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Electronic sketching on a multi-platform context: A pilot study with developers

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ABSTRACT

During the past 45 years there has been a recurrence of interest on supporting sketching at electronic devices and interactive surfaces, and despite being sketching *recognition* fairly well addressed on the literature, the adoption of electronic sketching as a *design tool* is still a challenge.

The current popularization of touch screen devices allows designers to sketch using their device of preference, while the current multi-platform capabilities made possible by HTML5 allows sketching systems to run on many devices at the same time. Those two factors combined might pose new opportunities for researchers to explore how designers use sketching on flexible setups by combining heterogeneous sketching devices for design sessions.

This may arise new possibilities in the field of prototyping user interfaces since, by using such multi-platform systems, designers would now be able of designing interfaces for multiple devices by producing and testing them on the device itself.

This paper reports a pilot experiment conducted with 6 developers, grouped into pairs on design sessions using Gambit – a multi-platform sketching system that provides a lightweight approach for prototyping user interfaces for many devices at once. We performed a discourse analysis of the professionals based on recorded videos of interviews conducted during and after design sessions with the system and aggregated the data in order to investigate the main requirements for multi-platform sketching systems.

1. Introduction

Sketching is an important – perhaps necessary – tool for design, since it function not as a mere fixation of finished solutions but as an external part of the mental process itself (Sachse et al., 2004). For over 45 years since the first sketch-based computer systems were proposed (Ivan, 1963; Ellis et al., 1969) there has been recurring interest in supporting sketching with computation (i.e. sketching at electronic devices and interactive surfaces).

Despite being sketching *recognition* fairly well addressed on the literature, the adoption of electronic sketching as a *design tool* is still a challenge (Johnson et al., 2008).

The current popularization of touch screen devices and the multi-platform capabilities made possible by HTML5 might pose new opportunities for developers to build distributed interactive systems with minimum effort on adapting the system for each platform. Systems to support design activities such as sketching are also included on this set of new opportunities, also giving room for researchers to investigate how designers use sketching to prototype interfaces on the current multi-platform scenario.

We then define *multi-platform sketching* as the activity of drawing with an electronic stylus at different devices while having the same system running on those different devices (Sangiorgi et al., 2012).

When designing, people draw things in different ways, which allows them to also perceive the problem in new ways. People engage in a sort of *conversation* with their sketches in a tight cycle of drawing, understanding, and interpreting (Schon and Wiggins, 1992). However, nowadays there are many devices available for designers to sketch upon (MacLean et al., 2011), with different characteristics such as screen sizes, weight and processing capabilities; this is a fact to be addressed into contemporary sketching research.

Therefore, the fundamental question we seek to answer with this paper is regarding the sketching activity for prototyping. Since designers need to consider many factors while designing interfaces for many device types, what are the most important requirements for a sketching system for prototyping interfaces?

In this paper we report a pilot experiment conducted with 6 developers from IT companies in Belgium, grouped into pairs on design sessions using a multi-platform distributed sketching

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system called Gambit (Gatherings and Meetings with Beamers and Interactive Tablets) (Sangiorgi et al., 2012). The system is flexible enough to accommodate various configurations and its interface can be distributed among many different devices (Desktops, Tablets, Smartphones, etc.).

We performed a discourse analysis of the professionals based on recorded videos of interviews conducted during and after design sessions with the system and aggregated the data in order to investigate the main requirements for multi-platform sketching systems.

This paper is organized as follows: the next session shows the motivation for sketching user interfaces in a multi-platform context. Section 3 presents the state of the art on the areas of Sketching and Distributed Systems. Section 4 presents the Gambit system and its initial requirements. Section 5 describes the experiment with some indications of improvements for the system and Section 6 concludes.

2. Sketching in user interface design

Sketching is considered to be a powerful tool for doing design. As the findings of Goel (1992) point out, the presence of ambiguity in early stages of design broads the spectrum of solutions that are considered and tends to deliver a design of higher quality.

Some works had already investigated the sketching activity as a fundamental human activity, as van der Lugt (2002) who conducted an experiment to analyze the functions of sketching in design, in which participants produced individual sketches and then presented them for the group for discussion. Three primary sketching functions were identified:

F1 Sketching stimulates a re-interpretive cycle in the individual designer's idea generation process: Schön (1983) describes design as a cyclic process of sketching, interpreting and taking the sketches further.

F2 Sketching stimulates the designers to re-interpret each other's ideas: when sketching to discuss (as opposed to sketch for self-interpretation), the designer invites others to interpret her drawings as well. The function of inviting re-interpretation is especially relevant for the idea generation process, as re-interpretation leads to novel directions for generating ideas (van der Lugt, 2002).

F3 Sketching stimulates the use of earlier ideas by enhancing their accessibility: Since it is externalized, sketching also facilitate archiving and retrieval of design information.

UI design by sketching is recognized for several proved virtues such as, but not limited to: maintaining an informal representation to foster creativity (Coyette et al., 2007; Newman et al., 2003; Mangano et al., 2008), complementarity between paper and pencil and software (Bailey and Konstan, 2003; van der Lugt, 2002), capability to take one design idea at a time and work it out in details or consider alternative designs at a time (i.e. lateral transformation Mangano et al., 2008), ability to reveal as much usability problems as if it was a real UI (Johansson and Arvola, 2007).

In order to support sketching into UI design, we needed to analyze the process in which UI design is included. Currently, the development life cycle of interactive applications consists of a sophisticated process that does not always proceed linearly in a predefined way. The tools available for UI development are usually not focused on UI **design**, in which designers usually explore different alternatives but in UI **modeling** as a final product, where designers must attend to formal standards and notations.

There are many tools available for both modeling and design, however practitioners are currently forced to choose formal and flexible tools. Whichever they choose, they lose the advantages of the other, with attendant loss of productivity and sometimes of traceability and quality.

As the study reported in Cherubini et al. (2007) mentions, designers desire an intelligent whiteboard because it would not require hard mental operations while sketching during meetings and design sessions.

However, electronic sketching is still behind the classical sketching in paper, since the tool in use becomes too evident (Weiser, 1991). Perhaps until the gap between displays and paper are minimized, (for instance with paper-like displays Shah and Brown, 2005), this distance will continue high, hindering the designer's *conversation*.

A great care must be taken to support the designer's reflection when making design software that employs sketch recognition, for instance. If the system interprets drawings too aggressively or at the wrong time, it may prevent the designer from seeing alternative meanings.

Therefore, we can observe that fostering creativity is the main concern of current sketching tools for design. This is specially important since design is essentially a problem of *wicked nature*, i.e. the process of solving it is identical with the process of understanding it (Rittel, 1973). In wicked problems, the designer does not have a clear understanding of what to produce and has only a vague goal in mind in the beginning.

However, electronic sketching has some important advantages over classical 'pen and paper' approach. While sketches are useful to facilitate discussions on the conceptual level, computer prototypes are useful for discussing operational and interaction issues (Johansson and Arvola, 2007). Thus, raw sketches and interactive prototypes are complementary.

One important issue with currently sketch-based systems for prototyping of user interfaces is that they are *single-platform*, since they are usually made to be used on Desktop computers (Newman et al., 2003; Mangano et al., 2008), even though the prototypes are targeted at multiple devices (Lin et al., 2002). The motivation question here is: At what extent can we successfully design multi-platform systems by prototyping and testing using single-platform systems?

A designer could sketch and test interfaces for many platforms using just a single platform such as a large sketching device (e.g. Wacom, TabletPC). However, assuming that the main benefit of sketching as a prototyping technique is to allow us to 'see as' and 'see that' (Schon and Wiggins, 1992), we observe that in current prototyping practices that benefit is hindered since only the size of the target device is being considered, while there are other significant factors such as weight, screen resolution, brightness and interaction modes (e.g. multi-touch, WIMP).

When designing multi-platform user interfaces, designers either have to design a UI separately for each device, which is time consuming, or use a program to automatically generate or adapt interfaces, which often result in interfaces that are awkward (Lin, 2005). Whichever method used, designers would lose the benefit of iterative design, considered critical for creating good user interfaces.

We argue that a more complete prototyping system would allow sketching and simulation on the target device, enriching both designers' and users' experience with an interactive prototype, allowing them finally to have a richer *conversation* with the working design at hand.

3. State of the art

This section describes the current state of the art considering the two main areas in which the Gambit system is included: Sketching and Distributed systems. We also position the system