On the development of idShare, a platform to support interaction design activities of small co-located teams

On the development of idShare, a platform to support interaction design activities of small co-located teams

Quevedo-Fernández Javier
Eindhoven University of Technology
Department of Industrial Design
j.quevedo.fernandez@tue.nl

Schouren, Jamie-Maria
Jamie Maria Design
jamie@todefine.nl

Martens, Jean-Bernard
Eindhoven University of Technology
Department of Industrial Design
j.b.o.s.martens@tue.nl

ABSTRACT

Externalizations and boundary objects are crucial for effectively communicating between stakeholders in multidisciplinary design teams. Especially when discussing ideas for new interactions, practitioners are increasingly finding themselves in need of new tools that allow them to rapidly, easily and more explicitly describe the dynamically changing aspects of their designs. For this purpose, we are investigating, in collaboration with the design departments of three industrial companies, the development and evaluation of a platform to support co-located (interaction) design activities. Previous research has already resulted in innovations in both hardware and software infrastructure, and in this workshop paper we therefore mostly report on some recent and planned activities towards a more coherent vision for an environment that we have named *idShare*. This is an interactive space that consists of two areas, an area for individual work and an area for the coordination of collaborative activities. In this paper we describe the aim and motivation of our research, the current stage of the development of the tools, and the design process and evaluations that are conducted in collaboration with the industrial partners.

Categories and Subject Descriptors

H5.1 Multimedia Information Systems

General Terms

Design, Human Factors.

Keywords

Design, CSCW, Creativity Support Tools, Shareable Interfaces

1. INTRODUCTION

The research presented in this paper is part of the RePar project (http://www.repar-project.com) and relies heavily on the hardware infrastructure in the ConceptLab (http://conceptlab.tue.nl). The aim of the project is to develop a suite of tools for the creation of prototypes and virtual contexts, useful for designers in industry. The goals are to facilitate the dialogue between both stakeholders in multidisciplinary design teams, and with end users in a collaborative design process. The claim is that such tools can assist designers to conduct a more effective and efficient design process. For this purpose, the RePar project has organized a longitudinal collaboration with three international companies active in diverse areas: automotive, printing and document management, and food production assembly lines.

2. BACKGROUND

In the early stages of the design process, when ideas are still vague and undefined, designers in multidisciplinary design teams work together on discussing and expanding design briefs. In this stage, in order to optimally manage design decisions, tasks and resources, a fluid exchange of information between the different stakeholders is essential. External design representations are created and shared between stakeholders in order to support such communication,. External representations are essential as they *form*, *inform* and *transform* the ideas in the collaborative design processes [2], support creativity, expression, communication, and facilitate shared understanding, awareness, and decision-making.

In the early stages of the design process sketches are the preferred externalizations [9], as the cost and time needed to create them is minimal. However, observations of industrial design teams have demonstrated that practicing designers, especially due to the increasing complexity introduced by interaction design, are in need of tools that enable them to rapidly build externalizations that are more complex than paper sketches [6]. In essence, due to their static nature, there is a gap between sketches (whether on paper or in digital form) and the interactive experiences they are intended to represent [1].

Thus, in a growing number of design situations there is a need for tools that can support designers in creating animations, prototyping interactions and visualizing complex contexts in a more *sketch-like* (and hence effective) way. Facilitating such design activities is not an effort that can be solely restricted to software design, as such software tools also need to fluently integrate into a physical environment where multiple designers are active at the same time, and where physical artifacts (such as paper sketches) still play an important role.

In order to investigate and address the aforementioned challenges, we are iteratively researching and developing, in collaboration with three industrial companies active in very distinct application areas, a platform to support interaction design activities of small co-located teams. The approach is, on the one hand, to develop new tools for individual design activities that are presented to designers within an integrated design environment, and, on the other hand, to use the industrial design teams and their typical design activities to try out the environment and tools, and to provide feedback for further improvement.

3. The idShare platform

As stated before, the *idShare* platform aims at supporting interaction design activities of small design teams. To achieve such a goal, we continuously improve on past activities and developments. We therefore discuss *idShare* in two parts. First, we provide a brief summary of some relevant past work. Next, we discuss some more recent, mostly unpublished, developments, as well as some of our plans for the near future.
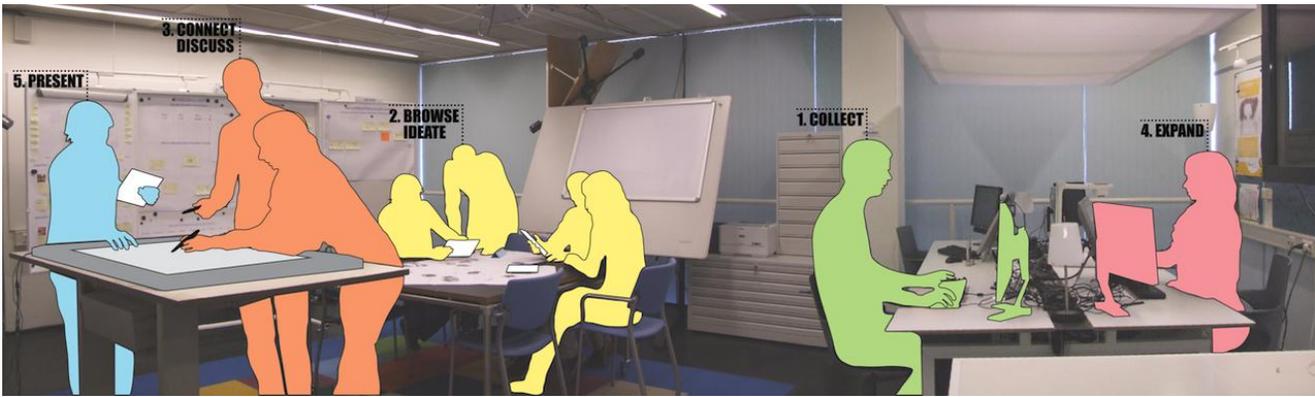
Figure 1 - *idShare*, a platform to support interaction design activities of small co-located teams

3.1 Previous related work (private work area)

The private work area of *idShare* (see figure 1) is part of the *Design TeamMate* [5], which is a system consisting of two connected pieces of furniture in which individual workstations on one table are coupled to a second system containing an augmented tabletop and a wall display. Two of the individual workstations have a large Wacom CINTIQ21UX tablet with integrated display and are especially suited for using graphical design software (such as Adobe Creative Suite). One of the other workstations is connected to document scanning equipment, and is mostly used for video editing, while the fourth workstation is more general purpose and often used for coordination and presentation activities. We will not discuss *Design TeamMate* in detail, but want to recapture the vision on design activities that motivated its creation, as it is also relevant for the development of *idShare*. The major difference is that in case if *idShare* the focus is more on how design activities of teams can be supported and integrated with individual activities. Note that our requirements for design tools, as described below, also overlap to a large extent with the framework for creativity support tools proposed by Shneiderman [11]. Specifically, we think it is useful to distinguish the following stages in the design process:

Collecting: Designers not only collect items that are of direct interest to them, but also items that they might find useful in the future. They not only collect digital items, such as documents, pictures and videos, but also physical artifacts such as magazines and (3D) objects. Many of them carry a (digital) camera most of the time to take pictures of things that they find interesting. As a result, they own a personal collection that consists partly of digital and partly of physical items. The Cabinet system [3] is an example of an augmented tabletop that was explicitly created for the purpose of assisting designers to more easily merge these collections. A similar functionality is included in the *Electronic Paper* software [14] that runs on the *Design TeamMate.*

Browsing/Ideating: Designers spend a substantial amount of their time on selecting and combining appropriate material to illustrate their ideas. This material might be extracted from their own collection or from external sources. Often, this is not a directed search for a specific item, but takes the form of browsing through available material. Browsing through materials can also be a way to inspire the ideation (or brainstorming) process.

Connecting/Discussing: The materials selected in the browsing stage can be used within new concepts and connected in new ways. Traditional design activities such as sketching and making collages or mood boards are increasingly being combined with activities that are inspired by new media. While the Electronic Paper prototype mentioned above was mostly intended to enable such traditional activities on a computer platform, such as the integrated tablet/display of a Wacom, more recent tools, such as the *idAnimate* tool discussed in the next section, aim at creating artifacts such as animations that are fairly impossible to create with traditional media.

Expanding/Building/Prototyping: Creating a working prototype from selected materials and conceived concepts is a production activity that is often subdivided in tasks that can be carried out by a single designer. The preferred media may range from purely digital, in which case existing software tools are often preferred, to purely physical, most often performed in a physical workshop. While both media might be used to design the form (shape, material, color) of new objects, a problem arises when designing interactions, as the time course of events becomes a very relevant factor of the design. We have recently released the software tool *Sketchify* [6] for prototyping interactions in a *sketch-like* way. Sketchify allows designers to conceive and build interactive systems that could previously only be realized by skilled programmers. The core concept of *Sketchify* is that the properties of visual objects (such as their appearance, their position, orientation, etc.) can be coupled to variables that can be both software generated (by other software components), or hardware generated (i.e., from external sensors).

Presenting: Presenting and discussing the results of the aforementioned design activities is an inherent part of the design cycle, as such a discussion can initiate new iterations or modifications. Next to the physical or digital outcome of the design process, the ideas and intentions of the designer may be equally important. The Funky Wall [4] is an example of an augmented system that was created to enrich such presentations.

3.2 Recent & future work (shared work area)

3.2.1 idAnimate
We recently identified the creation and sharing of animations as a potentially interesting activity within the early stages of interaction design (please see section 4 for a more detailed argumentation). We are developing a rapid animation-authoring tool called *idAnimate* (http://www.repar-project.com/idanimate/) [publication currently under submission] that allows users without explicit animator skills to author simple but expressive animations. Such animations help to illustrate the dynamics of

envisioned interaction techniques. The design of *idAnimate* was much inspired by the guidelines proposed by Resnicks *et al* [10]:

Low threshold: In order to draw more people into the process of using animations to describe their ideas and stories, the threshold for using the tool needed to be as low as possible. This implies that novice users, even those that are using the tool for the first time, should be able to create simple animations without or with minimal instruction.

Speed: The tool must make it possible to create animations very rapidly. Ideally the cost of creating an animation should be similar to that of creating sketches on paper.

Flexibility and wide walls: The tool should not impose a predefined set of patterns or prescribed scenarios. The tool should allow users to describe most of their ideas, within the reasonable boundaries of what animations can describe.

Simplicity: Besides having a low threshold, the tool must also feel intuitive to use after a prolonged period of time. Instead of providing an extensive set of highly configurable features, the tool therefore only provides those features that are strictly necessary to achieve the desired flexible outcome.

Encourage collaboration: The tool must make it possible to easily share the outcomes with others, and should not limit the dialogue between participants (especially of co-located activities). This also implies that users should be able to easily modify animations created by others.

Fit into existing workflow: The tool should provide mechanism for participants to easily draw material from existing libraries or repositories.

Tablet devices (*iPad* in particular*)* were selected as platform for the prototype, mainly due to their form factor, portability, and the affordances that multi-touch devices provide. Popular multi-touch interaction paradigms such as resize and rotate are applied in *idAnimate* to extend an existing motion-by-example paradigm to a more general transformation-by-example [13] one. In a nutshell, the strength of the technique relies on the possibility to *apply three transformations (translation, rotation, resizing) in one single user action*, using the two-finger gestures of pan, rotation and pinch. When recording, all of the transformations performed on a region are recorded and time-stamped relatively to the animation start time, which results in an animation. The animation can be replayed, and while doing so, new transformations can be applied on other regions.

3.2.1.1 idAnimate case study
A design team of one of the industrial partners agreed to try out the tool as part of a scheduled two-hour creative group session, and to provide feedback. The results of the study showed that *idAnimate* was perceived as a valuable tool in such a setting: it was easily used immediately by participants with diverse backgrounds, it supported the exploration of design alternatives, it assisted in the communication and discussion of concepts, it allowed to iterate and to refine ideas on the spot, and it integrated well with existing media such as paper sketches and the personal media repositories of the participants. On a more emotional level, using animations next to sketches was perceived as playful, which is an aspect that is appreciated in its own right in design sessions [publication currently under submission].

3.2.2 Towards idAnimate surface
During the evaluation of idAnimate we identified the following situation. When brainstorming (in groups in this particular case) practitioners started by generating a large number of concepts (divergent phase), and subsequently applied selection criteria to select a specific proposal (convergent phase). The next stage was to refine and work on the selected idea in more detail. At this stage, the small size of the *iPad* implied limited visibility, which was considered as a considerable limitation for the group activity. Even in those groups where the participants were willing to work simultaneously on the device, the small size lead to hand collisions. Some objects also become very small in relation to the size of the hands, which made it difficult to define movements with sufficient precision. Hence we realized the need to provide a larger surface with multi-touch capabilities to which the functionalities of *idAnimate* could be ported. We are currently in the stage of realizing this. We designed a hardware platform (see figure 2) consisting of a 52inch PQLabs G3-plus frame (supporting 32 simultaneous touches), together with a 1080p projector. The image is projected through the frame onto Anoto paper, so that Anoto Digital Pens (http://www.anoto.com) can be used next to fingers.
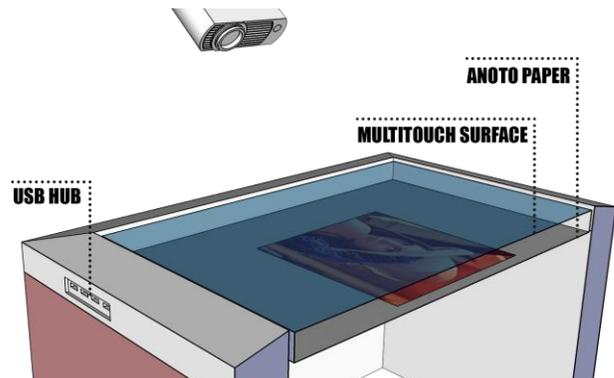

Figure 2 – An augmented surface with support for Anoto digital pen and multitouch input, with a resolution of 1920 x 1080 pixels.

4. Relationship to industrial design activities
Three preliminary studies were conducted to better understand the needs, concerns and limitations of industrial designers, and to inform our design of *idShare*.

4.1.1 Company Visits
A team of three researchers visited each of the three companies for a period of two weeks. In every company, the team not only observed the daily working routines of the R&D teams, but also conducted between 10 and 15 semi-structured interviews with individual designers, engineers and management personnel. Each visit was concluded with a workshop where the findings were presented to the participants and discussed. The outcome of these visits was a detailed analysis of the design process of the company concerned, describing the different stages, inputs and outputs, a comprehensive catalogue of the methods utilized for end-user involvement [7], and a detailed list of the tools utilized by the designers throughout the process. Amongst others, the results confirmed the concerns mentioned in the background section, and provided inspiration for the *idShare* development.

4.1.2 Demonstration Projects

The company visits were followed by a workshop session with four designers from each company, where they were presented with a number of example projects that were created using our in-house software tool *Sketchify* [6]. These examples were related to representative use cases from the companies themselves. In the follow-up discussions, the industrial designers provided feedback, which confirmed our expectation that such a tool could indeed be valuable for their design process, especially thanks to its capabilities for quickly building low fidelity interactive prototypes and sketches [8]. However, the designers also pointed out that, even though the tool did not explicitly require writing programming code, it still did require a programming mindset, which could pose a problem for users without programming experience. Because of this high threshold, and because it takes considerable time and effort to create the artifacts, the tool in its current form was considered inadequate for certain early stage design activities, such as generative brainstorm sessions. The tool was considered most appropriate for prototyping [8].

4.1.3 Context mapping eliciting requirements and design considerations

In order to collect ideas for complementary tools, we conducted a third study [publication currently under submission], which included a context-mapping study [15] with a multidisciplinary group of 12 designers from the three companies. The study was divided in two phases. The first phase was a diary study where participants were individually provided with a workbook for them to become sensitized by reflecting on "*past experiences, memories, opinions and dreams*" concerning face-to-face design-related meetings, over a period of three weeks. The second phase was a one-day workshop with two sub-activities. In the first activity, the participants from the same company grouped to create storyboards describing problems in their design meetings, and subsequently shared and discussed them with the other participants. The second phase was a participatory design session to generate concepts that could help to address the previously mentioned problems, especially considering novel technologies such as shareable interfaces, intelligent environments and so on. The results revealed a number of detailed problems and contextual factors that regularly occur in, and influence, design-related meetings, such as the absence of desired material, not being able to create, combine or transform certain artifacts, problems related to capturing and documenting meetings, and problems about social protocols and conventions. Additionally, the study provided a number of scenarios/ storyboards and design concepts illustrating new ideas, one of which motivated and triggered the development of *idAnimate*.

5. ACKNOWLEDGMENTS

6. REFERENCES

[1] Buxton, B. Sketching User Experiences: Getting the Design Right and the Right Design. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA. (2007)

[2] Dix, A., Gongora, L. 2011. Externalisation and design. In *Procedings of the Second Conference on Creativity and Innovation in Design* (DESIRE '11). ACM, New York, NY, USA

[3] Keller, I. 2005. *For Inspiration Only: Designer interaction with informal collections of visual material.* Ph.D. thesis, Delft University of Technology.

[4] Lucero, A., Aliakseyeu, D., and Martens, J.B. 2008. Funky wall: presenting mood boards using gesture, speech and visuals. In *Proceedings of the Working Conference on Advanced Visual interfaces* (Napoli, Italy, May 28 - 30, 2008). AVI '08. ACM, New York, NY, 425-428

[5] Martens, J.B., Frans Parthesius, and Berke Atasoy. 2010. Design TeamMate: a platform to support design activities of small teams. In *Proceedings of the International Conference on Advanced Visual Interfaces* (AVI '10), Giuseppe Santucci (Ed.). ACM, New York, NY, USA,

[6] Obrenovic, Z., Martens, J.B.O.S. Sketching interactive systems with Sketchify. ACM Trans. Comput.-Hum. Interact. 18, 1, Article 4, (2011).

[7] Ozcelik, D., Quevedo-Fernández, J., J. Thalen, and J. Terken, J. Engaging users in the early phases of the design process: Attitudes, concerns and challenges from industrial practice. *Designing for Pleasurable products and Interfaces*, ACM (2011), 8

[8] Ozcelik, D., Quevedo-Fernandez, J., Thalen, J., and Terken, J. (2011) On the development of electronic design tools and associated guidelines for supporting the early stages of the design process. *DESIRE '11: Proceedings of the Second Conference on Creativity and Innovation in Design*, ACM

[9] Purcell A.T., Gero J.S. (1998) Drawings and the design process: A review of protocol studies in design and other disciplines and related research in cognitive psychology, Design Studies, Volume 19, Issue 4.

[10] Resnick, M., Myers, B., Nakakoji, K., Shneiderman, B., Pausch, R., Selker, T., Eisenberg, M. Design Principles for Tools to Support Creative Thinking. Institute for Software Research. Paper 816. (2005).

[11] Shneiderman, B. 2000. Creating creativity: user interfaces for supporting innovation. *ACM Trans. Comput.-Hum. Interact.* 7, 1 (March 2000), 114-138.

[12] Shneiderman, B. Creativity support tools: accelerating discovery and innovation. Commun. ACM 50, 12 (December 2007).

[13] Moscovich, T., Hughes, J. F. Animation Sketching: An Approach to Accessible Animation. Technical Report CS-04-03, CS Department, Brown University. (2003)

[14] Aliakseyeu, D., Martens, J.B., Rauterberg, M. A Computer Support Tool for the Early Stages of Architectural Design, *Interact. Comput.* 18, 528-555, 2006.

[15] Sleeswijk Visser, F., Stappers, P.J., van der Lugt, R., Sanders. 2005. Contexmapping: Experiences from practice E.B.N 119-149. CoDesign (2005)