

## Ten Lessons Learned from Integrating Interaction Design and Agile Development

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**Abstract** — Agile development have a distinct culture that at first glance seems to conflict with Interaction Design. Therefore, integrating these two areas becomes a challenging task. There is little guidance about integrating them. Very limited empirical evidence exists on Agile development and Interaction Design being combined in practice. In order to better understand how these approaches are combined in practice, a multiple-case study of Agile teams working with Interaction Designers was performed. In the paper, we present a set of ten lessons learned from these studies.

**Keywords** - Agile; Interaction Design; Integration; Lessons Learned.

### I. INTRODUCTION

From Interaction Designers perspective, Agile is about to get to code as quickly as possible. Agile methods strive to deliver small sets of software features to customers as fast as possible in short iterations, implying that design is not a crucial part of the development process. What an Interaction Designer sees are multiple, short deadlines where working software is delivered and no consideration is given to the many activities of the design activities [1].

Nevertheless, claims about how Interaction Design and Agile development should work together based on an analytical appraisal highlight similar points of focus and possible tensions [2]. However, there is little guidance on how to integrate these two perspectives.

Traditionally, these two methodologies use different approaches with regard of allocating resources in a project [3]. Agile methods strive to deliver small sets of software features to customers as quickly as possible in short iterations. On the other hand, Interaction Design spends a considerable effort on research and analysis before development begins.

According to Ferreira *et al.* [4], there is a growing literature concerned with combining Interaction Design with Agile development, as can be seen in [5]. However, it is known that this integration is not adequately addressed [6].

The goal of this paper is to present lessons learned during the construction of a framework for integrating Interaction Design and Agile development, thus presenting practices that should be adopted and pitfalls to be avoided (the framework is partially described in [7]).

The lessons learned, presented in Section III, were obtained from exploratory studies carried out in two companies. These companies have Agile practitioners and posse the usability of their products as one of their main concerns. In these studies, we observed Agile teams and Interaction Designers in their day-to-day work and interviewed Agile teams' members as well as Interaction Designers. Then, the findings and conclusions were confirmed with the teams involved. As a result, there is a set of practices to be used to facilitate this integration, so that neither the user experience is impaired nor the Agile principles are injured.

This paper is organized as follows: Section II presents basics and related work on integrating Interaction Design to Agile environments organized according to a proposed taxonomy; Section III describes the research method and settings; Section IV presents the lessons learned organized according to the taxonomy presented in Section II; Section IV brings up a brief discussion on the topic as well as the final remarks of this work.

### II. BACKGROUND AND RELATED WORK

Hussain *et al.* [8] describe an integration of XP (eXtreme Programming) and UCD (User-Centered Design) in their project regarding a multimedia streaming application for mobile phones. According to the authors, they used different HCI (Human-Computer Interaction) instruments like user studies, personas, usability expert evaluations, usability tests, extended unit-tests, and lightweight prototypes. The authors conducted a one-day retrospective workshop with all the team members and the usability engineer engaged in the project in order to reflect on the integrated process as well as on the HCI instruments. The authors present lessons learned from this integration, but only focused on the use of the instruments aforementioned.

Chamberlain *et al.* [9] present a framework to be used by teams that aim at integrating Interaction Design practices to Agile development by presenting some similarities between Interaction Design and Agile methods based on the literature and on an observational study. They suggest five principles to a successful integration of Interaction Design and Agile, as follows: (i) User Involvement; (ii) Collaboration and Culture; (iii) Prototyping; (iv) Project Lifecycle; (v) Project Management.

Ferreira *et al.* [10] present a qualitative study of real Agile projects involving Interaction Designers. Some of their results are that the nature of iterative development facilitates the performance of usability testing, allowing Developers to incorporate the results of these tests in subsequent iterations. They say that this can also significantly improve the communication and relationship between Interaction Designers and Developers.

According to Ferreira *et al.* [2], the problem of Agile Developers and Interaction Designers having to contribute their skills to a software development project has typically been characterized as a problem of merging one method with another: an Agile method with a UX (User eXperience) design method.

Sy [11] describes adjustments on the timing and granularity of usability investigations, and on how they report their usability findings in an Agile environment. The author found that the new Agile user centred design methods produce better-designed products than the ‘waterfall’ versions of the same techniques. Agile communication modes have allowed her to narrow the gap between uncovering usability issues and acting on those issues by incorporating changes into the product.

Beyer [12] advocates that Interaction Designers must better understand the Agile principles and presents some practices to the integration of these two fields.

Finally, based on ethnographically-informed studies, Ferreira *et al.* [13] have identified four essential themes to achieve this integration: (i) Expectations about Acceptable Behaviour, (ii) Mutual Awareness, (iii) Negotiating Progress, and (iv) Engaging with Each Other.

In order to integrate Interaction Design and Agile Development in a harmonious way, we performed theoretical studies [5], which served as basis to the exploratory studies described in Section III.

Following, we present the main practices adopted and/or suggested by the literature. They are organized according to the taxonomy defined in [5].

#### A. Little Design Up Front

Ambler [14] suggests modeling the UI (User Interface) in advance by using tools that reflect the Agile practices such as: index cards, sketches on whiteboards and low fidelity paper prototype, since these artifacts enable rapid iterations to collect information about users.

Authors like Hodgetts [15], Kollmann *et al.* [16], Chamberlain *et al.* [9], Fox *et al.* [3], Najafi and Toyoshiba [17] and Hudson [18] suggest the use of Sprint 0 to perform research and interviews.

#### B. Prototyping

Authors like Sohaib and Khan [19], Coatta and Gosper [20], Fox *et al.* [3], Meszaros and Aston [21], Holzinger *et al.* [22], Detweiler [23], Miller [24], Ungar [25] and Chamberlain *et al.* [9] suggest that prototyping activities should occur early – in the first phases – in the development process. They also comment on the benefits of using prototypes to improve communication between Interaction Designers and Developers, and on the use of such prototypes

to perform usability evaluations, both by inspection and with users. Hussain *et al.* [26] say that prototypes can be derived from User Stories.

Ungar [25] and Benigni *et al.* [27] also suggest that Interaction Designers must develop UI prototypes one iteration ahead of the development team. On the other hand, Federoff *et al.* [28] suggest that Interaction Designers should work in parallel with the development team. However, Sy [11] suggests that Interaction Designers must work one iteration ahead, regarding prototyping, but one iteration behind, with regard to testing.

#### C. User Testing

Hudson [18], Hussain *et al.* [8], Meszaros and Aston [21], Fox *et al.* [3], Lee *et al.* [29], Obendorf and Finck [30], Hussain *et al.* [26] and Holzinger *et al.* [22] indicate or suggest running user testing on paper prototypes.

Miller [24] reports the execution of user testing on both low and high fidelity prototypes and Illmensee and Muff [31] mention that user testing should be performed in a more informal way and not in usability labs.

Beyer *et al.* [32] suggest that the UI could be tested with users through mockups and interviews because User Stories are quite refined features definitions that can be covered in tests with paper prototypes.

#### D. User Stories

Jokela and Abrahamsson [33] comment that activities such as users Task Analysis should contribute to the development of User Stories.

Meszaros and Aston [21] suggest that User Stories should be originated from usability testing on paper prototypes. Hussain *et al.* [26] and Fox *et al.* [3] report that User Stories could be refined to the prototype construction.

Holzinger *et al.* [22] suggest that User Stories could be used as tasks to be performed by users when conducting user testing on prototypes.

Broschinsky and Baker [34] report the integration of prototypes with User Stories. DÜchting *et al.* [35] comment that the Product Backlog and User Stories are the best places to capture usability requirements. Singh [36] mentions that User Stories should contain usability issues in their acceptance criteria. Beyer *et al.* [32] suggest that mockups could be part of the definition of User Stories and also of the acceptance criteria.

#### E. Inspection Evaluation

Some authors, like Constantine [37], Hudson [18], Hussain *et al.* [8], Williams and Ferguson [38], Fox *et al.* [3], Hussain *et al.* [26], Ungar [25] and Miller [24], suggest that usability evaluations could be carried out by inspection of paper prototypes, always aiming to refine them for the next iteration.

Albisetti [39] reports that, in his project, Developers did usability revisions and that this has completely changed the way that Developers saw the work of the Interaction Designers. Having seen this work from a perspective of someone who does not care how organized and lean is the

code, but what was being used by people, seems to have had a profound impact on Developers [39].

#### F. One Sprint Ahead

Some authors, like Chamberlain *et al.* [9], Najafi and Toyoshiba [17], Ungar [25], Sy and Miller [40] and Williams and Ferguson [38], suggest that Interaction Designers should work one sprint ahead of the development team. Chamberlain *et al.* [9], Najafi and Toyoshiba [17] and Sy and Miller [40] also comment that this practice must start in Sprint 0.

Illmensee and Muff [31] suggest that Interaction Designers should work two or even three iterations ahead of the rest of the team, but they must pay attention to the current iteration to provide feedback effectively. Cho [41] comments that UX is part of the business strategy, and then it is necessary that UX should be aligned with business analysis.

### III. RESEARCH METHOD

In order to understand how Interaction Design has been addressed in Agile development, we performed a multiple-case study in two large companies.

The criteria for case selection included the following: (i) companies using Agile methods for at least one year; (ii) companies focusing on the usability of their products as one of their main concerns

In the next sections, we describe who participated in the two studies, the projects, the data collection and the data analysis.

#### A. Study 1

In Company 1, our study involved a team of seven individuals and one Interaction Designer and was carried out over three months iteratively. The Developers were part of the ‘Development Team’ and the Designers part of the ‘UX Team’. The Developers had been developing software using Agile – Scrum in this case – for approximately two years. Although they are called Developers, individuals in the team have their own roles according to their area and skills. The roles were Project Manager/Scrum Master, Product Owner, Technical Leader, Developer and Tester.

Information Architects, Graphical Designers and Interaction Designers compose the UX team. Each project has one Interaction Designer, but an Interaction Designer usually work with more than one development team. The same goes for Project Managers, and they are also known as Scrum Masters in the teams.

Due to confidentiality constraints, we cannot provide much information about the projects. We named the projects as Project X and Project Y. All we can say about them is that Project X consists of the development of new features for an existing product of the company and Project Y consists of the development of an existing product of the company for a mobile/tablet device.

The Interaction Designer's role in Project X was to help software engineers to envision new features for this product. In Project Y, the Interaction Designer's role was to prototype

and design the UI and the user interaction flow for the product.

Table I presents the roles and individuals of the complete team.

TABLE I. ROLES AND NUMBER OF INDIVIDUALS IN THE TEAM

<i>Role</i>	<i>Individuals</i>
Project Manager/Scrum Master	1
Product Owner	1
Technical Leader	1
Developer	2
Tester	2
Interaction Designer (shared)	1

In Company 1, the team of Developers was one of several Scrum teams in the company working on software development. The Developers and Designers were seated in an open-plan office space located in the same building. However, they were not co-located, *i.e.*, they did not share the same workspace. They were spread in the building, but the UX team members were seated close to each other.

#### B. Study 2

Company 2 is not structured by projects, but by digital products. It is a digital product-driven business. The study of Interaction Designers and their interactions with an Agile team working on the same product was carried out over two iterations – 25 working days. The length of the sprints varies according to the project, but for the two teams observed they have two weeks sprints with a week between the sprints.

Two different teams developing two different products were studied, as follows. Product A is a web portal about national agribusiness and Product B is a web portal of services and opportunities in which there are addresses and data from companies and services from the Southern Brazil.

The teams are composed by Product Leader/Product Owner, Interaction Designer, Developer, Tester and Search Engine Optimization (SEO).

One team – Product A – has two individuals focused on Interaction Design, a Interaction Designer and a Graphical Designer, whereas the other team – Product B – has just a UX Designer who plays the Graphical Designer role as well.

The Interaction Designer's role in Product A was to perform user research, benchmarking and interaction design. The Graphical Designer's role was to design the UI based on the wireframes provided by the Interaction Designer. Whereas in Product B, Interaction Designer used to play both roles, performing user research, benchmarking, interaction design and UI design.

Unlike the first company, in Company 2 there is no separated UX Team and Developers Team. Each team has its own individuals, *i.e.*, a team does not share a UX person.

These teams were selected because they were the most senior Agile teams in the company.

Table II presents the roles and individuals of each team.

TABLE II. ROLES AND NUMBER OF INDIVIDUALS IN THE TEAMS

Role	Individuals	
	Product A	Product B
Business Owner/Director	1	1
Product Leader/Product Owner	1	1
Scrum Master	1	1
Developer	4	6
Tester	1	1
SEO	1	1
Interaction Designer	1	1
Graphical Designer	1	--

The Developers and Designers were seated in an open-plan office space located in the same building and in the same floor. Each team is co-located.

### C. Data Collection

We used two first-degree techniques to the data collection: observations and interviews.

In Company 1, regarding observations, due to the characteristics of invoking the least amount of interference in the work environment and the least expensive method to implement and still because the company did not allow video or audio recording of the meetings, we choose to manually record the observations of the meetings.

We shadowed an Interaction Designer during his activities for 45 days and observed meetings that he was involved, such as UX Team meetings and some meetings of two different projects, as follows:

- Project X: 2 requirements meetings, 1 retrospective meeting.
- Project Y: 1 demo meeting, 3 planning meetings, 3 retrospective meetings and 2 user testing sessions.
- UX group meetings: 4 meetings.

Regarding interviews, we interviewed three members of the UX Team that work in different projects and one project manager.

The Project Manager was interviewed aiming to define which Agile Method the company uses and how this integration of UX and Agile works or not through his point of view. And the UX people were interviewed aiming to understand how they work on the different projects of the company.

In Company 2, we also conducted interviews and observations, manually recording our observations. We observed some meetings of two different teams.

- Product A: five daily meetings.
- Product B: five daily meetings.

Regarding interviews, we interviewed the UX Designer and the Product Leader of the two selected teams.

### D. Data Analysis

In both studies, we performed Open Coding in which the researcher reads fieldnotes line-by-line to identify and formulate any and all ideas, themes, or issues they suggest, no matter how varied and disparate. We also performed Focused Coding in which the researcher subjects field notes to fine-grained, line-by-line analysis on the basis of topics that have been identified as of particular interest [42].

Initial memos were extracted from the fieldnotes produced during the observations and from the interviews performed.

Having the memos produced, Open Coding was performed aiming to generate new insights and themes. Focused Coding was also performed and this coding consisted of linking the memos generated to key aspects identified in a Systematic Review previously performed. Also some new aspects emerged from the analysis of the observations and interviews. Later, integrative memos were also written in order to relate the fieldnotes, the key aspects and the new codes from the open coding.

We classified the findings according to the key aspects of the Focused Coding and presented them to the company in order to validate them. They are presented as follows.

## IV. FINDINGS

In this section we present our findings structured according to the same taxonomy used to present the theoretical findings.

### A. Little Design Up Front

Regarding designing ahead of the development, we noticed that, in general, Interaction Designers used to know about the importance of researching, analyzing and designing ahead of the development. However, it hardly happens. Mainly when the Interaction Designer has a very high workload, working on multiple projects simultaneously:

*“We don’t have much time to work up front. Then we try to do at least something up front, and it seems to be working”* [S2 – UX B]

*“We have a Sprint 0, pre-production”* [S2 – PL A]

The principle proposed by Chamberlain *et al.* [9] – “UCD practitioners must be given ample time in order to discover the basic needs of their users before any code gets released into the shared coding environment” – do not match with Agile principles. Just ‘some’ time should be provided to research and analysis before of the development begins. That is why practitioners used to say ‘little’ or ‘some’ design up front. Although, whenever asked about how much time is ‘little’ or ‘some’ neither Designers nor Developers know the answer. We concluded that the Interaction Designer should research, analyze and design up front just enough to build the Big Picture of the project/product, *i.e.*, holistic view. However, it is not necessary to design the entire system up front:

<sup>1</sup> S# means Study – 1 or 2 – and the following term means the role of the person observed/interviewed and the Project/Product. For instance, S1 – UX B means Study 1 – UX Designer of Project/Product B.

“We don’t need to design everything up front” [S1 – UX 3]

Techniques like benchmarking, focus groups and players’ analysis provide good basis for constructing a Big Picture.

### B. Prototyping

All the participants of the studies understand the need for prototyping in the early stages of the development process. Actually, they already use it in practice.

However, we could observe that paper prototyping, as suggested by several authors, may not be that efficient. Mainly, when the teams are distributed. We noticed a major use of low-fidelity prototypes, but digital rather than on paper.

We also noticed that prototyping in low-fidelity may not be mandatory, since Interaction Designers have different backgrounds. Some of them are able to prototype both in low and high fidelity, whereas others are even capable of encoding their projects. Thus, the prototyping technique depends on the Designer’s skills:

“It’s tricky to UX people to code”. [S1 – UX 2]

“Once the product is defined, I prototype it in two or three weeks. Paper prototype to communicate between us and some HTML to present to directors.” [S2 – UX B]

We also heard reports about how low fidelity prototypes frequently help the communication between the development and the Interaction Designers. However, sometimes they are not enough to communicate design decisions to the stakeholders, for instance.

### C. User Testing

Ferreira *et al.* [10] comment that the nature of iterative development facilitates the performance of usability testing, allowing Developers to incorporate the results of these tests in subsequent iterations. However, we could not confirm this statement in our studies.

The reason is that user testing are expensive and time consuming to plan, perform and analyze. We noticed some initiatives of performing user testing with internal users – companies’ employees not involved with the project. This is a reasonable practice, however, they were not performing user testing with their end users:

“Internally studies... new people and old people from inside the Company (...) With real users just at the final stages of the project.” [S1 – UX 2]

Patton [43] suggests a practice named ‘design partners’, which consists of having a database of potential users, who are partners available to carry out user testing. We observed this practice working quite well in the second study:

“As we have a set of users (database of volunteers), we can call them and carry out some focus groups. We have 4 different personas with them.” [S2 – UX B]

### D. User Stories

We notice that the inclusion of usability issues as acceptance criteria into the User Stories, suggested by several authors, is a really good practice used in both studies. This practice become even more efficient whether combined with the use of prototypes, as suggested by Broschinsky and

Baker [34]. This facilitates the understanding by the Developers about what the Designer is trying to say:

“We put UX criteria as acceptance criteria at the User Stories, or we reference the behavior of the interface in a sequence of wireframes.” [S2 – UX A]

### E. Inspection Evaluation

The use of prototypes to carry out inspection evaluations is frequently performed. We observed an interesting practice – not mentioned by the literature –, which consists of peer reviews on low fidelity prototypes. Pairs of Interaction Designers, Designers pairing with Developers or even Designers pairing with Product Owners or Business Analysts in order to validate ideas before the definition and implementation of a design:

“We perform some experts evaluations, peer review.” [S1 – UX 1]

However, we did not observe inspection evaluations being performed on a product already developed.

### F. One Sprint Ahead

Interaction Designers know about the importance of working one iteration ahead of the development team. However, this practice should be adopted since the beginning of the development process. Once the process has its beginning with the Interaction Designer working in the same iteration or even behind of the development team, just testing interfaces already implemented, they can not work one iteration ahead.

We noticed that oftentimes Interaction Designers try to work ahead of the development team. Though for being concerned or busy with other projects, they cannot adopt this practice:

“We should work at least one sprint ahead the development team.” [S1 – UX3]

In one of the studies, we noticed that the ‘some’ design up front provided a really good basis for the Interaction Designer, allowing him to work at least one iteration ahead. This design up front provided him the Big Picture of the project. The Interaction Designer could consume the data extracted in the research/design up front during the entire release:

“Me and UX work one sprint ahead of the rest of the team.” [S2 – PL A]

Therefore, having the Interaction Designer available to the development team becomes extremely important, both to clarify Developers’ doubts as to have a better understanding of the project under development.

## V. LESSONS LEARNED

In this section, we number ten lessons learned covering all the key aspects discussed above:

1. Use Sprint 0 to Research and Design something upfront.
2. Prototype and evaluate iteratively independently of the technique or tool chosen.
3. Paper prototyping might not be so efficient, mainly when the teams are distributed.

4. Use of low-fidelity prototypes, but digital rather than on paper. However, it depends on the Designer's skills/background.
5. Low-fidelity prototypes frequently help the communication between the development and the Interaction Designers. However, sometimes they are not sufficient to communicate design decisions to stakeholders.
6. Perform user testing with internal users. This is a reasonable practice, but keep in mind that they may not be your end users.
7. Keep a database of 'design partners', which consists of having a database of potential users who are partners available to carry out user testing.
8. Set UX issues as acceptance criteria in the User Stories, preferably enriched with prototypes.
9. Evaluate iteratively, pairing with other Designers, Developers and Analysts.
10. Design one sprint ahead of the development team but be always available to clarify Developers' doubts.

Throughout the reports herein presented, we could observe that having the Interaction Designer dedicated to only one project becomes extremely important. We noticed that whenever the Interaction Designer is working on several projects simultaneously, it causes delay in the deliveries, because frequently the Interaction Designer blocks the development team by not being available and missing deadlines.

Thus, we advocate the setting of a precondition: *Interaction Designer must be a full member of the Agile team.*

Another important issue is the co-location of Interaction Designers. We noticed that the communication and collaboration between Interaction Designers and Developers is vastly better when they work in the same environment. This is an issue already commented by Ferreira *et al.* [4]. However, we will not set this as a precondition but something desirable and that would be a consequence of the precondition of being a full team member: *Interaction Designer should work co-located to the Agile team.*

We could also observe throughout the reports that all the aspects presented in Section IV are related. For instance, the definition of 'some' design up front is related to the practice of prototyping, which can be used both to evaluate – inspection evaluations of user testing – as to define User Stories. This design up front also supports the construction of the Big Picture, allowing the Interaction Designers to work one iteration ahead of the development team.

We noticed that Interaction Designers and Developers must be willing to communicate and work together extremely closely, on a day-to-day basis. Designers must feed Developers with prototypes and feedbacks from the users.

Therefore, the communication and relationship between Interaction Designers and Developers become closer, as mentioned by [10]. Thus, confirming Sy's report [11], that states that the integration of Interaction Design with Agile produce better-designed products.

We believe that a successful integration of Interaction Design and Agile is also a matter of culture. Our results corroborate the themes presented by Ferreira *et al.* [13]: we could notice that the Close Collaboration issue is considered in all the aspects presented. Thus, unless there is a close collaboration between all the members involved, especially Developers, Interaction Designers and Business Analysts, this integration of Interaction Design and Agile will never happen.

## VI. CONCLUSION AND FUTURE WORK

This paper reported on two case studies of Agile development and Interaction Design. Our aim with these studies was to understand how Interaction Design is addressed in Agile development.

We presented a set of lessons learned addressing issues ranging from the use of specific artifacts to prototype and evaluate to broader issues as co-localization and communication of Interaction Designers and Developers.

However, we should be careful on generalizing from our findings. Although the teams analyzed in these studies are considered to not be atypical, these studies do not cover all the possibilities and the contexts can vary widely. The teams may vary with respect to their maturity on Agile development, whether Developers are co-located with Interaction Designers, just to mention a few.

Agile has openly declared that it is opposed to big design upfront, which sounds like a criticism of design. As a result, many Designers go into defensive mode, believing that design will be compromised [1]. On the other hand, some Developers also go into a defensive mode because they think Designers spend too much time designing up front.

The issue is that most of Designers get used to design the entire system up front because they usually work on a traditional development process, *e.g.*, waterfall.

Thus, there is a clear need for a definition of the Interaction Designer's roles in Agile environments. This definition will help Interaction Designers to make their work in a real Agile fashion, facilitating their integration in Agile teams. And this is one of the most challenging and imperative future work in this topic.

Finally, we state that certain practices just work in certain contexts. We do not want to stiffen the process, by defining which artifact a team or organization must use. Because most or the organizations or teams do not follow a method 'by the book', they adapt the methods to their contexts. Hence we advocate the sharing of lessons learned making the integration of Interaction Design and Agile easier for new practitioners and even for the old ones who are facing this challenge for the first time.

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