

[DEMO] Exploring multimodal interaction techniques for a mixed reality digital surface

Martin Fischbach*

Chris Zimmerer

Anke Giebler-Schubert

Marc Erich Latoschik

Human-Computer Interaction
University of Würzburg

ABSTRACT

Quest – XRoads is a multimodal and multimedia mixed reality version of the traditional role-play tabletop game *Quest: Zeit der Helden*. The original game concept is augmented with virtual content, controllable via auditory, tangible and spatial interfaces to permit a novel gaming experience and to increase the satisfaction while playing. The demonstration consists of a turn-based skirmish, where up to four players have to collaborate to defeat an opposing player. In order to be victorious, players have to control heroes or villains and use their abilities via speech, gesture, touch as well as tangible interactions.

Keywords: Multimodal, Mixed Reality, Tangible, Speech, Gesture, User Experience, Tabletop.

Index Terms: H.5.2 [Information Interfaces and Presentation]: User Interfaces—; I.3.7 [Computer Graphics]: Three-Dimensional Graphics and Realism—

1 INTRODUCTION

Traditional tabletop games are a highly social interaction medium. Usually, multiple players sit around a shared interaction space where they compete or collaborate to solve tasks in a fictive world, typically driven by an embracing narrative. Therefore the players utilize tangible components, like cards and dices. However, the provided immersion and the complexity of potential game rules are restricted by the static nature of these games [9]. The augmentation of traditional setups with virtual elements to create a mixed reality scenario provides the opportunity to surpass these limits and entails two major benefits: (1) The enhancement of the (human) gameplay experience and (2) the availability of a challenging basis for the exploration and evaluation of multimodal mixed reality interaction techniques. In particular the fusion of dynamic, multidimensional and multimedia contents of the virtual world with real world artifacts contributes to a new experience for the players [7]. In addition, the combination of traditional gaming concepts with digital media has also increasing economic relevance: *Scotland Yard - Master or tiptoi* [12] by Ravensburger and *The Eye of Judgment* [14] by Sony Computer Entertainment provide hybrid gaming concepts based on a mix of real and virtual game elements.

As a summary of our efforts to explore and evaluate multimodal interaction techniques for interactive systems in the context of tabletop games, we present *Quest - XRoads*, a mixed reality version of the role-play-based tabletop game *Quest: Zeit der Helden* [11] realized within the scope of the eponymous project *XRoads* (Cross Reality On A Digital Surface) [2]. The demonstration showcases the augmentation of a traditional setup and allows players to experience auditory, haptic and spatial interfaces, that are combined in a novel way to support *Quest*'s original gameplay.

*e-mail: martin.fischbach@uni-wuerzburg.de

2 RELATED WORK

The presented demonstration can be generally categorized as a *pervasive game* [8]. Kasapakis et al. [5] refine this categorization by classifying pervasive game projects based on their game environment and features. Games referring to the genre *Mixed Reality* are thereby denoted by the integration of “virtual and physical elements within a coherently experienced perceptual game world”. It is obvious to use *tangible user interfaces* [13] to realize tabletop mixed reality games, since the table already provides a surface as base for interaction. In addition, enhancing digital games with tangible objects increases the physical activity of players and encourages the players' social interaction [4]. These benefits have been shown in the course of mixed reality tabletop applications like the STARS platform [9], *Weathergods* [1] and the *IncreTable* [7]. Beyond the use of sole tangible user interaction, the integration of alternative or complementary interaction techniques towards multimodal user interfaces, is highly beneficial for this kind of setups [10, 15].

3 DEMONSTRATION

3.1 Description

Quest – XRoads consists of a playable, mixed-reality role-play scenario (see fig. 1a). Up to four players collaborate in a turn-based skirmish against another player, who takes on the role of the evil questmaster. Players have to avail themselves of a hero's or villain's specific abilities to defeat the enemy. Attribute points and the roll of the dice decide on the outcome of a fight. Both design and game mechanics are adapted from the original tabletop game. Basic elements, like tokens and character abilities (represented as cards) are kept as tangible objects, whereas supplementary elements are augmented or replaced by real-time interactive rendering. In addition, auxiliary visual and auditive feedback is integrated to support the gameplay. Finally an increase of the overall satisfaction while playing is targeted by relieving the players from inconvenient game mechanics, like the measurement of distances, and by utilizing multimodal interaction techniques.



Figure 1: Collaborative gameplay and interaction techniques realized in *Quest – XRoads*: a) gameplay setup, b) one-finger tab for the activation of abilities, c) performance of the “throw a dice” gesture, d) rotation of a tangible for the selection of a target, and e) placement of tangibles for the activation of special abilities.

3.2 Multimodal Interaction Techniques

Players can use multiple interaction techniques that are provided via touch, tangible, gesture and speech interfaces (see fig. 1b-e). Besides to the classic interaction with a touch interface, like one-finger tapping or dragging, the player is able to interact with physical objects. These tangible interactions are supported by realtime position and orientation tracking of special marker tagged objects and enable the re-incorporation of traditional game concepts like moving the pawn or playing a card. Alternatively players can use speech commands to select their characters' abilities. In addition, the player is able to perform a "throw a dice" gesture with his hand. A physically simulated virtual dice is spawned, which collides with both the virtual borders of the virtual and the physical objects of the real world.

3.3 Technical Details

The software implementation is based on *Simulator X*, a component based software platform for distributed realtime interactive systems targeting augmented, virtual and mixed reality [6]. The application runs on Samsung's multi-touch table *SUR40*. The integrated Microsoft *PixelSense* technology is able to recognize up to 50 touch inputs simultaneously as well as to capture the position and orientation of objects, tagged with fiducial markers (1.9 × 1.9 cm). In addition to the *SUR40* sensors, a leap motion sensor for hand tracking and a Sennheiser *EW 100 G3* microphone for voice recording are used. The "throw a dice" gesture consists of four individual gestures, each recognized through a dedicated template based algorithm. An *augmented transition network* detects a correct sequence of gestures as a successful dice roll. The voice recognition is performed by the *Dragon NaturallySpeaking* software. To compensate for the limited internal hardware of the *SUR40* the application uses the *Simulator X* clustering capabilities to outsource the speech and gesture recognition to an external computer.

4 USER FEEDBACK

Quest – XRoads has been demonstrated in several non-scientific fairs (e.g. Role Play Convention 2013 & 2014, Spiel 2013) and university-internal exhibitions. In addition, a pilot study has been conducted to evaluate the satisfaction of users interacting with the game [3]. The received feedback was very positive and already provides some qualitative findings. The utilization of multimedia content and the evaluation of game rules by the system is perceived to be beneficial for the gameplay as well as the enjoyment of the game. The gesture interface in combination with the fusion of real and virtual objects, i.e. rolling a dice, is fun to use, but oftentimes refused in favor of its straightforward touch alternative. Uttering simple commands instead of touching buttons is already perceived beneficial, especially in situations where real objects are near to or occlude virtual user interface elements. Generally however, more complex (multimodal) commands and positioning of user interface elements sensitive to tangibles is desired. Altogether the demonstration has proven to be highly attractive, especially for children, who seem to have less reservation about this novel tabletop game concept. Moreover Quest – XRoads was mostly not considered to be a computer game and appreciated for the preserved social and physical interaction aspects of traditional tabletop games.

5 FUTURE WORK

The planned future milestones for the XRoads project are twofold. On the one hand, we aim to research the potential differences in gaming experience between traditional and mixed reality tabletop games in more detail. This includes the exploration of novel gameplay mechanics that would not be feasible with the means of traditional tabletop games, e.g. highly dynamic environments or the integration of artificial players. On the other hand, we plan to improve

the usability of this kind of mixed reality applications by exploring novel approaches and by evaluating the already implemented techniques. In particular the enhancement of the existing speech commands and its combination with gestures as well as the realization of interaction techniques with alternative, low-cost hardware, are targeted by ongoing efforts. Furthermore, we are currently extending the interaction space to go beyond the scope of an indoor game. The new prototype, still under evaluation, is connecting our mixed-reality tabletop application to mobile platforms and supports game mechanics based on diverse localization techniques, such as QR codes or global positioning systems.

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