Organized Chaos: Supporting Collaborative Design

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Abstract

Modern design teams must deal with limitations related to the lack of adequate tools to support their practices. This paper introduces my efforts to pinpoint the bottlenecks in collaboration and propose solutions that adapt to the practices of multidisciplinary design teams.

Author Keywords

Collaboration; design practices; multidisciplinary teams.

Introduction

Design problems are "ill-defined" in the sense that each problem is unique, with no straight-forward solution, and which resolution depends more on the skills of the designer than on the problem itself [1]. According to [6], design is a "reflective activity", where design practitioners iteratively explore solutions by transforming elements, observing the consequences of those transformations, and adapting the elements accordingly. The nature of the design problems and how designers approach it are recognized as the challenges but also the sources of creativity and inspiration in the design process.

In addition to the aforementioned challenges, modern design has evolved to involve multidisciplinary teams. This is the case of user-centered design (UCD), which embraces an iterative approach to the design and development of interactive systems with focus on the end-user needs and requirements. The multidisciplinary aspect of UCD processes requires that a team conformed by members with different expertise collaborate towards shared goals and objectives. While involving a multidisciplinary team is one of the core characteristics that enrich a UCD process, problems frequently arise due to the use of different terminologies and lack of common ground to evaluate or estimate the work of others. Furthermore, multidisciplinary design teams often face challenges as there is lack of appropriate tools to support group collaboration [3].

Design is a complex process [6]. Moreover, the multidisciplinary aspect, the dynamic nature of design projects, and the lack of adequate tools to support design teams increases the complexity further. My research focuses on describing practices that create bottlenecks in the design process, and propose tools that could be used to "organize the chaos" and
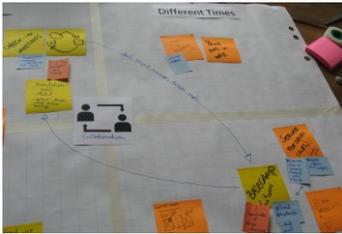
Figure 1. Mind map created during interviews with designers using the Time-Space matrix.

ultimately improve the productivity and outcomes of the design process. Nevertheless, the main challenge is to provide structure and adequate tools without hindering creativity and innovation. I approach this challenge by conducting an in-depth analysis of the work practices of designers to identify the activities that could be better supported with technology. Furthermore, I focus on studying the early stages of the design process, where collaboration between teams is vital to define the course of a project.

Previous research has identified that communication in the early stages of the design process is frequently linked to visual artefacts [7]. These artefacts, which include sketches, storyboards, and prototypes, are used to contextualize design decisions and communicate them to other team members and project stakeholders (e.g. clients, end-users, etc.). Furthermore, artefacts aid teams to focus discussion by clarifying concepts when a shared terminology is missing [7]. This paper describes the approach I use to uncover the work practices of designers that need to be supported in order to empower collaboration across multidisciplinary design teams by means of visual artefacts.

My Approach
I use an iterative UCD approach to create an application to support collaboration in the early stages of the design process. The sections below give details about the methods and results for each stage.

First stage: understanding the early design process
The first stage to explore the work practices of professional design teams was to get a general outline of who is typically involved, for what activities, and how these activities take place. With this objective, I

interviewed 22 design practitioners and stakeholders of the design process (project managers, software developers). Participants ranged between 3 and 20 years of experience in one or more design disciplines, including graphical design, product design, and UCD. The interviews were conducted using a semi-structured protocol in either a face-to-face or online setting. During the sessions, participants were asked to create a mind map to visualize and reflect on their design processes. The mind maps were constructed using a representation of the Time-Space matrix [2] to identify the context in which tools, tasks, people and challenges are involved in the early stages of the design process. Figure 1 illustrates the mind map of the face-to-face setting.

The results indicated that the designers use a wide variety of digital tools, ranging from commercially available ones to ad hoc systems to communicate and collaborate with their team. Furthermore, I identified three common workflows that act as bottlenecks of collaboration [3]. These workflows made clear that most issues occur as designers communicate and share their designs with others. This is due to the difficulty of communicating design results, the limited functionalities of tools that are not adapted to the design process and the wide variety of perspectives involved in multidisciplinary teams.

SUPPORTING DESIGN RATIONALE
The results of these interviews were the basis for creating *Helaba*, a system prototype that supports artefact-based communication [4]. For instance, as illustrated in Figure 2, Helaba allows users to "point" to specific parts of the artefact.
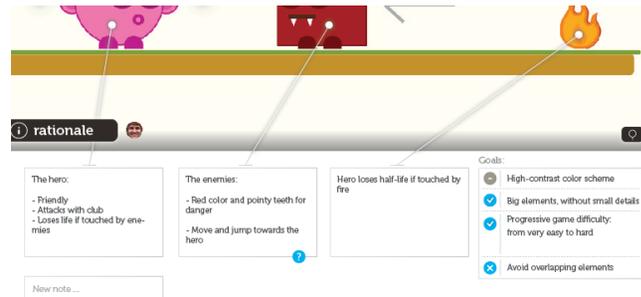
Figure 2. Helaba supports artefact-based communication.

The core characteristics of Helaba are: (1) a shared workspace to document the design rationale of an artefact, i.e. why a design is the way it is; (2) a record of team discussions to keep track of "who said what"; and (3) a visualization of artefact evolution. I reflected about the utility of Helaba by conducting an observation with a UCD team and validating the prototype with 8 design practitioners. These results, reported in full at [4], remarked the need of sharing the design rationale in a simple, accessible way.

Second stage: observing design teams in action
As a second stage to understand the needs of multidisciplinary design teams, I conducted observations of design meetings, which are coordination points where designers meet with the stakeholders of the design process. I observed 6 design meetings involving professional multidisciplinary teams where the overarching topic was the early design of an interactive system following an UCD process. I analyzed who was involved in these meetings, what kind of activities were organized, and the similarities among different teams and projects.

During these meetings, I observed how designers framed and re-framed problems in order to figure out solutions that were satisfactory for all the partners involved [1]. Design meetings require "mutual learning" [5], as two or more groups of experts, with little to no knowledge about each other's domain, have to learn from each other. When successful, mutual learning promotes creativity and innovation by building on top of each other's ideas in a collaborative way [5]. Nevertheless, while mutual learning and a free flow of ideas during the team discussions help to solve complex problems, it can create traceability issues [8].

SUPPORTING DESIGN DECISIONS
Design decisions constitute a "team memory" [8] that is used as reference into the next steps of the design process. Therefore, design teams invest plenty of resources in recording this memory as formally as possible, creating minutes, reports, workflows, prototypes, etc. A potential risk of recording the "team memory" is that the design rationale attached to each decision may be lost, as ideas are extracted from a larger, more extensive conversation [8].

To support team memory and design rationale in an efficient way, the Helaba prototype was iterated to support the recording of design decisions by introducing the *Decision Cards* (DC) feature. DC is a format to document core decisions made by the team, giving details of what the decision is about and who was present. To validate this approach, a workshop with 5 design students was organized. During this session, students were prompted to use a paper version of the DC to record and communicate their ideas (see Figure 3). An analysis of the workshop results revealed that DC were useful to organize and structure the

Figure 3. Workshop with design students where the *Decision Cards* were used to guide discussion.

discussions among participants. Two main lessons were learnt to iterate the DC feature: (1) DC should be seamlessly integrated into the design process, requiring minimal effort to be created. (2) Users need a visualization of all DC in order to have a clear overview of the evolution of their decisions.

In this second stage of my research, while still ongoing, I have learnt the need to contextualize – or organize – the chaos that surrounds the design process while preserving plenty of room for creativity and innovation. I believe this can be achieved by reducing the burden of the cumbersome activities that designers realize, such as creating extensive documentation of meetings, by providing a space where design decisions and rationale can be used as a way to communicate and reflect on the project evolution in a visual way.

Future Research
The next stage in my research will include the validation of Helaba with a larger set of design practitioners over a longer period of time. Furthermore, I am interested in exploring features to promote team equality within Helaba. Future user studies will be conducted to explore the needs of other team members of multidisciplinary design teams such as software developers. I expect to integrate their perspective with that of the designers into Helaba or other prototypes to promote effective collaborative design.

Acknowledgements

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