design perspectives and Salah, Paige and Cairns (2014a) reveal lacking managerial awareness of the importance of UCD on resulting quality may lead to integration and collaboration challenges. Examples are lack of allocated time for upfront activities and lack of support and time for UCD activities including user testing. Generic principles for an integrated methodology have not yet been arrived at, though this work has started (Bhrel, Meth, Maedche & Werder, 2015).

Integrated process models for User-Centered Agile (UCA) software development often suggest parallel paths of design and development, where design activities are a Sprint ahead of development (Miller, 2005; Sy, 2007; Silva da Silva et.al, 2011; Nodder & Nielsen, 2009; Thorkildsen, 2014). Most models focus on integrating IxD and UI-design over UX and user involvement, and suggests some design up front (SDUF) through a Sprint 0 containing user research. Several researchers note that full integration of UX/IxD resource as team members as well as team co-location is important for successful merger (Raison & Schmidt, 2013; Silva da Silva, Silviera & Maurer, 2013; Brhel et.al, 2015).

3   Methodology

This paper investigates user-centered agile integrated development practices and perceptions through an exploratory interview study. An exploratory and flexible approach is deemed fitting for the investigation, as there is limited previous knowledge of Norwegian developers

integrated work practices and views (Lazar, Feng & Hochheiser, 2010:180). The goal of the study is to provide an initial understanding of practices in the area of agile user-centered processes, as well as potentially identify interesting insights and hypotheses that may be explored further. Therefore, an in-depth qualitative approach was chosen even if this results in limited validity due to a local and small sample. The number of informants in this study is 7, which is slightly less than the desired target number of 10. The selection criteria are software developers/programmers that have experience working in agile projects as well as on inter-disciplinary agile projects where user-centered professionals (UX/IxD) are part of the team. Convenience sampling is used. The study is more situated than embedded, as the researchers are interaction designers with a somewhat limited experience in agile and user-centered projects. The authors thus have a partially critical distance to agile development culture.

A semi-structured method is utilized collecting qualitative data, aiming at pursuing information, questions and ideas identified during the study (Rogers, Sharp & Preece, 2011). The core research focus is framed through an interview guide. The guide is divided into three parts; one focuses on background data, a second focuses on the informants knowledge and experience with agile methodology and user-centered methodology, and a third target the informants reflections and insights related to integration and multidisciplinary collaboration. An example of a suggested parallel integration model (Thorkildsen, 2014) is presented to the informants as a tool for discussion. Interview questions are designed to be neutral and non-biased, avoiding double-barred questions, complex phrasings and biased or negative words (Lazar, Feng & Hochheiser, 2010). The interviews are audio recorded, and transcribed based on recording and notes prior to data analysis. Oral consent is used both for interview and audio recording separately.

Thematic content analysis is used to analyze the transcripts. Both emergent and a-priory coding is utilized during analysis, with an emphasis on emergent categories. Only two a-priory categories are used; *perception of user-centered design* (UCD) and *costumer versus user distinction*. In relation to understandings and perceptions of UCD focus is on coding the developers' knowledge, terms usage and descriptions in order to explore if their perception covers core aspects of the methodology as described in ISO 9241-210:2010 (ISO, 2015), and to investigate whether there is an awareness of who the *user* is within UCD methodology. Emergent coding is used to investigate the developers' experiences and insights into integrated UCA processes and multidisciplinary team collaboration.

4   Results

In the Results section, the informants background data is first described along with their level of experience with agile methodology. Next, the informants' perception and understanding of user-centered methodology is presented. Third, the informants experiences and insights related to multidisciplinary collaboration is reported, and the final section covers reflections and views on agile and user-centered merger.

4.1   The Informants Backgrounds

The informants work in 6 different companies (see Table 1). Two of the companies are categorized as *small* (< 29 employees), 2 as *medium* (30-99 employees) and 3 as *large* (> 100 employees). Two of the companies are more streamlined towards delivering a specific type of software, while the other are more general IT-consultancies. Six of the informants are male, and one is female. Two informants have dual positions as developers *and* managers.

Table 1. Informants Overview

Informant	Gender	Age	Company	Size	Position
"Are"	M	20-30	SW company A	Small	Developer
"Dan"	M	30-40	Consultancy A	Large	Developer /Manager[1]
"Per"	M	30-40	Consultancy B	Large	Developer /Manager[2]
"Pia"	F	20-30	Consultancy B	Large	Developer
"Roy"	M	30-40	Consultancy C	Medium	Developer
"Tor"	M	30-40	Consultancy D	Medium	Developer
"Jon"	M	30-40	SW company B	Small	Developer

The informants are asked on their experience with agile development, measured by an estimated number of agile projects they have participated in, as well as their total years of experience as developers. Based on a qualitative assessment of these data they are categorized as having *novice*, *intermediate* or *expert* agile proficiency. Further, the types of agile experiences are explored. Three main types of agile methodologies are identified; Scrum-based, Kanban-based, and hybrid processes that are modified versions of Scrum (no longer adhering to basic Scrum-principles). Table 2 presents agile experience data.

Table 2. Agile Experiences

Informant	Agile Proficiency	Agile Methodology Experience
"Are"	Novice	Hybrid
"Dan"	Expert	Scrum/Hybrid
"Per"	Expert	Scrum/Kanban/Hybrid
"Pia"	Expert	Scrum/Kanban Hybrid
"Roy"	Novice	Hybrid
"Tor"	Expert	Scrum/Hybrid
"Jon"	Intermediate	Scrum/Hybrid

4.2 Perceptions of User-Centered Design

Descriptions of UCD vary among the informants and most are very general. For example, "Jon" and "Tor" explains UCD as developing software *"with the user in mind"* and "Per" as "focusing on users' needs". Only one of the informants – "Roy" – is uncertain as to what UCD is and describes it as *"related to user involvement"* which is a correct assumption, but is unable to elaborate. Compared to ISO 9241-210 the most noticeable UCD knowledge missing from discussions is related to the overall process and phases typically involved in UCD, and the principles of basing design upon a deep understanding of users, contexts and addressing the whole user experience. Instead, "Jon" and "Tor" highlights usability aspects rather than UCD methodology; focusing on ergonomics, solutions that are easy to learn and easy to use, as well as aspects such as readability and font size, while "Per", "Dan" and "Pia" focus on specific methods for user research and evaluation, such as interviews, personas and user tests. On the other hand, 4 of the 7 informants mention user-contact or involvement, and of these 3 emphasize early involvement. Table 3 presents categorized aspects mentioned.

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[1] Project Manager
[2] Technical Project Manager

Table 3. User-Centered Design Descriptions

Aspect of methodology	Mentioned by
User focus	"Per", "Jon", "Tor"
User involvement	"Are", "Dan", "Pia", "Roy"
Early involvement	"Are", "Dan", "Pia"
User research (including interviews)	"Dan", "Per", "Pia"
Personas	"Per"
User testing	"Dan", "Per"
Interface design	"Tor"

The informants easily separate a *costumer* from a *user* theoretically; however report that in UCA practice the two are often blurred. "Dan" explains costumers convey business requirements, while users convey user requirements – an important distinction sometimes forgotten in real life. "Jon" describes how the costumer may feel there is no need for user involvement – for instance due to costumer confidence in already knowing user needs. Both "Jon" and "Tor" describes scenarios in agile development where the costumer represents the users and controls the dialogue with end-users. "Dan" and "Jon" states end-user needs may be given a low priority due to limited resources, and how constraints related to organizational issues may outweigh user needs. All informants agree that UX/IxD contributions are highly relevant within agile development. Two developers, "Dan" and "Pia", emphasize the importance of UX/IxD for identifying needs in project startup. As such, there seems to be an awareness of UCD principles related to involving users throughout design and development. The more experienced developers are able to give somewhat detailed descriptions, but the impression is still that this study was not able to fully capture knowledge, perceptions and attitudes towards UCD among the Norwegian developers.

4.3   Agile and User-Centered Integration

All informants emphasize resource constraints as vital for a successful integration of user-centered and agile methodology. They express positive attitudes to Thorkildsen's parallel integration model; see Figure 3 (2014). However, the informants mention a number of different aspects influencing whether such a process model is beneficial, such as: budget, project size and time-frame, type of costumer and priority given user-centered work over other requirements, type of solution being built, type and size of company delivering the solution, human resources and project manager. In addition, some weaknesses related to collaboration are reflected on related to parallel models; "Per" points out that a parallel approach may separate design-work from development, which is not considered beneficial for team collaboration. "Tor" points out that development may take more time than design and need more Sprints, making a parallel model disadvantageous. Informants seem somewhat split on the importance of Sprint 0 design up front and the need for L/S/BDUF. Several developers argue increased focus on requirement and needs specification is necessary for projects that are large, risky or have inexact or innovative solutions. Table 4 summarizes feedback related to agile and user-centered integration.

Table 4. Integration of UCD in Agile Processes

Insight	Informants
Parallel model seems beneficial	*All*

Parallel model seems disadvantageous	"Per", "Tor"
Fitting project constraints significant for model benefit	*All*
Sprint 0 is always important	"Dan", "Pia", "Roy"
Sprint 0 is not necessarily important	"Are", "Per", "Tor", "Jon"

4.4 Multidisciplinary Collaboration

As Table 5 presents, the informants have different perceptions of the current cooperation between UX/IxD resources and developers. "Jon" reports on limited UX/IxD contributions in agile projects because of part-time UX-resources, limiting the opportunity to follow the agile process continuously. "Dan" and "Per" experience fairly good cooperation; "Dan" due to the prominent focus UX has in his organization, while "Per" report a good cooperation both with full and part-time UX resource. "Tor" suspects there are conflicting interests and priorities between UX/IxD resources and developers. The novices "Are" and "Roy" have limited reflections on the topic. Informants are fairly pleased with the current situation, but there are some challenges. Described challenges are mainly related to A) UX/IxD resources not being full members of the team; instead specialized and spread out on different projects, B) team members have narrow competences, limiting opportunities for collaboration and support compared to a team where developers and designers have some academic overlap, and C) limited continuous cooperation and dialogue between team members. Some developers share UX/IxD resources with several other teams without difficulty, such as Per, however there are challenges related to following an agile methodology when remote designers do not become full members of the team. Most of the informants believe a continuous, closer, more interdisciplinary and cross-task team collaboration throughout the project could be beneficial. Per and Tor express the partnership could be better if UX-designers had programming skills, allowing demand-driven task distribution.

Table 5. Views on Collaboration

View	Informant
Current multidisciplinary team collaboration is conflict-free	"Are"
Current multidisciplinary team collaboration is fairly conflict free	"Dan", "Per", "Jon"
Current multidisciplinary team collaboration is challenging	"Pia", "Tor"
Closer continuous team collaboration and dialogue is needed; Discussing technical aspects in relation to design possibilities	"Pia", "Per", "Jon"
Closer continuous team collaboration and dialogue is needed; UX/IxD resources should be full members of the team	"Per", "Tor", "Jon"

5 Discussion

In general, the agile developers are positive to a merger between the two methodologies and towards the parallel example model. However, the informants highlight a number of aspects and constraints related to project conditions believed to influence whether a parallel model is appropriate. A main insight from this study is how informants believe more interdisciplinary approaches would be beneficial, especially related to UI design, and how the suggested parallel models may be disadvantageous in this respect. Existing models support multidisciplinary work, where people from different disciplines work together, each drawing on their disciplinary knowledge and perspectives to contribute to coordinated work tasks

(additive). However, the models do not seem to support *interdisciplinary* or *transdisciplinary* practices, integrating and synthesizing knowledge and methods from different disciplines in collaborative cross-task work (holistic).

Interviewed developers express they would like to be more involved in discussing UI design options and technical consequences of design. Some also mention the benefit if designers are able to code, so all tasks can be assigned to all team members. It might be unrealistic to expect UX-designers to be expert programmers, but it could be that a certain level of interdisciplinarity in both developers and designers on UCA teams would be beneficial and should be recommended. The suggestion of larger academic overlap between team resources is an interesting idea that could potentially facilitate a closer and more continuous cross-task collaboration, support team efforts in reaching deadlines and resolving congestions. It could also increase team affiliation among team members and allow designers to be dedicated to fewer teams at once where appropriate.

Agile development is all about multidisciplinary team efforts; people from different disciplines working together to reach common goals. Agile teams are ideally autonomous self-driven teams where teamwork is essential; aiding each other in solving tasks and reaching deadlines. The proposed parallel models may separate the designers from the developers; asking them to work in parallel with the designers one sprint ahead instead of continuously pulling together from the same backlog and solving congestions and complications. Discrepancies in workload sizes between the parallel processes are described as a major challenge in parallel processes. If design work takes significantly longer than development in a sprint, or visa versa, the parallel model becomes inefficient. Existing models do not seem to support the notion of a team pulling together to complete tasks, limit the number of unfinished work in progress, encouraging collaboration to resolve congestions and distributing the workload. Instead, based on the views and experiences of the practitioners in this study, the success of parallel processes seem to rely on fairly generous project constraints and resources.

Overall, the developers are positive towards UCD and UX/IxD work. Informants are able to make a theoretical distinction between *costumer* and *user*, but report that in practice the two are blurred, and project constraints seem to affect IxD/UX work such as user involvement and user testing prior to development work. Challenges reported by Constantine (2001) and Salah, Paige and Cairns (2014a) related to agile and user-centered merger thus seem relevant, warning that lacking managerial awareness of UCD on resulting quality may lead to integration and collaboration challenges. If project constraints tighten and UX activities are affected more than those available for development, this may potentially increase workload discrepancies, the need for developers to make design decisions themselves in order to prevent delays, thusly undermine design work and cause collaboration issues.

The work on generic principles for an integrated methodology is currently based on a theoretical literature study approach (Bhrel, Meth, Maedche & Werder, 2015), and could be strengthened by a more practical approach. This study is only deemed partially successful in measuring in-depth perceptions on UCD amongst the interviewed developers. As it is still somewhat unclear how informants perceive the potential value and impact of UCD on quality, and whether their views are based on superficial or general knowledge, the thematic semi-structured approach in this study is deemed insufficient in adequately capturing in-depth views on IxD, UCS and UX work among the developers. A more specific approach using more detailed questions could thus be complementary; e.g. asking UCA-developers to rank UCD principles compared to agile principles. Likewise, it would be interesting to explore

attitudes towards agile development among UCA IxD/UX resources, and compare rankings between the groups.

6   Conclusion

This exploratory study provides new insights into the challenges of user centered and agile merger. In particular, the study discusses how the parallel workflows proposed by current UCA integration models may be counterproductive to efficient multidisciplinary team collaboration, due to the separation of design and development decisions which may lead to UX-work being done part-time and/or detached from the agile team, the risk for workload discrepancies which may lead to ineffectiveness, communication issues, and undermined design decisions and the need for generous constraints to ensure cooperation between design and development and sufficient UX-work. Instead, a closer and continuous interdisciplinary collaboration throughout the project process is suggested, focusing on a productive team-driven communication and cross-task workflow in order to create a more efficient process of solving tasks and distributing workload, and interdisciplinary decision making. In this respect, the idea of larger academic overlap between the individual team resources is proposed to support collaboration, arrive at better design decisions, strengthened team affiliation and dialogue. Improved or alternative integrated process models may be needed to better supporting interdisciplinary work as well as UCA-projects with limited available resources. Further studies aim to validate findings from the limited sample of this study, and further the work on deriving shared, general methodological principles for UCA.

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