Interaction via tangibles and virtuals in a tabletop application

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Abstract

Tangibles are often used for interactions on tabletops. In this paper we investigate the potential benefits of tangibles compared to virtual objects. As a basis for our research we choose a traditional non-computer-based tabletop game, which makes use of miniatures. We report on our experience when transferring this game to a simplified computer-based version makes use of a projection surface in combination with tangibles. The design process was guided by interviews with professional tabletop gamers. In particular these interviews provided useful insights regarding the use of tangibles versus virtuals.

1 Introduction

In the last years a lot of diverse research has been made on horizontal, direct-touch tabletops, which became publicly prominent due to the presentation of Microsoft's Surface [7]. or Jeff Han's multi-touch table [10] to the general public. One of the more interesting research topics for the HCI field are Tangible User Interfaces or Interactions with Tangibles on such tabletops [9, 12]. Tangibles are physical objects, which can represent digital associations and make the digital realm graspable, thus extend the possibilities of tabletop interaction with physicality and increase user experience when interacting with tabletops. Using tangibles also gives the feeling of a more direct interaction with the digital realm compared to touching on surfaces.

In this paper we describe the transfer of a traditional tabletop game into a game played on a horizontal, direct-touch tabletop. For the design process our work makes use of the results of interviews with professional tabletop players made within the context of usability studies. We were interested in how the possibilities of direct-touch tabletops could enrich or improve traditional tabletop games. Therefore an evaluation should compare the game experience between tangible interaction with tabletop interaction without tangibles. There are a lot of studies on Tangible Interaction and Tangible User Interfaces (e.g. [9], [12], [8] or [13]) and we will discuss three of the most recent ones.

Bakker and various co-authors investigated in a case study [5] the difference in game experience between iconic and symbolic play pieces. For their study they developed and implemented a tabletop game called 'Weathergods' [6], which makes use of Tangible Interaction by means of two kinds of play pieces. Iconic play pieces have a physical representation of their association with virtual objects and symbolic play pieces have not. They found that both iconic and symbolic play pieces result in a similar understanding of the game and fun experience, whereas iconic play pieces were preferred by the participants of the study. Regarding the understanding of play pieces, the iconic play pieces were better because of their inherent association to virtual objects. In our comparison between tangibles and virtuals, we are using iconic tangibles and investigate the possibilities of tangibles for increasing or improving user experiences, such as understanding of complex game rules.

As for affordances Terrenghi et al. reported on a study [3] which compared physical and virtual manipulation of objects on a tabletop by carrying out the same tasks on both. This work shows that mimic physical interaction with objects in the digital realm is not sufficient, but understanding the relationship between affordances and interaction of physical objects provide a design resource for novel ways of interaction in tabletop applications. From Terrenghi's findings a user-centered design process follows, like the one we applied.

Van den Hoven et al. discussed in [11] the need for design research on tangible interaction in different contexts of usability such as contexts-of-use, ease-of-use or an iterative design process accompanied by evaluations with prototypes. They confirmed and showed that know design research approaches can be of practical use for tangible interaction as well.

In the next pages we will discuss the design process, describe the implemented prototype and eventually draw a

conclusion based on our observations.

2 Design Process

This section will show why we chose an existing tabletop game, explain the rules of the game we chose and illustrate the interviews we conducted with professional tabletop gamers.

2.1 Motivation

Like described in section 1 our objective is to develop a tabletop application with tangibles. So we had to decide which kind of application we wanted to develop. One option was to port a traditional desktop application to tabletop. Another option was to construct an entirely new application. Both options would have inherited the risk, that the resulting application would not be suited for tangibles or that the concept of how the tangibles should be used in the context of the application would not be understood by our users. So we decided to take an existing application, already on a table and making use of tangibles, and to transfer it to a tabletop.

We found that a tabletop game would be particular suited for this purpose.

We chose the tabletop game "Warmachine" by Privateer Press and therefore we the cards and miniatures we used are from the Warmachine tabletop game.

2.2 Game rules

Let's take a look at how the Warmachine tabletop game works in principal, before we explore the game rules in more detail: Usually two people play against each other on a table. Both start by placing their units. Furthermore players can place obstacles, such as trees or walls. Then in the main game both players take turns by moving and fighting with their units. Usually the game is over when one player loses all his units.

The game is centered around these units. Those units are represented by miniatures, which must be first glued together, and are usually painted individually. Typical Warmachine miniature are shown in figures 1(a) and 1(b).

(a) Glued model

(b) Painted model

Figure 1: Models

Attributes and special abilities of a unit are noted on a card, as shown in figures 2(a) and 2(b). Also each time a unit takes damage, this has to be recorded on the damage grid on the front of the card.

(a) Card (front)

(b) Card (back)

Figure 2: Card

Standard abilities are moving and fighting, but some unit types have additional abilities, such as casting a spell.

Each turn the player can execute a limited number of actions per unit, which make use of these abilities. The outcome of such an action is determined by two criteria: The value of the relevant attributes, and the rolling of a given number of dice. There are not only rules for those actions, but also for: How the units shall be placed at the beginning; how each turn shall be played, etc. Those rules are contained in rulebooks and their complex nature often require players to look them up.

2.3 Interviews

To base our design on the input from passionate gamers, we conducted a number of interviews. In the interviews we used a questionnaire containing a mixture of qualitative and quantitative questions. As locations for our interviews we chose: a tabletop store and a tabletop gaming convention. Those locations where specifically chosen to catch the tabletop gamers in their natural environment, as suggested in "Understanding contexts by being there: case studies in bodystorming" [4].

The questionnaire contained a number of questions on the following areas:

- The background and the experiences of the respondent
- The playing habits
- What makes the game fun?
- What should remain physical or get virtual?
- How complex are the game rules?
- What kind of visualization and special effects should be used?

Our target respondents were the tabletop community of Warmachine around *** which consists of roughly 40 players. Out of this we managed to interview eight players. Each interview lasted about one hour.

All of the respondents were male. Their mean age was 30.3 years. Half of them were students while the other half were employees. On average they had been playing tabletop games for 12.1 years and they had already tried 8.1 different types of tabletop games. On average they played 5.3 games per month and each of them lasted 1.7 hours. The most frequently played tabletop game mode was one versus one. All players stated that the game table should have a size of at least 1.2m x 1.2m.

All participants responded that they had a lot of fun collecting, assembling and painting their miniatures. For Warmachine they owned between 70 and 300 miniatures, on average 159. To the question, if they wish to employ their miniatures in a computer-based table top game as well, all of them responded with yes. This came as no surprise to us, as we already suspected, that the act of collecting, assembling and painting might result in a strong bond between the player and his miniatures.

In contrast to this they were open to replace other physical objects with virtuals: cards, rulebooks or obstacles, such as trees or walls. This result in particular was rather surprising to us because we thought they wanted to keep them physical, but obviously there was much less attachment to those things compared to the miniatures. Regarding the rules half of them responded, that they were bothered by having to carry the rulebook with them. All of them said, that they had to regularly look up rules, that often a rule could be unclear and that sometimes there were disputes, that could only be resolved by referees. As a result of this they were in favor of rule support.

Concerning the graphical special effects there was a positive attitude, while sound effects were regarded as annoying by most players.

3 Prototype

Encouraged by the interviews, which revealed that the players had a positive attitude in general towards an transfer of their game to a tabletop, we decided to develop a prototype.

The requirements we got through our interviews are:

- In general each player only interacts with the table on his own turn. Thou there are some exceptions, sequential interactions should suffice for us.
- The position of the miniatures has to be tracked.
- Actions like attacking or casting a spell should be accompanied by graphical effects.

We decided to first investigate the potential benefits of tangibles compared to virtual objects to verify the following theses which we got from the interviews:

- Miniatures should not be replaced by virtuals.
- Cards should be made virtual.
- Rules should be supported.

The prototype makes use of a tabletop which has a projection surface and has the capability to handle multitouch and tangible input. More about the technical aspects will be shown later.

By developing our prototype we had to adhere to the following constraints: While the traditional non-computer-based tabletop requires a lot of table space, we only had limited space on our tabletop. Furthermore the complete rule set would have been too complex for beginners. To combat these constraints we decided to come up with a strongly simplified version of the original game: Only two miniatures per player and a very basic rule set had to suffice.

Our application employs the TWING [2] framework, which provides a solid basis to develop multitouch and tangible applications. This framework was developed at the University of *** and makes use of an MVC architecture which made it very easy to connect our application logic with the table logic. Furthermore we made use of the included behaviour mechanism, that supports a large variety of interactions, such as moving, rotating or zooming. E.g. the miniatures can be moved and our cards can be rotated and zoomed. The underlying tracking layer keeps track of the multitouch and tangible interactions. Responsible for the visualization is Horde3D [1].

In our simplified prototype we implemented the following basic gameplay: moving, attacking and casting spells. At the beginning of the game both players have to place their miniatures on top of the table. The tabletop is able to distinguish between different miniatures by means of markers attached on the bottom of them.

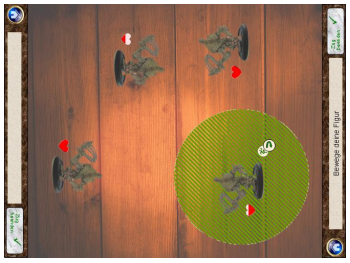

Figure 3: Screenshot of our prototype

After both players have placed their miniatures on table, the game starts. On his turn, each player can execute actions. For example he can start the move action by touching the move-button as shown in figure 3.
When moving the player has two options: either to directly drag his unit along or to explicitly position it. It will be interesting what options the player will choose. Especially the decision of the player could depend on the representation of the miniatures as tangibles or virtuals. We think that a tangible miniature would encourage the user to pick up and place it directly, instead of trying to drag it, as we think this is more common with virtual objects.

tangibles or virtuals for the miniatures.

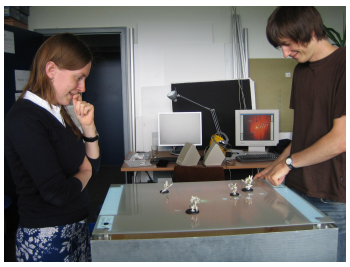

Figure 4: An evaluation session

For a first evaluation we recruited users, who were not familiar with our tabletop game, to avoid any bias. From their feedback we obtained the following insights:

- They preferred tangibles to virtuals, because it was more fun for them.
- Virtuals can be occluded by tangibles, so that the position of the tangibles on the table should always be taken into account when positioning interface elements.
- If an action is not possible, the reason should be clearly indicated
- Important feedback should be shown where the center of interest of the user relies. For example when a user wants to cast a spell and this is not possible, because he is not in range of any other unit, this feedback should be shown next to the cast button where the user is already looking at.
- Metaphers should be selected by the suitability for the application domain. E.g. for moving we first had an arrow symbol, but this was not well understood, so we replaced it with a picture of a running person.

4 Conclusion

We transferred a traditional tabletop game to a horizontal, direct-touch tabletop with tangibles following an user-centered design process, thus according to common usability recommendations. Our initial presumptions concerning the decision of leaving objects tangible or transferring them to a virtual representation in the digital realm, were different to the results concluded from our interviews. For example players preferred to have virtual playing cards since the possibilities of virtual objects to ease handling of complex playing rules are more beneficial than increased playing experience by grasping physical cards. Apart from our presumptions the interviews revealed possibilities of a direct-touch tabletop to extend a traditional tabletop game, such as automatically showing the reach of play pieces within the game context. Employing an user-centered design process helps to make decisions on tangible and virtual objects and enrich game experience as well.

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